IMPLEMENTATION OF CONTEXT BASED APPROACH IN THE TEACHING OF 'O' LEVEL BIOLOGY IN SELECTED SECONDARY SCHOOLS OF KAFUE DISTRICT

BY

MIYAMBO ALFRED

A Dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the award of degree of Masters of Education in Science Education

THE UNIVERSITY OF ZAMBIA

LUSAKA

2020

COPYRIGHT

© Alfred Miyambo 2020. No part of this dissertation may be stored, reproduced in any recovery system, or transmitted in any form, or by any means of photocopying, mechanical, electronic, recording or otherwise, without prior permission of the author or the University of Zambia.

DECLARATION

I, Miyambo Alfred, do hereby declare that this dissertation represents my own work and that it has not previously been submitted for a degree or other qualification at the University of Zambia or any other University.

Signed…….. Date……..

APPROVAL

This dissertation of Miyambo Alfred is approved as fulfilling the partial requirements for the award of the Degree of Master of Education in Science Education by the University of Zambia.

Examiner 1……. Date……

Signature……

Examiner 2 ……... Date……

Signature……

Examiner 3…… Date……

Signature…….

Chairperson Board of Examiners…….

Signature……. Date…….

Supervisor…….…. Date……..

Signature…….

ABSTRACT

The study investigated the implementation of context based approach in the teaching of 'O' level biology in selected secondary schools of Kafue district. The objectives were to: establish teachers' context based approach (CBA) knowledge in the design of 'O' level biology lessons, assess how teachers of biology implement CBA in the teaching of 'O' level biology and determine the usefulness of teachers' CBA knowledge in 'O' level biology to learners. The study used a qualitative approach and a case study design to investigate the implementation of CBA in the teaching of 'O' level biology in secondary schools of Kafue district. The target population were biology teachers teaching 'O' level biology syllabus in selected schools of Kafue district. The sample comprised six biology teachers and 30 learners drawn from three secondary schools. Instruments used to collect data were: an observation schedule, semi-structured interview schedule, focus group discussion guide and document analysis guide. Data were analysed thematically. The findings indicated that all the teachers showed CBA knowledge in designing teaching methods that could engage learners in the lesson. However, only few teachers (two) showed CBA knowledge in giving real life examples during 'O' level biology lesson design, the majority of the teachers (four) did not show CBA knowledge in giving real life examples during biology lesson design. None of the teachers showed CBA knowledge in preparing context based problem solving tasks for the learners. Furthermore, it was noted that teachers did not implement CBA in their lessons, except in few cases were they gave real life examples (two). Teachers CBA knowledge in 'O' level biology was useful to the learners in terms of increasing learner attention, motivating learners, helping them to understand biology concepts and pass examinations. The study concluded that context based approach knowledge is necessary if science teachers were to be effective in their lesson design and delivery. In view of the findings above, the study recommended that teachers of biology should provide learners with sufficient opportunities to link biology concepts to everyday life experiences. Furthermore, there is need for teachers of biology to develop knowledge and skills during Continuous Professional Development (CPD) on how to link their lessons to learners' everyday life experiences by using real life objects as teaching Aids from the learners nearest environment.

Keywords: ***Implementation, context based approach, real life experience, 'O' level biology***

DEDICATION

This dissertation is dedicated to my wife Constance Miyambo, my children: Alfred Miyambo Jr, Kelvin Miyambo and my brother Kalenga. K. Miyambo for their support during my postgraduate studies.

ACKNOWLEDGEMENTS

I wish to acknowledge the Almighty God for allowing me to complete my master's programme. Special thanks are due to Dr. G. Kaulu, my supervisor for tirelessly advising and guiding me from the proposal stage up to report writing.

Secondly, I also wish to express my gratitude to the head teachers of the various secondary schools I visited and the participants for their willingness to participate in this study, for their time and co-operation that they provided.

Lastly but not the least, I wish to thank my wife Constance Miyambo, my children; Alfred Jr and Kelvin for their great understanding, support and encouragement.

TABLE OF CONTENTS

LIST OF TABLES

page

LIST OF FIGURES

Page

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

CBA	Context Based Approach
CDC	Curriculum Development Centre
CORD	Center for Occupational Research and Development
CPD	Continuous Professional Development
ECZ	Examinations Council of Zambia
MoE	Ministry of Education
UNZA	University of Zambia
ZASE	Zambia Association for Science Education

CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter presents the background to the study, statement of the problem, purpose of the study, research objectives, research questions, significance and scope of the study. After that it describes the theoretical framework, conceptual framework, operational definitions of key terms and ethical considerations.

1.2 Background to the study

In Zambia science is made up of Physics, Chemistry, Biology, Agricultural Science and Integrated Science as outlined in the Zambia National Education Curriculum Framework of 2013. Science subjects form a very important component of the secondary school curriculum (Ministry of Education, MoE, 1996). Therefore, all pupils in secondary schools are expected to take biology as one of the science subjects.

Before the end of the 20th Century, 'O' level biology was mostly taught in a traditional way (MoE, 1996). The focus was on covering the whole syllabus which often involved recitation of facts and evaluating students using standard tests that asked them to regurgitate facts (Howes, 2000). Students did not see the relevance of the content of the syllabus to their everyday lives when content was presented in that way (De Vos & Reiding, 1999; Hobden, 1998). No wonder, Barmby (2008) asserted that the inability of learners to make a link between sciences taught at school and everyday life, caused science subjects been perceived as difficult and irrelevant.

In view of the above problem, researchers and science educators recommended the use of context based approach (**CBA**) as a way to help learners benefit from biology lessons (Hake, 2000; Gilbert, 2006; Gilbert, Bulte & Pilot, 2011). CBA is described as a learner centered teaching method in which the learners' diverse learning experiences are used in teaching and learning process (Glynn & Koballa, 2005). In CBA actual life examples and learner engagement are used to introduce biology concepts (Bennett, Lubben & Hogarth, 2007). According to Gilbert (2006), the introduction of context in science education in particular biology attempts to bridge the gap between abstract concepts and everyday life in order to show students the significance of science for their own lives. This is why Gilbert, Bulte and Pilot (2011) recommended the use of teaching programs that are designed within the structure of the context based learning approaches and make connections with real life, make subjects interesting, provide meaningful learning and engage learners in active participation in the classroom.

As a result, many countries in the world have adopted CBA as a way of teaching science in secondary schools in order to help the learners realise the link between the lessons and their everyday life experiences. The first context based project started a long time ago in the Netherlands with the large scale secondary physics education program called 'learn physics package Development' (Stolk et al., 2009). Later, the American Chemistry in the Community (ChemCom) and Chemistry in Context (CiC) programs were developed. In Africa several small scale context based projects were implemented in secondary science education. Examples were the Lessons project and the Linking School Science to Industry and Technology (LISSIT) project in Swaziland, and the Basic Education into Rural Development (BEIRD) project in Uganda (Kazeni, 2012). The programs were short term and focused in general on context in science education.

Zambia has not been an exception regarding the implementation of the context based approach. Six years ago, the biology syllabus was reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize analyze and practically apply knowledge that can help them gain life skills (CDC, 2013). Unfortunately, despite the review of the biology syllabus, performance of candidates in all (3) biology examination papers in Zambia has remained lower than expected (ECZ, 2015; 2016). For example, Figure 1 shows countrywide biology school certificate results for the year 2015.

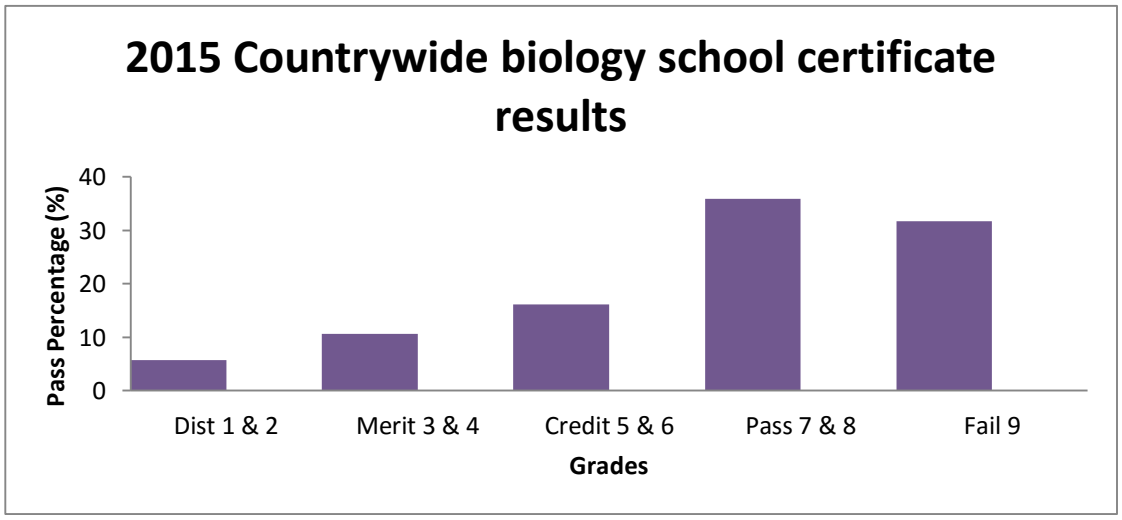


Figure 1: Countrywide school certificate biology results for 2015

The figure shows that in 2015, 35.9% of the candidates barely passed and 31.7% failed biology. Furthermore, according to the examining body, between 2015 and 2016 the mean performance for Biology in Zambia only increased from 21.59% in 2015 to 24.14% in 2016 (ECZ, 2016). This is incredible because studies in other countries that use CBA have revealed positive results in science subjects in terms of improving students' motivation, developing a sense of curiosity about nature, developing students' positive attitudes towards science and providing easier learning (De Jong, 2008; Wieringa et al., 2011; Ozcan & Gercek, 2015). There could be a

problem regarding how CBA is implemented in the teaching of ordinary level biology in Zambia.

1.3 Statement of the problem

When biology is taught in a traditional way, learners do not see the relevance of the content of the syllabus to their everyday lives (MoE 1996, De Vos & Reiding, 1999; Hobden, 1998). Therefore, in Zambia it is recommended that teachers use CBA in teaching biology so that learners can benefit fully from their biology lessons (CDC, 2013; Gilbert, 2006). Because of this recommendation, for several years now teachers of biology in Zambia have been using CBA in their teaching of biology (ZASE, 2016; 2017). However, little is known about the implementation of CBA by teachers in 'O' level biology lessons in the Zambian context. This creates a knowledge gap.

1.4 Purpose of the study

The purpose of the study was to investigate the implementation of context based approach by teachers in 'O' level Biology lessons in selected secondary schools of Kafue district.

1.5 Research Objectives

The research objectives were to:

i. Establish teachers' context based approach (CBA) knowledge in the design of 'O' level biology lessons.
ii. Assess how teachers of biology implement CBA in the teaching of 'O' level Biology.
iii. Determine the usefulness of teachers' CBA knowledge in 'O' level biology to learners.

1.6 Research questions

In this study, three research questions were addressed:

i. What knowledge of CBA do teachers of biology have in lesson design?

ii. How do teachers of biology implement CBA in the teaching of 'O' level biology?

iii. How useful is teachers CBA knowledge in 'O' level biology to the learners?

1.7 Significance of the study

The study might help teachers of biology to link their lessons to learners' everyday life experiences for meaningful learning and enhance learners' conceptual understanding of biology concepts. Policy makers may also benefit from the study by knowing were the nation is in terms of CBA implementation and act accordingly. Additionally, the findings of the study might add to the existing literature on the use of CBA in the teaching of biology.

1.8 Scope /Delimitations of the study

The study was limited to Kafue district of Lusaka provincea. It was conducted in selected secondary schools in the district.

1.9 Limitation of the study

Since the study employed a case study design, findings would not be generalized to all secondary schools in the Republic of Zambia.

1.10 Theoretical framework

The study was informed by social constructivism theory of Vygotsky (1978). This theory of learning stipulates that learners are active in the construction of their knowledge. Vygotsky

(1978) amplifies this point when he states that social interactions are important in the construction of this knowledge. The theory focuses on a number of teaching/learning methods such as inquiry, problem solving, discovery and project work (Schunk, 2012). All these methods place emphasis on the active participation of the learner. In CBA a clear social constructivist perspective is taken. According to current research in science education, learning is understood as a process in which learners construct their own meanings from their experiences as they interact with more knowledgeable others who are teachers of biology in this case (Taconis & Jochems, 2013). Therefore, implementation of CBA in the teaching of 'O' level biology in this study puts across the premise that knowledge could be actively constructed by the learners, through the help of the teacher playing a role of a facilitator and making biology lessons relevant by connecting the lessons to real life experiences of the learners.

Kim (2014) highlighted that Social constructivism is based on specific assumptions about reality, knowledge, and learning. Social constructivists believe that reality is constructed through human activity. Members of a society together invent the properties of the world (Kukla, 2000). Hence, for the social constructivist, reality cannot be discovered, it does not exist prior to its social invention. Furthermore, Social constructivists believe that knowledge is also a human product, and is socially and culturally constructed (Ernest, 1999). Thus, individuals create meaning through their interactions with each other and with the environment they live in. Finally, learning is viewed as a social process. It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces. Meaningful learning occurs when individuals are engaged in social activities (McMahon, 1997). This theory underpins the use of CBA in the teaching and learning process as was supported by Burton and Caroll (2001) who contended that classrooms which practice constructivist activities empower the learners to

gain access to their experiences and beliefs that reshape their prior knowledge in the light of the applied course content.

In addition, the theory clarifies that culture and the learner's immediate environment determine both how he or she learns, that is, the processes of reasoning, and also the content of his or her thinking (Rose, 2009). One's success in learning is dependent upon the environment of learning and the activity is best facilitated through a process of problem solving in collaboration with peers, relations, or teachers. Intellectual development depends greatly on the social situation of learning and how interactions with teachers, relations, and peers around the learner occur.

Therefore, in a classroom it's the duty of the teacher to use CBA to create a social learning environment that enables all the learners to work together in a social context while reflecting on their everyday life experiences (Vos, Taconis, Jochems & Pilot, 2011).

Kim (2014) stated that one of the general perspectives of social constructivist theory is situated cognitive perspectives. This perspective focuses on the relationship between the people and their environment. Humans are a part of the constructed environment (including social relationships); the environment is in turn one of the characteristics that constitutes the individual. Therefore, if the environment and social relationships among group members change, the tasks of each individual also change (Gredler, 1997). Teaching and learning thus should not take place in isolation from the environment. Social constructivism emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (McMahon,1997).Therefore, implementation of CBA in the teaching of 'O' level biology in this study puts across another premise that learner's immediate environment and social activities have an influence on learning.

1.11 Conceptual framework

Sozbilir, Sadi and Yildirim (2007) asserted that the basic goal of context based approach is to introduce scientific concepts through examples from daily life. Students can easily learn those scientific concepts which are related with daily life.

Furthermore, Rose (2012) indicated that the context is based on dual axis: on one hand, the context is the social situation of learning whereby knowledge is acquired, processed and produced through collaboration and use rather than direct dissemination; on the other hand, the context must be an engagement with a real life task whereby knowledge interfaces with an actual, empirical reality. Both axes instigate a move away from the hierarchical model of passive learning in the classroom situation.

In addition, Pate (2003) highlighted that contextual teaching enables learning in which students employ their academic understandings and abilities in a variety of in and out of school contexts to solve real world problems, both alone and with others. This means, that the process of learning and instruction in the classroom must be connected to the real world. This can be done by using various teaching techniques, for example; simulation, group work, discussions and games. Therefore, this study investigated the implementation of CBA in the teaching of 'O' level biology.

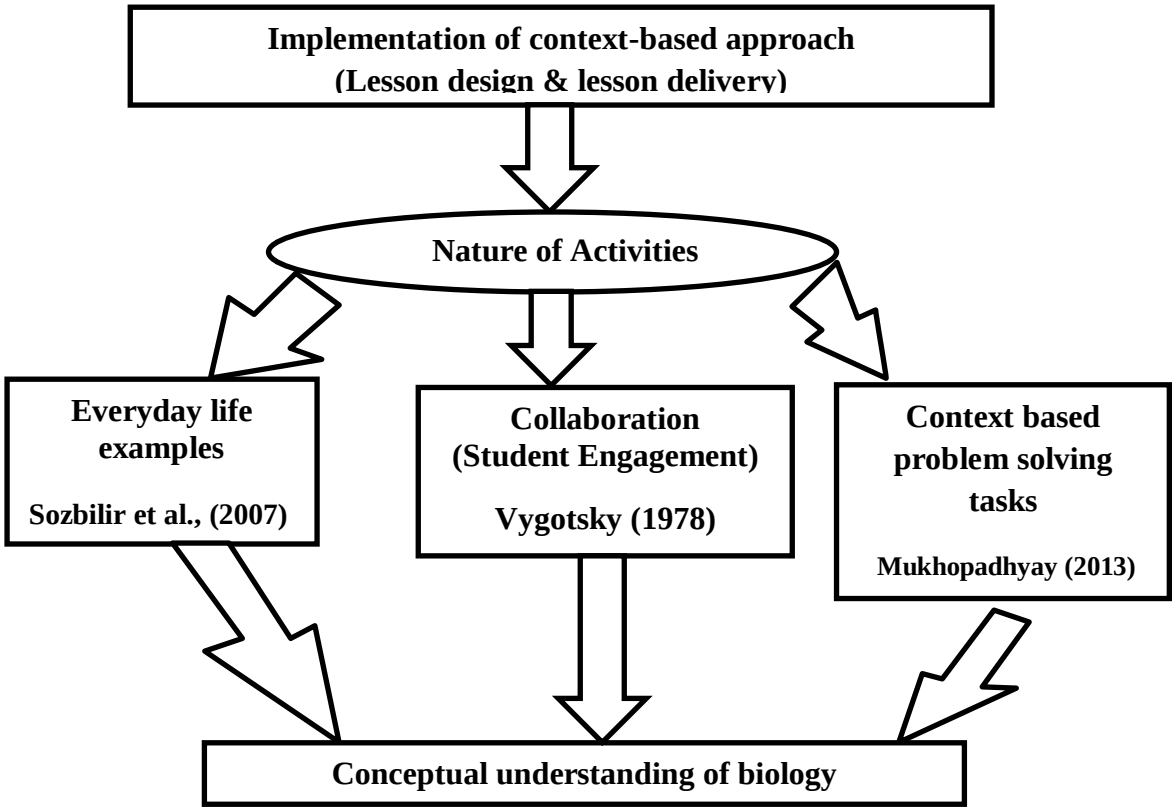


Figure 2: interaction of ideas in the Conceptual framework

1.12 Definitions of key terms

- **Context Based Approach**: Teaching method which involves use of learners' real life experiences to teach biology.
- Teaching methods related to Context Based Approach are the following; **Experiment, Group work, Field trip** and **Discussion.**
- **Teacher Context Based Approach Knowledge**: Teachers knowledge of using real life examples in lesson design and delivery, engaging learners actively in the lesson and preparing context based problem solving tasks for learners.
- **Teachers:** Trained instructors of biology in Zambian secondary schools.

1.13 Summary of Chapter 1

This chapter presented background information. It also outlined the statement of the problem, purpose of the study, objectives, research questions and the significance of the study. After that it described the scope of the study (delimitation and limitation), the theoretical and conceptual framework, operational definitions and ethical considerations. The next chapter presents the literature review.

1.14 Organization of the dissertation

Chapter 1 introduces the study by giving the background. It also outlined some key items such as the statement of the problem, purpose of the study, objectives with their research questions, and the significance of the study, scope (delimitation and limitation), the theoretical and conceptual framework, definition of key terms and finally summary of the chapter.

Chapter 2 presents a review of literature related to the problem under investigation. Literature is presented under the following sub-headings: Historical overview of context based approach in science education, Teachers CBA knowledge in 'O' level biology lesson design, the implementation of CBA in the teaching of 'O' level biology and Usefulness of teachers CBA knowledge in 'O' level biology to the learners.

Chapter 3 gives the methodology which includes the Research approach, philosophical underpinning guiding the study, research design, study site, target population, study sample, sampling procedures, research instruments, data collection procedures and finally data analysis.

Chapter 4 presents an analysis of qualitative findings. Section 4.2; presents findings on biology teachers' context based approach knowledge in the design of 'O' level biology lessons.

Section 4.3; presents findings on biology teacher's implementation of context based approach in the teaching of 'O' level biology. Section 4.4; presents findings on the usefulness of teacher context based approach knowledge in 'O' level biology to the learners. The data analysis procedure in this study was specifically guided by the research questions. The chapter ends with a summary.

Chapter 5 provides the discussion of the findings presented in chapter four in the light of the research objectives. The findings are discussed in line with literature reviewed and the theoretical foundations that informed the study.

Chapter 6 provides the conclusions and recommendation of this study which investigated the implementation of context based approach in the teaching of 'O' level biology. The conclusions are in line with the research questions.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter reviews literature related to the current study under the following headings: Historical overview of context based approach in science education, Teachers CBA knowledge in 'O' level biology lesson design, the implementation of CBA in the teaching of 'O' level biology and Usefulness of teachers CBA knowledge in 'O' level biology to the learners.

2.2 Historical overview of CBA in science education since 1970s

According to Stolk et al., (2009), the first context based project started in the Netherlands in the 1970s with the large scale secondary physics education program called 'Project *Leerpakket Ontwikkeling Natuurkunde'* (learn physics package Development). In 1980s the American Chemistry in the Community (ChemCom) and Chemistry in Context (CiC) programs were other context based projects that developed. The ChemCom program was initiated after criticism that the American science subjects were presented as a large amount of isolated facts which didn't transfer the knowledge about concepts to the world the students lived in. Hofstein and Kesner (2006) added that in 1980 Israel contexts were introduced in secondary science education, resulting in the Industrial Chemistry project and the Science for all programs.

Furthermore, Eilks et al., (2004) indicates that in 1999 context based courses were developed in Germany for different science disciplines. *Chemie im Kontext* (Chemistry in the context) was the first project which was introduced at the universities of Oldenburg, Dortmund, Kiel and *Saarbrücken*. The other science subjects followed later with the courses *Biologie im Kontext*

(Biology in the context) and *Physik im Kontext* (Physics in the context). The context courses were initiated because there was criticism on the German secondary science education system and they had the purpose of improving the interest and attitude of students towards learning science.

Kazeni (2012) asserts that in Africa several small scale context based projects were implemented in secondary science education. These programs included; Lessons project and the Linking School Science to Industry and Technology (LISSIT) project in Swaziland and the Basic Education into Rural Development (BEIRD) project in Uganda. The programs were short term and focused in general on context in science education. The projects technological contexts related to students everyday life were used as a starting point to teach scientific concepts.

In Zambia the concept of CBA is not new; it has been emphasized in the teaching of science subjects by linking the lessons to learner's daily life experiences. In 2013 the biology syllabus (5090) was revised in order to link education to real life experiences that give learners skills to practically apply knowledge that can help them gain life skills (CDC, 2013).

2.3 Biology Teachers CBA Knowledge in the design of 'O' level biology lessons

Teachers CBA knowledge involves the use of both the social context of learning environment and the real, concrete context in the teaching process (Gilbert, 2005). In CBA, content is taught through connections and knowledge to be learned becomes easy to acquire through learners connection with the nearest environment. Teachers' knowledge in CBA would help the learners to learn what is relevant and help them solve problems in their daily life situations (Ozcan & Gercek, 2015). Therefore, this calls for biology teachers to design lessons in line with the learners' everyday life experiences for meaningful learning.

A study was done in Turkey by Ozcan and Gercek (2015), which focused on physics candidate teachers' opinions about CBA in physics lessons. The findings showed that the physics teacher candidates had lack of knowledge and lack of applications about the context based approach used in physics lessons. Another study was done in the same country by the same researchers, which aimed at finding out the views of biology teacher candidates about context based approach. The findings of the study revealed that the biology teacher candidates lacked knowledge of context based approach, which could be improved by using the CBA activities in courses at university level. The two studies by Ozcan and Gercek (2015) examined teacher candidates and the findings seem to be in harmony. However, the current study investigated in-service biology teachers' CBA knowledge in lessons design.

Additionally, Center for Occupational Research and Development, CORD (1999) emphasized that learning occurs only when learners process new information in line with their everyday life experiences. The mind naturally seeks meaning in context by searching for relationships that make sense and appear useful. Henceforth, contextual learning encourages teachers to design lessons that combine diverse forms of learners' experiences for meaningful learning. It encourages teachers to use real life examples from learners nearest environment. Therefore, in such an environment, learners discover meaningful relationships between abstract ideas and practical applications in the context of the real world; concepts are internalized through the process of discovering, reinforcing, and relating. However, in spite of the significant contribution by CORD (1999) the study did not consider teachers' knowledge in the design of the learning environment which can expose learners to real life examples. Therefore, the current study investigated teachers CBA knowledge in 'O' level biology lesson design and the following

constituted CBA knowledge; giving real life examples, engaging learners actively in the lesson and preparing context based problem solving tasks for the learners.

A study was done in Netherlands by Wieringa, Janssen and Van Driel (2011) which aimed at biology teachers designing context based lessons for their classroom practice. Findings of the study indicated that all the participants seemed to follow roughly the same process of designing context based lesson, but only two out of six participants followed the formal designing principles when designing the lessons. Therefore, it was strongly recommended to take teachers' knowledge and beliefs into account during curriculum innovation (Borko & Putnam, 1996). However, regardless of the valuable contribution of Wieringa, et al., (2011) the study did not examine teachers' knowledge in the design of context based lessons and this creates a knowledge gap.

Furthermore, CBA is expected to improve students' understanding and trigger learners' preconceptions, which are the starting point for meaningful learning (Scott, Asoko & Leach, 2007). This is further stimulated by the use of questions and problems from real life situations of the learners (Bulte, Westbroek, de Jong & Pilot, 2006). In addition, Mukhopadhyay (2013) asserted that in the context of learning science, when learners are given problems or identify problems by themselves, they examine the situation and search for the solutions of those following the guidelines of problem based learning. Therefore, Mukhopadhyay (2013) recommended that problem based learning is very critical to contextual learning because it promotes conceptual understanding of biology concepts. However, Mukhopadhyay (2013) did not evaluate teachers' CBA knowledge in the design of biology lessons with attention to how they prepare context based solving activities for the learners in secondary schools.

In addition to problem solving tasks, Roth and McGinn (1997) emphasized that if the education system is to serve its intended purpose and live up to expectations, then the goal is to educate the learners to be problem solvers. However, a major concern in science education in which the kinds of problems pupils do in school to practice their problem solving competence have little to do with the problems they will need to solve in everyday life experiences (Roth & McGinn ,1997). Despite the emphasis on problem solving activities, the study by Roth and McGinn (1997) did not examine teachers' knowledge in the preparation of problem solving activities for the learners.

Furthermore, research identified three structures of context that form the conditions for effective learning: task, situation and idioculture (Finkelstein, 2005). Context as the form of a particular problem that has to be solved is called the task. The activity in which the task takes place is called the situation, for example a group of three students working together to solve the problem. The circumstances of the situation are formed by a larger context, for instance the biology class, which is called idioculture. During the solving of a particular problem all three structures of context interact and influence each other.

A study was done in one of the black sea region Universities in Turkey on the process of creating context based problems by teacher candidates in the department of secondary science and mathematics education (Uzunboylu, 2012). The findings showed that the pre-service teachers could develop context based problems even though they were accustomed to traditional problems. The study used the following guidelines to determine the process of developing context based problems by teacher candidates;

i. Appropriate context should be determined.

ii. The problem should make learners feel the principles related to real life.

iii. Each problem should contain a scenario, event or story that the major character is the learner.

iv. In the problem, learners should be faced with a problem that can be solved using mental skills.

v. The problem must be encountered in real life.

However, despite all these guidelines of creating context based problem solving tasks for the learners, candidate teachers were still accustomed to traditional way of teaching. This indicated that teacher candidates lacked the knowledge of designing context based problem solving tasks. The current study did not use the guidelines above to create context based problem solving tasks and it focused on in-service biology teachers CBA knowledge in the design of context based problem solving tasks for their learners.

Furthermore, Gilbert (2006) emphasized that an important element of a context based learning environment is active learning. Learners are required to be responsible for their own learning. The combination of self-directed learning and the use of contexts are in line with a social constructivist view of learning. In a social constructivist view of learning, Labudde (2008) distinguished four learning dimensions. The first dimension concerns the individual; he said knowledge is a construction of the individual learner. The second dimension concerns social interactions; he said that knowledge construction occurs in exchange with other people. The third dimension concerns the content; if learning is an active process of constructing new knowledge based on existing knowledge then the contents to be learned must be within the familiarity of the

learners. The fourth dimension concerns the teaching methods, which is the role of the teacher (Labudde, 2008).

Therefore, it is worthwhile to state that the four learning dimensions by Labudde (2008) are fundamental to meaningful learning based on social constructivist view of learning. Hence, it is important for teachers to design teaching methods which could engage learners in the learning process which raise their interest, appreciation and understanding of science.

2.4 Biology teachers Implementation of CBA in the teaching of 'O' level biology

According to Yerrick et al., (1997), both implementing context based curricula in schools and creating context based learning environments in classrooms critically depend on teachers. Teachers are a critical factor in creating the desired context based learning environments. This was supported by Sadler (2009) who said that teachers play an important role in implementing and shaping of context based curricula. Besides, some studies which focused on the impact of context based approaches on teaching and the behavior of teachers showed that it was difficult to let teachers engage with contextual teaching in science beyond the traditional procedure (Sadler, 2009). De Jong (2008) pointed out that several problems in secondary education were associated with lack of learners to transfer scientific concepts to the real life situation. In a similar view, King and Ritchie (2013) added that there are reasons which prohibit the implementation of CBA on a large scale. These reasons include lack of understanding the way students learn in context based learning environment. In view of the studies by (De Jong, 2008; King & Ritchie, 2013), it was important for this study to examine how CBA is implemented in the teaching of 'O' level biology in selected secondary schools of Kafue district.

The national policy on education in Zambia identifies the diversity of the educational process and the various needs to encourage qualities and potentialities of each pupil (MoE, 1996). Mwanza (2010) asserted that one way to achieve this and develop the full potential of the pupils in science is to teach them in ways that promote contextual learning by giving real life examples with the things they meet in everyday life in order for them to see the relevance of school science. Mwanza added that, this will not only enable learners to attach more meaning to the scientific concepts learnt in school science but also give the pupils more realistic application of science in everyday life and acquire a meaningful life time experience and long-term memory. Therefore, it is important to note that the focus of the current study is in support with the emphasis by Mwanza (2010) that teaching should be contextualize by giving learners real life examples from the nearest environment in order to attach relevance to the learning process.

In a similar view, one of the aims of the biology high school syllabus in Zambia is to allow the learners attain adequate knowledge and understanding that would help them identify the usefulness and application of science in everyday life experiences (CDC, 2000). Therefore, biology teachers should deliver their lessons in line with learners' everyday life experiences.

Furthermore, De Jong (2008) defined four domains of the origin of contexts: the personal domain, the social and societal domain, the professional practice domain and the scientific and technological domain. The domains are distinguished to explain in which incidence contexts give meaning. In the personal domain contexts make a link between science and the personal life of the learner, for example personal health care is given as a useful example of an everyday life concern. In the social and societal domain contexts refer to the role of the learner in a community and in social issues, for example climate changes and the effect of acid rain are provided. In the professional practice domain contexts are related to the prospective career of the learner. The

practices of chemical engineers can be used as a context for several processes and topics. In the scientific and technological domain the context is shaped by scientific innovations and discoveries. Hence, the purpose of CBA is to improve relevance of science education to the learners.

A study at University of Zambia conducted by Mwanza (2011) which focused on grade 10 pupils understanding of saponification and its application to everyday life experience. A qualitative case study strategy was used in this research as it was intended to gain in depth insight of the pupils' knowledge and understanding of saponification concepts and how they linked saponification concepts to everyday life phenomena. The findings of this study seem to provide insights which show that many pupils in environmental science and chemistry gained very low levels of understanding on saponification. The pupils found it difficult to make meaning of saponification concepts and consequently did not link saponification to soap making phenomenon in everyday life world. However, the findings seem to indicate that environmental science teachers did not link the topic on saponification to learners' everyday life experience. You can agree with me that almost on daily basis learners use soap for washing clothes, bathing, cleaning dishes and so many other things which need soap for cleaning. Despite all the uses of soap, the study revealed that learners had low levels of understanding of saponification. Nevertheless, the study by Mwanza (2011) only investigated pupils understanding of saponification and application to their everyday life experiences, but it did not consider how teachers of science linked their lessons to learners' everyday life experiences. In view of this, the current study investigated biology teachers and how they implement CBA in the teaching of 'O' level biology.

Furthermore, another study at the University of Zambia conducted by Haambokoma (2007) focused on nature and causes of learning difficulties in Genetics at high school level in Zambia. One of the findings was that the learning difficulty in genetics faced by high school pupils in Zambia was due to the inability of teachers to explain the concepts clearly to students. Therefore, Haambokoma (2007) recommended that teachers must give adequate explanation to students by relating things taught to real life situations. The findings were consistent with those of Chama (2019), who asserted that during chemistry lessons there were no questions from the teachers that could help learners to link practical activities to their real life situations. The findings of the two studies suggested that science teachers did not link their lessons to learners' real life situations, which is contrary to context based approach. However, regardless of the contributions by Haambokoma (2007) and Chama (2019) they did not examine how science teachers link their lessons to learners' real life experiences. Therefore, there was need for the current study to investigate how biology teachers link their lessons to the learners' real life situations.

De Putter-Smits et al., (2012) explored the competencies teachers need to successfully implement context based learning in their classroom. The following are required teaching competencies that the study revealed:

i. To understand the context at hand.
ii. To be able to handle contexts in educational practice adequately.
iii. To be willing and able to focus their lessons on more than just formal.
iv. To be able to coach and regulate the learning process of student that have a relative freedom on what, when and how to learn.
v. To be able to flexible adapt the learning environment as to facilitate the various learning courses taken.

vi. To be able and willing to compose adequate tests for fair and complete assessment.

vii. To be able and willing to advocate and demonstrate the context based approach to their colleagues and within their schools.

Out of the seven competencies, the last one was relevant for successful implementation of context based education at the level of the whole school. Therefore, implementing CBA should go with creating constructivist learning environments in order to help the learners to link the lessons to their everyday life experiences.

2.5 Usefulness of teachers CBA Knowledge in 'O' level biology to learners

Holbrook (2014) asserted that teaching of biology is uninteresting and difficult for students. It is necessary to connect teaching and daily life to a larger degree. Learning scientific facts, concepts and natural phenomena in school should not be separated from the context in which they appear. Teaching should be based on the learners' previous knowledge, and the connection between the experience of learners and biological concepts can help students better understand biological concepts.

Furthermore, According to Kukliansky and Eshach (2013), the key to successful learning is to link the knowledge gained to something that is meaningful to learners. Wieringa et al., (2011) added that use of context based teaching provides a better understanding of teaching content, which is the starting point for meaningful learning. This is expected to improve students' motivation, develop a sense of curiosity about nature, develop students' positive attitudes towards science and the scientific view of the world and provide easier learning.

De Jong (2008) asserted that an increasing amount of studies have been performed on the impact of different aspects of context based science education. Results from these studies are generally

in favour of context based education because the understanding of scientific concepts obtained from these approaches is at least good compared to traditional approaches and the interest, motivation and attitude towards science of learners is usually improved in context based education. This motivation due to CBA results in learner conceptual understanding of biological concepts than when they use the traditional approaches only.

In England, Ramsden (1997) carried out a study on the effects of context based teaching and traditional teaching by comparing learners answers in high schools. The findings showed that there was a slight difference in understanding the content in question. However, the approach based on context encouraged the learners' interests. The findings of this study were consistent with the study in Turkey by Sozbilir et al., (2007) that context based learning improves students' skills of research, observation, scientific and critical thinking and connecting theory with practice. This was supported by Avargil, Herscovitz, and Dori (2011) that studies on application of context based teaching have confirmed the conclusion that teaching in context engages learners more and encourages them to engage in certain activities, such as argumentation and discussion.

Furthermore, a similar experimental study was conducted by Jelena, Milica and Ljubisa (2016) to evaluate the effectiveness of the application of context based teaching vs. conventional expository teaching. The results indicated that the use of context based teaching directly contributed to the better quantity and quality of knowledge. Through context based teaching, students connect the given content with everyday life experience, also learners are able to assess the value of learning, and connect it with the previously acquired knowledge, in order to build their own system of knowledge. In this way, learners become aware of the bigger picture and of

the value and application of the concepts learned. Nevertheless, the contribution of Jelena, Milica and Ljubisa (2016) was valuable, although the study used quantitative approach. The current study used qualitative approach.

It is clear from the reviewed literature that there had been no study in Zambia to the researchers' knowledge on the usefulness of CBA to learners. Therefore, it was in the researchers' interest to determine among other things the usefulness of biology teachers' context based approach knowledge in 'O' level biology to learners.

2.6 Summary of Literature Review

The chapter reviewed literature about the implementation of CBA in the teaching of 'O' level biology. The studies reviewed showed that teacher candidates lacked CBA knowledge in the teaching of science. However, the current study focused on in-service teachers CBA knowledge in designing 'O' level biology lessons. The chapter further reviewed that teachers are central in the implementation of CBA, but did not focus on how CBA is implemented by teachers. Conversely, the current study assessed how biology teachers implement CBA in the teaching of 'O' level biology. Finally, the majority of the reviewed studies focused on the impact and influence of CBA in the teaching and learning process. However, the current study determined the usefulness of teachers CBA knowledge in 'O' level biology to the learners.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Overview

This chapter covers the Research approach, philosophical underpinning guiding the study, research design, study site, target population, study sample, sampling procedures, research instruments, data collection procedures and data analysis.

3.2 Research Approach and Philosophical underpinning of the study

The study used a qualitative approach. Anderson (1987) defines qualitative approach as a research paradigm which emphasizes inductive, interpretive methods applied to the everyday world which is seen as subjective and socially created. Qualitative research does not usually employ statistical procedures or other means of quantification, focusing instead on understanding the nature of the research problem rather than on the quantity of observed characteristics (Strauss & Corbin, 1994). In addition, Denzin and Lincoln (2011) asserted that qualitative researchers generally assume that social reality is a human creation; they interpret and contextualize meanings from people's beliefs and practices.

Furthermore, qualitative approach allows gathering of multiple forms of data from multiple sources such as interviews, observations, documents and many more rather than relying on a single data source. This increases the depth of understanding of the situation about a much smaller number of participants but reduces generalizability (Patton, 2002). The number of characteristics of qualitative approach highlighted above is in line with the assumptions of interpretivism philosophy, which underpinned the current study. This was supported by Hefferman (2013) who contended that the interpretivism philosophical paradigm is associated

with the qualitative research approach. This is because the paradigm seeks to understand a phenomenon under study from the experience of the participants using different data collecting agents. The proponents of this philosophy put forward a number of basic ideas such as individuals seek understanding of the world in which they live and work. As a result, individuals develop subjective meanings of their experiences directed at certain objects or things (Creswell, 2014). Hence, the role of the researcher was to interpret the views or experiences of the biology teachers on how they implement CBA in the teaching of 'O' level biology.

3.3 Research Design

A case study design was employed in conducting this study. According to Hancock and Algozzine (2006), Case study research methods allow researchers to capture multiple realities that are not easily quantifiable. This approach differs from those of other methods in its holistic approach to information collection in natural settings and its use of purposive sampling techniques. Gerring (2004) added that a Case study research involves intensive study of a single unit for the purpose of understanding a larger class of similar units observed at a single point in time or over some delimited period of time. Baxer and Jack (2008) clarified that case studies provide an opportunity for the researcher to gain a deep holistic view of the research problem, and may facilitate describing, understanding and explaining a research problem or situation. The design also allowed the researcher to collect detailed data using a variety of data collection instruments and procedures (Yin, 2012). The study used observations, document analysis, semi-structured interviews and focus group discussion with pupils for data collection. Figure 3 illustrates the steps which the researcher followed in the case study design.

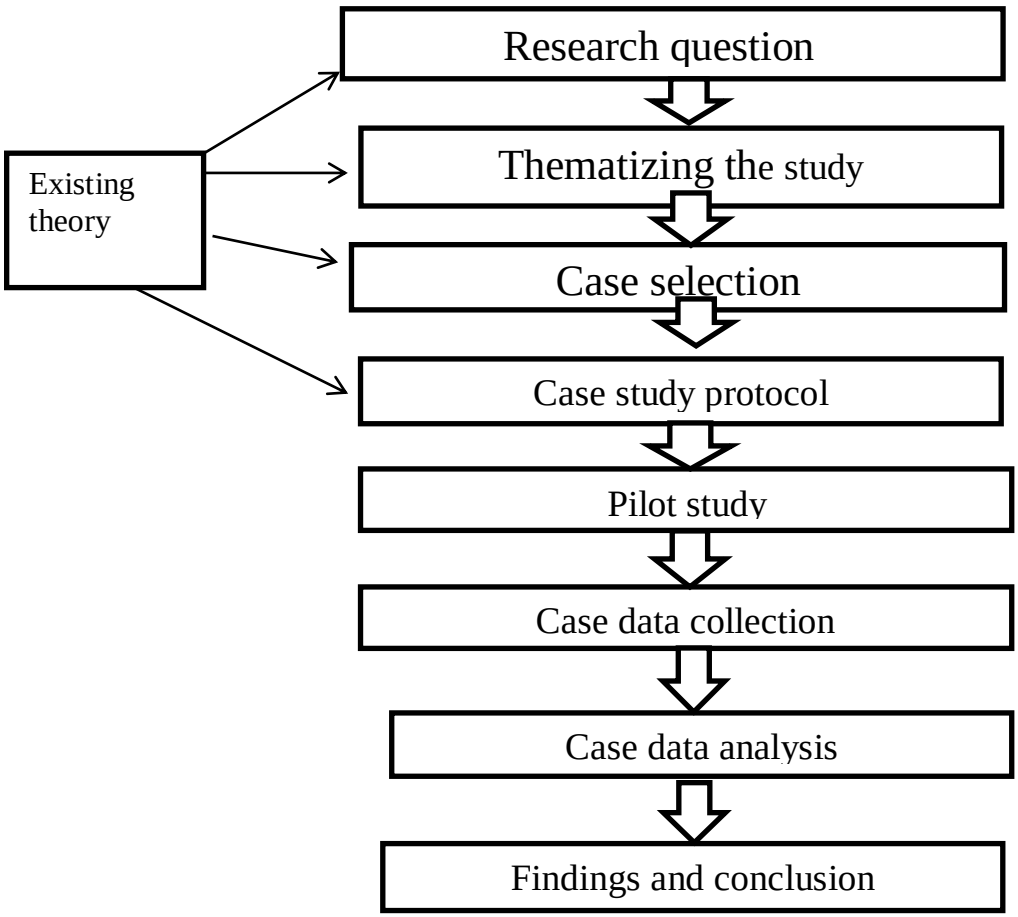


Figure 3: General steps in the case study design used

The design started with formulating appropriate research questions that shaped the structure of the study. Case selection followed after 'Thematizing' the study, making clear what the study aimed to investigate. Case study protocol was the next step and it served as a plan for the fieldwork. A pilot study followed after preparing a case study protocol and then data was collected and analysed.

3.4 Study site

The study was conducted in three selected secondary schools of Kafue district in Lusaka province of Zambia. The study site was considered appropriate because of the proximity of the areas to the location of the researcher.

3.5 Study population

This study targeted teachers teaching biology (5090) syllabus in three selected secondary schools of Kafue district in Lusaka province. In order to get a wider range of data, the study included pupils from the respective classes where lesson observations were done.

3.6 Study sample

The study sample comprised 6 biology teachers and 30 pupils drawn from three secondary schools that offered biology. There are no rules for sample size in qualitative inquiry; Yin (2003) recommends at least six sources of evidence. Creswell (2011) recommends not more than four to five cases. He further recommends three to five interviews per study. Therefore, due to so much time required for observation and focus group discussion in each school, the sample was representative enough (Ary, Jacobs & Sorensen, 2010).

3.7 Sampling techniques

In this study purposive sampling was used to select the six biology teachers. The six teachers were selected because they were teaching all the three grades (grade 10, 11 and 12). According to Patton (2002), Purposive sampling is a technique widely used in qualitative research for the identification and selection of information rich cases for the most effective use of limited resources. This involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest (Creswell & Plano, 2011). Marshall and Rossman (2011) indicated that there are a number of purposive sampling techniques used in qualitative research. The study used homogenous sampling. This is because the researcher intended to select participants that shared the same characteristics or experience in the teaching of 'O' level biology. Marshall and Rossman (2011) adds that

homogenous sampling is a purposive sampling technique that aims to achieve a homogenous sample; that is a sample whose units share similar characteristics or traits that are similar in age, gender, background and occupation. The 30 pupils were selected from the classes where lesson observations were done.

3.8 Research instruments

The objectives of the study provided the foundation from which the instruments were designed. The instruments used to collect data are outlined in section 3.8.1 to 3.8.4;

3.8.1 Observation Schedule

An observation schedule was used to help the researcher gather information on one objective; to assess how teachers of biology implemented CBA in the teaching of 'O' level biology. O'Leary (2012) asserted that observation is a systematic method of data collection that relies on a researcher's ability to gather data through his or her senses. However, One disadvantage of observations is that it is hard to act naturally when you know you are being watched, even worse when you know you are being studied. Therefore, building trust and making sure participants are comfortable the researcher was introduced to the participants by the Head of natural science department. Furthermore, anonymity and privacy was assured to the participants.

3.8.2 Semi structured Interview guide

Semi structured interview guide was used to collect data from six biology teachers (Creswell, 2009). White (2005) added that Open ended questions usually take time to analyze and are more difficult to analyze as compared to closed questions. However, open- ended questions allow more opportunity for creativity or self-expression by the participants. The instrument was designed by the researcher in such a way that it addressed all the three objectives of the study.

3.8.3 Document Analysis guide

The instrument was designed to capture one objective of the study; to determine biology teachers CBA knowledge in the design of 'O' level biology lessons. Document analysis provides a deep understanding of the study (Nkwi, Nyamongo & Ryan, 2001). In addition, Ary et al., (2010) asserted that a qualitative researcher may use written documents to gain an understanding of the phenomenon under study. The term document refers to a wide range of written, physical, and visual materials, including what other authors may term artifacts. The analysis may be of existing artifacts or records, or in some cases the researcher may ask subjects to produce artifacts or documents.

3.8.4 Focus Group Discussion guide

The instrument was designed by the researcher in such a way that it captured one objective of the study; to determine the usefulness of teachers CBA knowledge in 'O' level biology to the learners and further to clarify information from the lesson observation and semi structured interviews. The instrument had eight questions. According to Kumar (1987), focus group discussion is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants gather to discuss issues and concerns based on a list of key themes drawn up by the researcher.

3.9 Validity of the Instruments

Data collection was preceded by a pilot study at the school with similar characteristics to the schools where the main study was undertaken; this was in order to determine the validity of instruments (White, 2005). To ensure validity the instruments were checked and refined by two experts in the field of science education at the University of Zambia.

3.10 Data collection procedure

The researcher reported to the Head Teachers and presented an introductory letter obtained from the Directorate of Research and Graduate Studies of the University of Zambia through the Office of Assistant Dean Postgraduate in the School of Education. The letter introduced the researcher as a student and stated the purpose of the study. Then, the Head Teachers introduced the researcher to the Heads of Science Department. After which, the researcher was able to meet the biology teachers with the help of the Science Heads of Department.

A consent form was given out to all the biology teachers who participated in the study. This form contained the following information regarding the study: purpose, procedures, benefits, discomforts, confidentiality and the right to refuse to participate or right to withdraw from the study if need be. After accepting to participate in the study, the researcher made appointments with the participants according to their usual teaching time tables.

The first activity was lesson observation, the researcher observed 18 lessons in total. Each participant was observed three times in an eighty minutes lesson. The observations focused on context based teaching methods, connecting biology lessons to learners everyday life experience, use of real life objects or models as teaching Aid and context based problem solving tasks.

Secondly, document analysis of schemes of work and lesson plans was done after each observation. The document analysis focused on biology teachers CBA knowledge in the design of 'O' level biology lessons.

Furthermore, Semi structured interviews followed after document analysis. It consisted of the introductory request portion, partly for personal particulars and seven open ended questions

framed in statements with spaces for writing responses. The activity focused on all the three objectives.

Focus group discussion for the learners was the last activity to be conducted. This was done in three groups of 10 pupils in the three selected secondary schools. The main focus of this activity was to collect information on one objective; to determine the usefulness of teachers CBA knowledge in 'O' level biology to the learners and further to clarify information collected from lesson observation and semi structured interviews.

Taking into consideration ethical issues, the schools were identified by colours (purple, yellow and green) while for participants; teachers were identified by letters (A, B, C, D, E and F) and learners (P_1,P_2 , P_3, P_4, P_5, P_6, P_7, P_8, P_9 and P_{10} for school purple), (Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7, Y_8, Y_9 and Y_{10} for school Yellow) and (G_1, G_2, G_3,G_4, G_5, G_6, G_7, G_8, G_9 and G_{10} for school Green). The entire process of data collection lasted for six weeks and it was done in the first term of 2019.

3.11 Data analysis

In this study the collected data was analysed thematically. Thematic analysis is a method for identifying, analysing, and reporting patterns (themes) within data (Beyatzi, 1998). The data collected from observations, interviews, focus group discussion and information from document analysis was analysed in line with research objectives and questions. Firstly, the collected data was organized. This was done by transcribing semi-structured open ended written interviews, focus group discussion and data from document analysis. The researcher was indicating notes in the lesson observation schedule and focus group discussion guide during lesson observation and focus group discussion respectively. After which data was sorted and put into different categories

depending on its sources that is the instruments. Secondly, data was read through for general sense of the information and to reflect on its overall meaning (Creswell, 2008). Lastly, data from various sources was read several times and then organized into categories based on its meaning after which major themes were generated.

3.12 Ethical considerations

Clearance before conducting this study was given by Directorate of Research and Graduate Studies of the University of Zambia through the office of Assistant Dean Postgraduate in the School of Education. Thereafter, permission to conduct the study in the three schools and gain access to the participants was sought from their respective Head Teachers. The letter introduced the researcher as a student and stated the purpose of the study. The participants were informed about the nature of the study and their rights to withdraw from the study at any particular point were respected. Confidentiality, anonymity and privacy of the participants were assured as recommended by Creswell (2003). Fictitious names for participants and schools were used. Before recording the lessons, the researcher asked for permission from participants and explained why the lessons needed to be recorded. In order to protect the videos a folder and a password key were created and only the researcher had knowledge of this password key. Furthermore, the data collected was kept by the researcher and only used for achieving the objectives of the study.

3.13 Trustworthiness and credibility

Triangulation and member checking were engaged in order to enhance trustworthiness and credibility of data. Triangulation ensured that the study was accurate because of multiple sources of data, individuals, or processes. On the other hand, member checking is a process in which the researcher asks one or more participants in the study to check the accuracy of the account. This

check involves taking the findings back to participants and asking them (in writing or in an interview) about the accuracy of the report (Creswell, 2012). Participants were asked about many aspects of the study, such as whether the description was complete and realistic, if the themes were accurate to include, and if the interpretations were fair and representative.

3. 14 Summary of the Methodology

The chapter discussed the research approach, philosophical underpinning of the study, research design, population and sampling procedures. Additionally, research instruments, data collection procedures and analysis procedures were also explained. The next chapter is presentation of findings.

CHAPTER 4

PRESENTATION OF FINDINGS

4.1 Overview

This chapter is in three sections 4.2, 4.3 and 4.4. Section 4.2; presents findings on biology teachers' context based approach knowledge in the design of 'O' level biology lessons. Section 4.3; presents findings on biology teacher's implementation of context based approach in the teaching of 'O' level biology. Section 4.4; presents findings on the usefulness of teacher context based approach knowledge in 'O' level biology to the learners. The data analysis procedure in this study was specifically guided by the research questions:

4.2 Research question 1: *What knowledge of CBA do teachers of biology have in lesson design?*

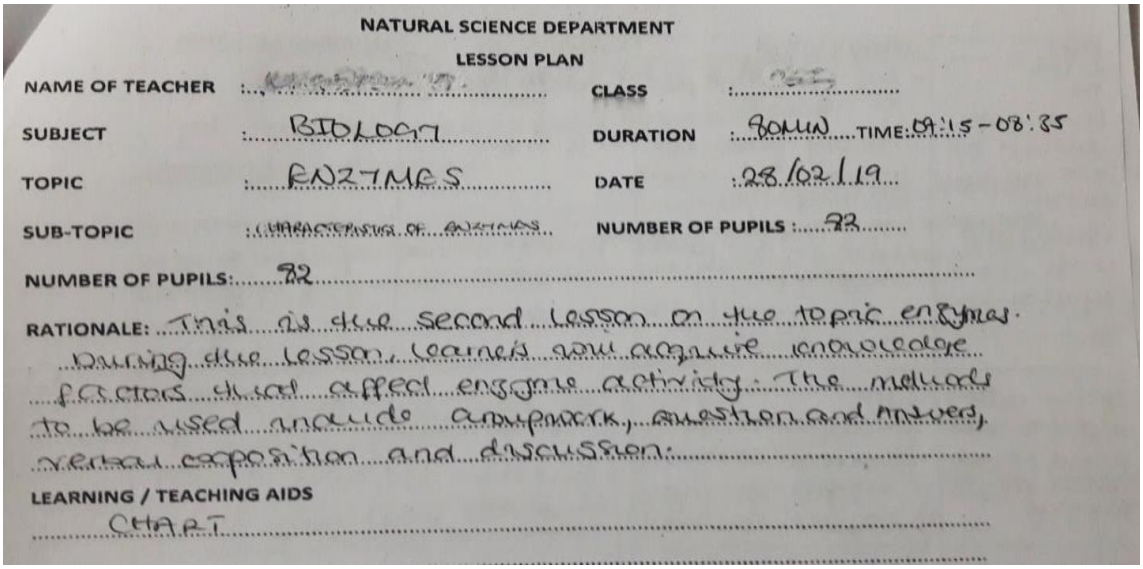
To determine teacher's context based approach knowledge (CBA) in lesson design, the study focused on how the teacher included the following at the stage of lesson preparation: real life examples, teaching methods planned with opportunities for collaborative learning, and context based problem solving tasks for learners.

4.2.1 Use of real life examples

In order to establish if teachers included real life examples from learners nearest environment at the stage of lesson design, the study used document analysis of lesson plans. The study revealed that very few participants (two) included real life objects as examples in their lesson plans. The majority of participants (four) did not include any real life example during lesson planning. This indicated that generally, teachers of biology did not show CBA knowledge of the use of real life

examples from the learners nearest environment. The following figures are examples of the lesson plans from different schools which were analysed. The names of schools were hidden.

The Figure 4 shows the rationale on the topic enzymes. It can be seen from Figure that the statement on the rationale does not represent a real life example that could help learners to connect the lesson to their everyday life experiences. Context based approach involves giving examples from the learners nearest environment. The statement from the rationale that learners will acquire knowledge on factors that affect enzymes is not context based.



NATURAL SCIENCE DEPARTMENT

LESSON PLAN

NAME OF TEACHER : [redacted] CLASS : [redacted]

SUBJECT : BIOLOGY DURATION : 80MIN TIME: 09:15 - 08:35

TOPIC : ENZYMES DATE : 28/02/19

SUB-TOPIC : CHARACTERISTICS OF ENZYMES NUMBER OF PUPILS : 32

NUMBER OF PUPILS: 32

RATIONALE: This is the second lesson on the topic enzymes. During the lesson, learners will acquire knowledge factors that affect enzyme activity. The methods to be used include demonstration, question and answer, verbal explanation and discussion.

LEARNING / TEACHING AIDS

CHART

Figure 4: showing the rationale on the topic Enzymes (characteristics of Enzymes)

The next Figure (5) shows the lesson plan for the teacher who planned perfume as a teaching aid for the topic diffusion. The participant identified perfume as a teaching aid for the lesson on diffusion which is a real life example. However, the rationale of the lesson does not include a real life example. The participant should have used perfume as an example that could help the learners to link the lesson on diffusion to their everyday life experiences.

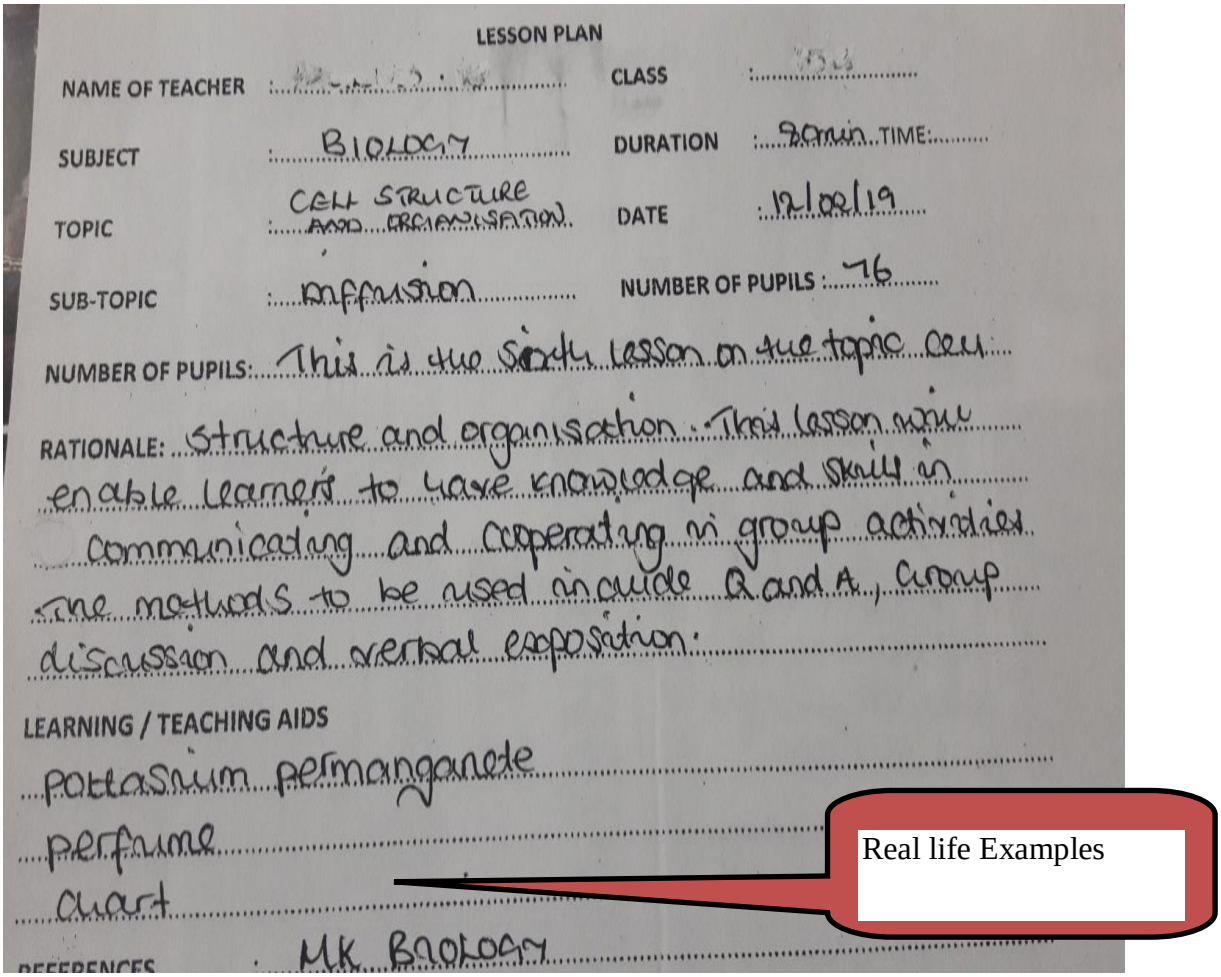
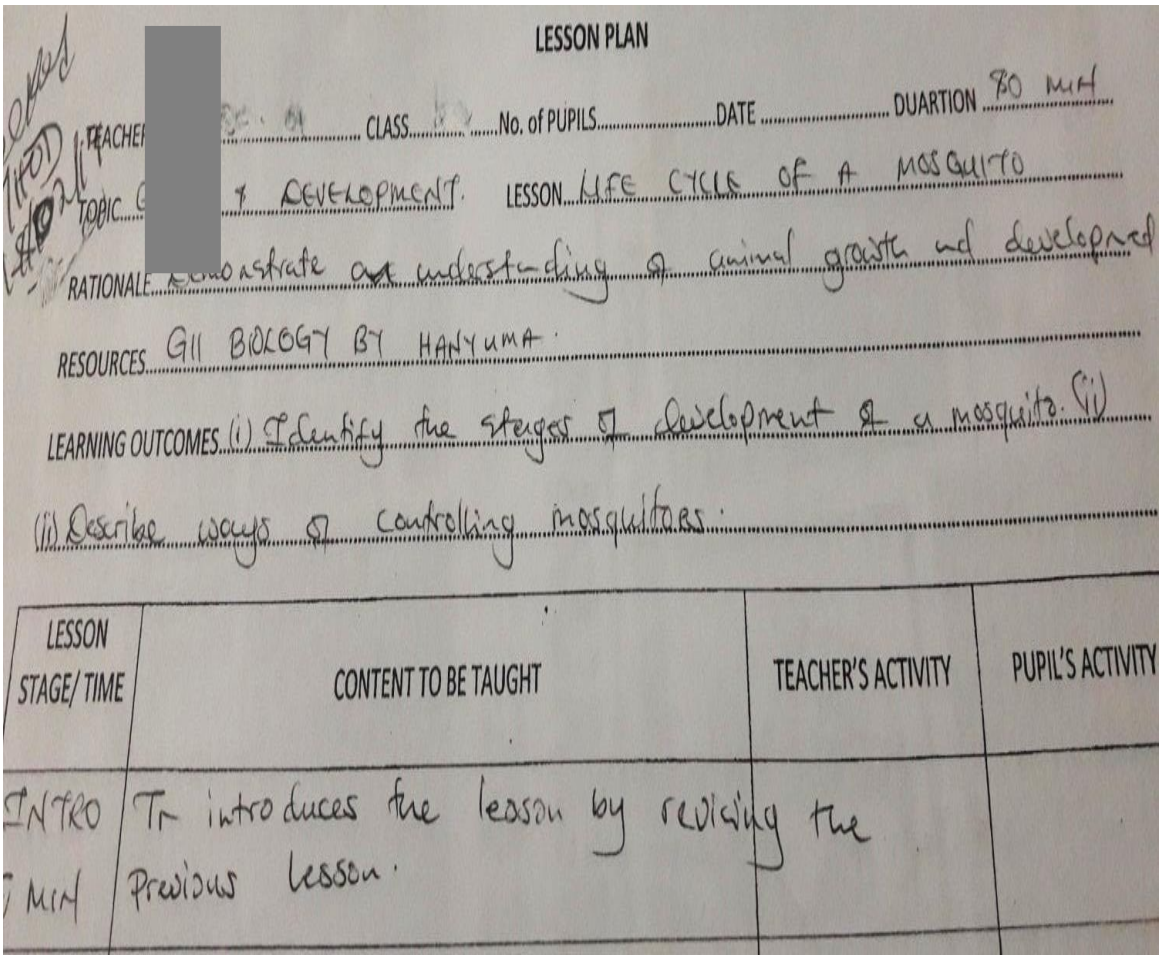


Figure 5: Lesson plan on the topic on cell structure and Organization (diffusion)

The next lesson was based on a life cycle of a mosquito. It can be seen from Figure 6 that there is no difference between the rationale and the topic; Growth and development. The rationale should have given the purpose of learning the lesson on life cycle of a Mosquito. Therefore, the rationale, demonstrating an understanding of animal growth and development, is not a real life example which can help learners to link the lesson to their everyday life experiences



LESSON PLAN

TEACHER [redacted] CLASS ..... No. of PUPILS ..... DATE ..... DUARTION 80 MIN

TOPIC ... DEVELOPMENT. LESSON... LIFE CYCLE OF A MOSQUITO

RATIONALE ... demonstrate our understanding of animal growth and developed

RESOURCES... GII BIOLOGY BY HANYUMA.

LEARNING OUTCOMES (i) Identify the stages of development of a mosquito. (ii)

(ii) Describe ways of controlling mosquitoes.

LESSON STAGE/ TIME	CONTENT TO BE TAUGHT	TEACHER'S ACTIVITY	PUPIL'S ACTIVITY
INTRO 5 MIN	Tr introduces the lesson by revising the Previous lesson.		

Figure 6: Lesson plan on the topic growth and development

The next Figure (7) showed a real life example (Herbaceous plant) for the topic transport and storage in plants. It can be seen from the Figure that the lesson introduction could not help learners connect the lesson to their everyday life experiences. Asking the pupils to define transport during lesson introduction can not help the learners link the lesson to their everyday life experiences. However, the participant used a real life object (Herbacious plant) as a teaching Aid for the lesson showing CBA knowledge in giving everyday life examples.

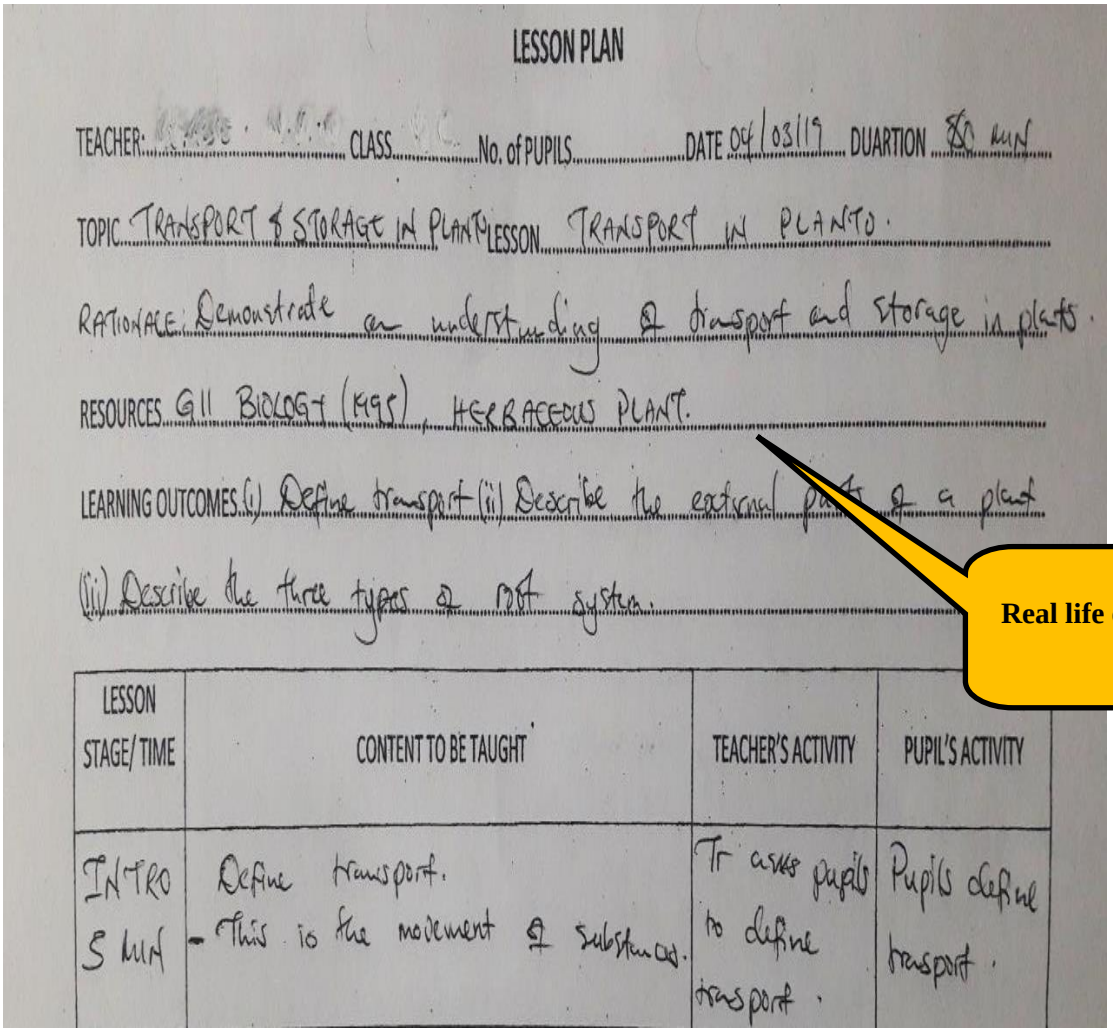
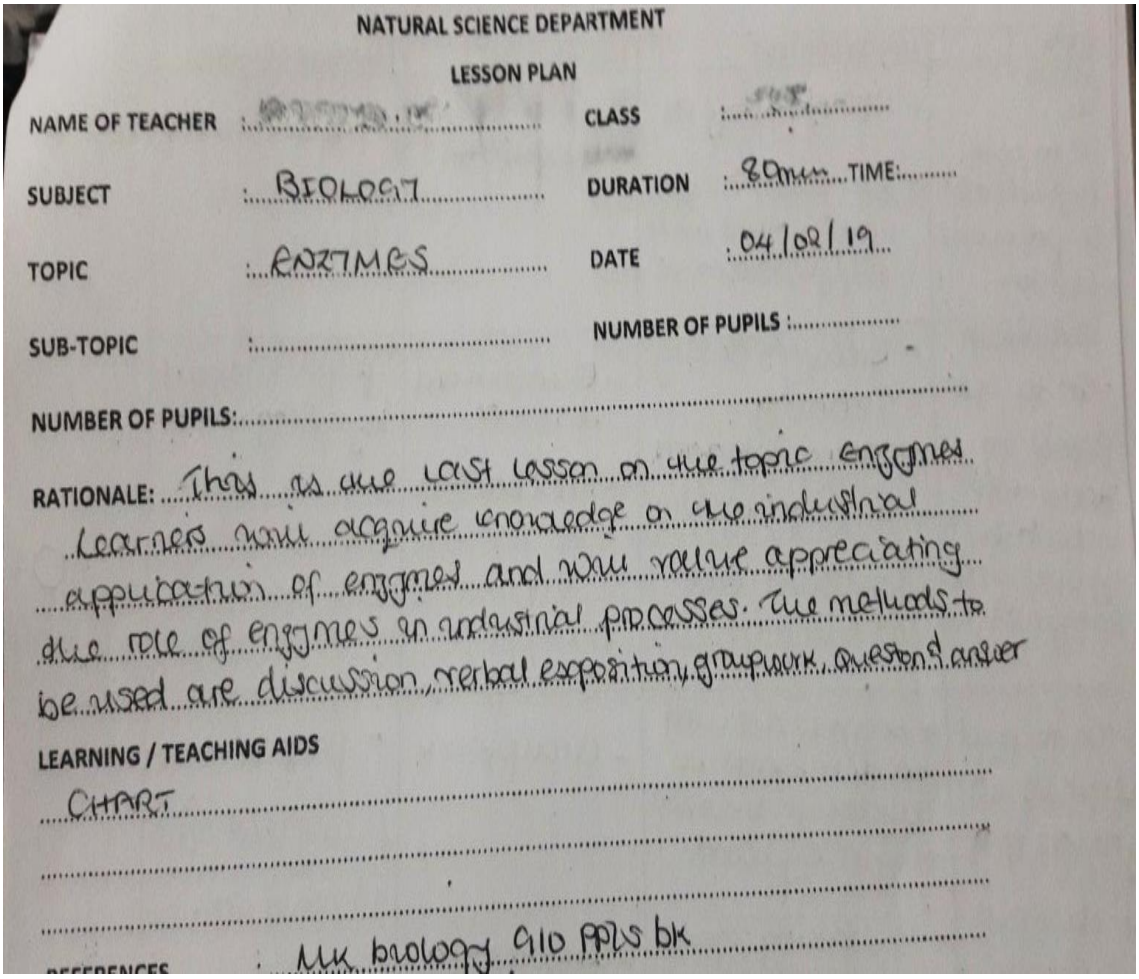


Figure 7: A real life example as a teaching Aid for the topic transport and storage in plants

The next lesson was based on industrial application of enzymes. It can be seen from Figure 8 that the rationale was supposed to be a sub-topic. A lot of industries use enzymes in their industrial process. The participant could have used the products from these industries to help learners link the lesson on industrial application of enzymes to their everyday life experiences.



NATURAL SCIENCE DEPARTMENT

LESSON PLAN

NAME OF TEACHER : ..... CLASS : .....

SUBJECT : BIOLOGY DURATION : 80mins TIME: .....

TOPIC : ENZYMES DATE : 04/02/19

SUB-TOPIC : ..... NUMBER OF PUPILS : .....

NUMBER OF PUPILS: .....

RATIONALE: This is the last lesson on the topic enzymes. Learners will acquire knowledge on the industrial application of enzymes and will value appreciating the role of enzymes in industrial processes. The methods to be used are discussion, verbal exposition, groupwork, question and answer

LEARNING / TEACHING AIDS

CHART

.....

.....

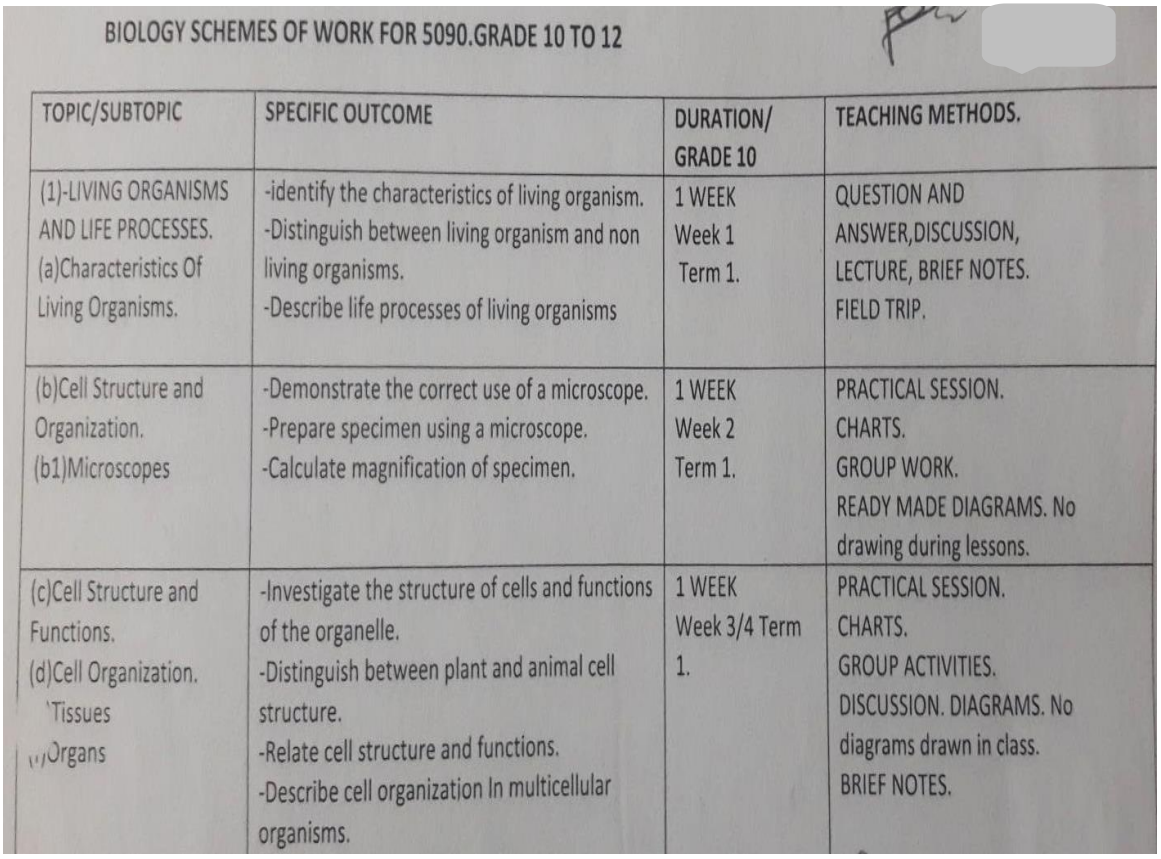
REFERENCES : MK biology 910 pp 15 bk

Figure 8: Lesson plan for the topic industrial application of enzymes

4.2.2 Teaching methods planned with opportunities for collaborative learning

The study used document analysis of schemes of work and lesson plans to determine biology teachers' context based approach knowledge in designing teaching methods which could engage learners in real life experiences through collaboration. The study showed that all the participants had CBA knowledge in designing teaching methods that could engage learners actively in the lesson and help them connect the lessons to their real life experiences. This could be due to the fact that the participants were using a common district scheme of work for biology 5090 as

shown in the Figures 10, 11 and 12 representing schemes of work from various schools in the district:

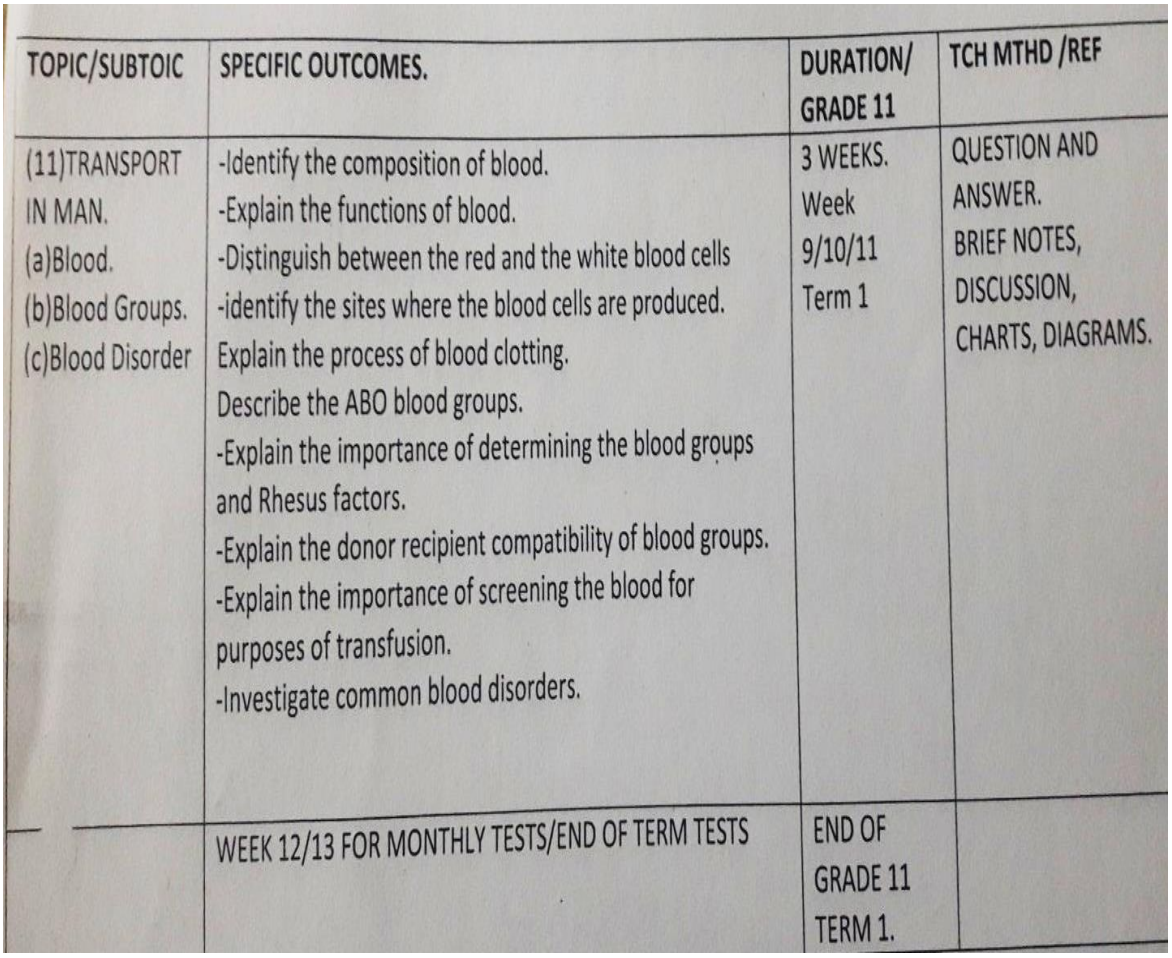


BIOLOGY SCHEMES OF WORK FOR 5090.GRADE 10 TO 12

TOPIC/SUBTOPIC	SPECIFIC OUTCOME	DURATION/ GRADE 10	TEACHING METHODS.
(1)-LIVING ORGANISMS AND LIFE PROCESSES. (a)Characteristics Of Living Organisms.	-identify the characteristics of living organism. -Distinguish between living organism and non living organisms. -Describe life processes of living organisms	1 WEEK Week 1 Term 1.	QUESTION AND ANSWER,DISCUSSION, LECTURE, BRIEF NOTES. FIELD TRIP.
(b)Cell Structure and Organization. (b1)Microscopes	-Demonstrate the correct use of a microscope. -Prepare specimen using a microscope. -Calculate magnification of specimen.	1 WEEK Week 2 Term 1.	PRACTICAL SESSION. CHARTS. GROUP WORK. READY MADE DIAGRAMS. No drawing during lessons.
(c)Cell Structure and Functions. (d)Cell Organization. 'Tissues Organs	-Investigate the structure of cells and functions of the organelle. -Distinguish between plant and animal cell structure. -Relate cell structure and functions. -Describe cell organization In multicellular organisms.	1 WEEK Week 3/4 Term 1.	PRACTICAL SESSION. CHARTS. GROUP ACTIVITIES. DISCUSSION. DIAGRAMS. No diagrams drawn in class. BRIEF NOTES.

Figure 9: Common schemes of work for biology 5090. Grade 10

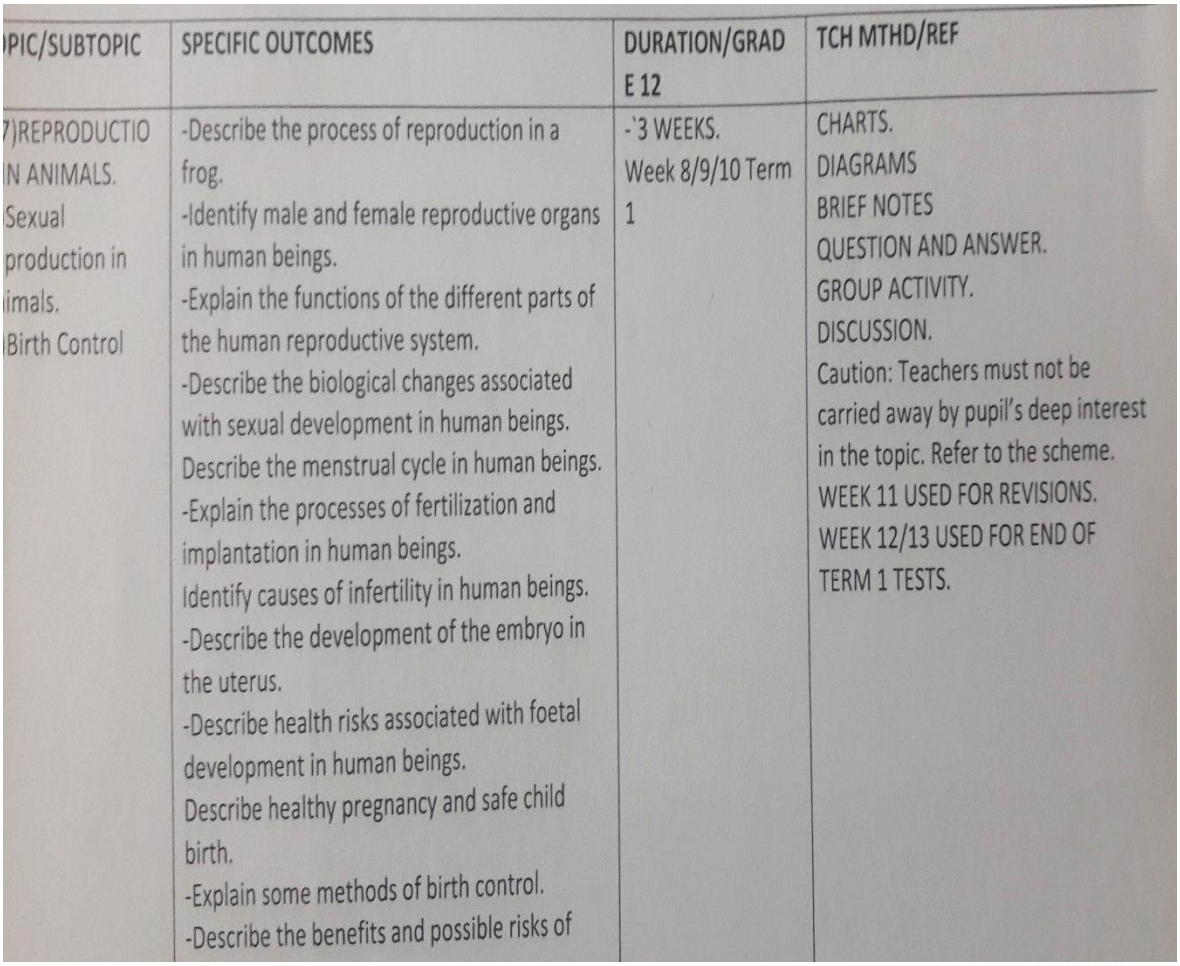
It can be seen from Figure 9 that the common schemes of work was designed from grade 10 to 12 and the teaching methods planned could engage learners in the lesson. For example field trip for the topic living organisms and life process can help learners realize the link between the lesson and their daily life experiences. The next Figure showed grade 11 common schemes of work for biology 5090.



TOPIC/SUBTOIC	SPECIFIC OUTCOMES.	DURATION/ GRADE 11	TCH MTHD /REF
(11)TRANSPORT IN MAN. (a)Blood. (b)Blood Groups. (c)Blood Disorder	-Identify the composition of blood. -Explain the functions of blood. -Distinguish between the red and the white blood cells -identify the sites where the blood cells are produced. Explain the process of blood clotting. Describe the ABO blood groups. -Explain the importance of determining the blood groups and Rhesus factors. -Explain the donor recipient compatibility of blood groups. -Explain the importance of screening the blood for purposes of transfusion. -Investigate common blood disorders.	3 WEEKS. Week 9/10/11 Term 1	QUESTION AND ANSWER. BRIEF NOTES, DISCUSSION, CHARTS, DIAGRAMS.
	WEEK 12/13 FOR MONTHLY TESTS/END OF TERM TESTS	END OF GRADE 11 TERM 1.	

Figure 10: Common schemes of work for biology 5090. Grade 11

It is clear from Figure 10 that discussion method was planned for the topic transport in man. The method could engage learners in the learning process, although it was not enough for the whole topic. The next Figure was based on grade 12 common schemes of work for biology 5090.



PIC/SUBTOPIC	SPECIFIC OUTCOMES	DURATION/GRADE 12	TCH MTHD/REF
7)REPRODUCTIO N ANIMALS. Sexual production in imals. Birth Control	-Describe the process of reproduction in a frog. -Identify male and female reproductive organs in human beings. -Explain the functions of the different parts of the human reproductive system. -Describe the biological changes associated with sexual development in human beings. Describe the menstrual cycle in human beings. -Explain the processes of fertilization and implantation in human beings. Identify causes of infertility in human beings. -Describe the development of the embryo in the uterus. -Describe health risks associated with foetal development in human beings. Describe healthy pregnancy and safe child birth. -Explain some methods of birth control. -Describe the benefits and possible risks of	-`3 WEEKS. Week 8/9/10 Term 1	CHARTS. DIAGRAMS BRIEF NOTES QUESTION AND ANSWER. GROUP ACTIVITY. DISCUSSION. Caution: Teachers must not be carried away by pupil's deep interest in the topic. Refer to the scheme. WEEK 11 USED FOR REVISIONS. WEEK 12/13 USED FOR END OF TERM 1 TESTS.

Figure 11: Common schemes of work for biology 5090. Grade 12

It can be seen from Figure 11 that group activity and discussion could engage learners in the lesson. However, teachers were cautioned to stick to the schemes of work and not to be carried away by learners' interest.

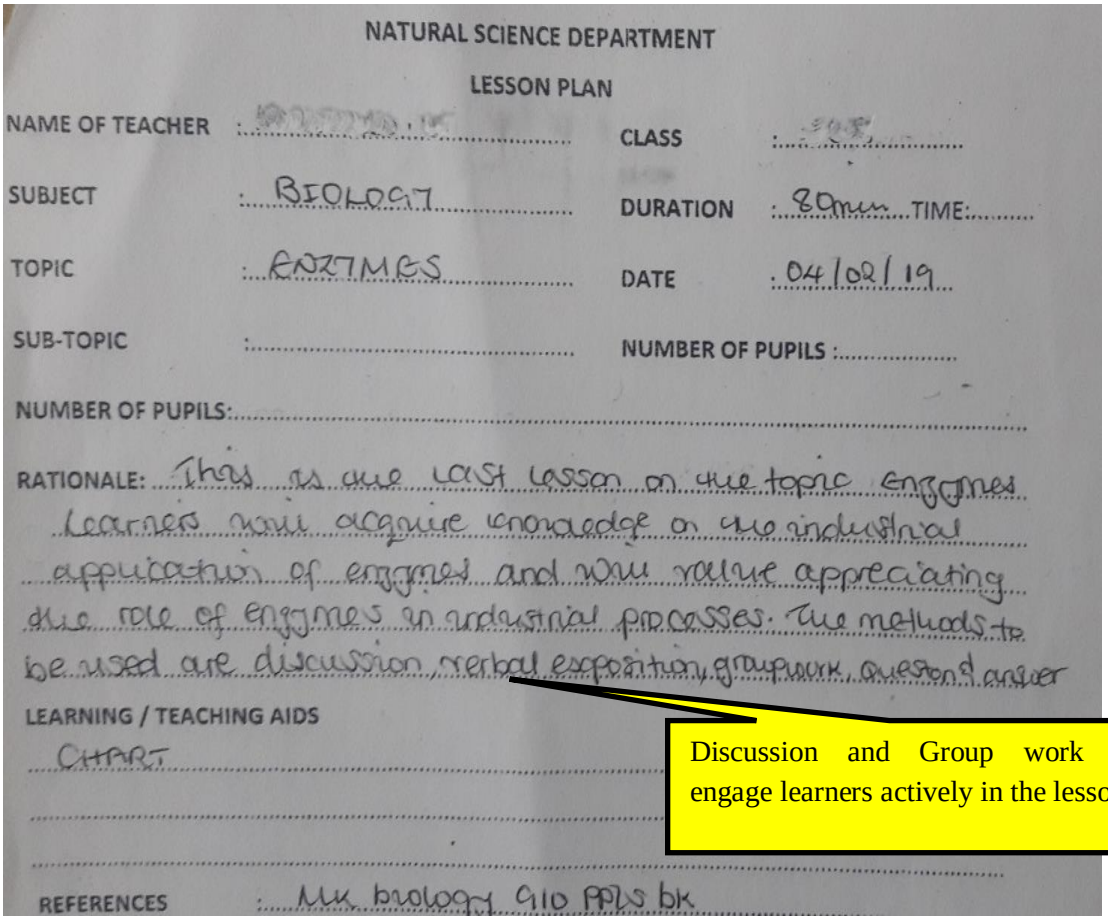
Henceforth, it is clear from Figures 9 to 11 that experimentation, discussion and group activity were the common teaching methods in the schemes of work that were meant to engage learners in the lesson actively. However, such methods appeared in the common schemes of work. The current study revealed teacher exposition, question and answer as the dominating teaching methods used by teachers in classes.

Document analysis of lesson plans also revealed that discussion, group work, teacher exposition, question and answer were the most frequent teaching methods. Results are shown in Table 1.

Table 1: Teaching methods

S/N	**Teaching methods**	**Frequency**
		Lesson plans (18)
1	Teacher exposition	16
2	Question and Answer	13
3	Discussion	10
4	Experimentation	6
5	Demonstration	2
6	Group work	11
7	Field trip	0

Teacher F, for example; planned for group work, discussion, verbal exposition and question and answer as the teaching methods for the lesson on industrial application of enzymes as shown in Figure 12:



NATURAL SCIENCE DEPARTMENT

LESSON PLAN

NAME OF TEACHER : [redacted] CLASS : [redacted]

SUBJECT : BIOLOGY DURATION : 80min TIME: .....

TOPIC : ENZYMES DATE : 04/02/19

SUB-TOPIC : ..... NUMBER OF PUPILS : .....

NUMBER OF PUPILS: .....

RATIONALE: This is the last lesson on the topic enzymes learners will acquire knowledge on the industrial application of enzymes and will value appreciating the role of enzymes in industrial processes. The methods to be used are discussion, verbal exposition, group work, question and answer

LEARNING / TEACHING AIDS

CHART

.....

.....

REFERENCES : MK biology 910 PPLS bk

Discussion and Group work could engage learners actively in the lesson

Figure 12: Teacher F, lesson plan

4.2.3 Preparation of Context based problem solving tasks

To determine teachers CBA knowledge in the preparation of context based problem solving tasks the study used document analysis of lesson plans and it was complimented by semi structured interviews. A total of 18 lesson plans were analysed and the analysis showed that no participant planned for context based problem solving tasks for the learners. However, participants were asked during semi structured interviews to explain how they could create a context based problem solving task that relates to learners real life experiences. Out of six participants only three participants said the following;

Teacher A said:

...by giving learners a research based assignment for example discuss the transmission, treatment and impact of HIV/AIDs.

Teacher C said:

…by providing practical work in which they investigate a cause for certain situation for example plant provided with culture solution and another plant without nitrogen. Observe and conclude what has led to situation under observation.

Teacher F said:

…by asking learners to take a field trip and identify living and non-living organisms. Ask the pupils to identify the similarities and differences between living and non-living organism.

Certainly from the responses, it is important to note that even the participants who managed to respond to the question did not explain clearly how a context based problem solving task can be created that could help learners relate to their real life experiences.

4.2 Research question 2: How do teachers of biology implement CBA in the teaching of 'O' level biology?

To assess how teachers of biology implemented CBA during 'O' level biology lessons the researcher focused on how teachers' of biology linked the lessons to learners everyday life experiences during 'O' level biology lessons.

4.3.1 Connecting biology lessons to learners everyday life experiences

The study mainly used lesson observation to establish the connection between biology lessons and learner's everyday life experiences by giving learners examples from their nearest environment, using real life objects or models as teaching aids and engaging learners in context based problem solving tasks. A total of 18 lessons were observed and out of 6 participants that were observed only two participants explained the following during 'O' level biology lessons in the classroom;

Teacher A explained that:

> …in woody plants when the xylem vessel matures the inner part of the stem or the roots become wood, this is the reason why it is difficult to cut the stem of guava tree than the stem of grass. Furthermore, the participant gave an example of a woody desk as a matured xylem in woody plants.

In a different class, Teacher A elucidated that:

> …Auxin promotes growth of the plants both in the root and shoots system. Places where goats graze, grass does not grow tall because goats feed on the shoots of the plants which store Auxin and this limits the growth of the grass.

On the other hand, teacher F during a lesson on the role of large intestine in digestion explained that:

> …eating spoiled food (for example spoiled beans) can disrupt the digestive system and cause diarrhea, because spoiled food contain pathogens which when taken inside can be virus which can infect the gut.

In a different class, Teacher F explained that:

…baking powder and yeast contains enzymes, when baking powder and yeast is added to dough, it causes the dough to increase in volume. Therefore, baking powder and yeast is used for baking bread, pancakes, cakes, scones etc.

Nevertheless, during lesson observations no participant engaged learners in the lesson in order to help them link the lesson to their everyday life experiences. It is also important to note that although the two participants (Teacher A and F) gave examples related to learners everyday life experiences, they did not engage learners and all the examples were given using lecture method.

Additionally, to assess how biology teachers connected their lessons to daily life experiences of learners, the study also used a semi structured interview. Participants were asked to choose any topic from 'O' level biology syllabus and explain how they could connect the lesson to the learners real life experiences. The following were the responses from the teachers;

Teacher A said:

…the topic drugs and drug abuse can be linked to real life experience of the learners by considering the effects of stimulants and depressants drugs on people that are addicted as they tend to affect the nervous system.

Furthermore, Teacher B on the topic response in plants explained that:

…plant roots grow towards earth due to response to gravity, this enables plant roots absorb water. Plant shoots also respond to light and this exposes leaves to photosynthesis.

On the other hand, Teacher C explained that:

…the topic seed dispersal can be linked to learner's daily life experience by choosing two local seeds; black jack seeds and guava seeds. Black jacks are dispersed by animals to far places because it sticks to clothes and animal fur, this helps preventing overcrowding of seeds on one area. Guava seeds are dispersed by man as he/she eats guavas, because guava seeds cannot be digested by gut enzymes.

Furthermore, Teacher D said that:

…Osmosis and diffusion can help learners to establish the importance of maintaining balanced concentration gradient, because any deviation from balanced concentration gradient results in negative effects such as crenation, wilting, lysis etc.

In the same line Teacher F explained that:

…the topic diffusion (cell structure and organization) can be linked to real life experiences of learners when it comes to smelling of perfume when it's sprayed. It shows that the particles are moving from one place more concentrated with perfume particles to a less concentrated place, so that the perfume scent is spread throughout the room.

Teacher E responded that:

…Reproduction in humans can be linked to learner's daily life experience by using a model and videos showing male and female reproductive organs. A model can also be used to demonstrate a pregnant woman appearance and learners will be able to connect to real life situations.

The responses show that teachers had the content of biology but how to help learners acquire and link the content to their everyday life experiences was a challenge. It is important to note that no participant explained the approach he/she could have used to help learners' connect the topic to their everyday life experiences.

Furthermore, it was also observed that no participant used a real life object or a model as teaching aid. Besides, results from lesson observations on the use of real life objects or models during 'O' biology lessons comprehended with the results from focus group discussions. The following extracts given by learners (P_2, P_{10} and G_8) act as typical examples:

…no we don't learn biology using models or real life objects, but our biology teacher sometimes uses charts **(P_2).** …..no our teacher of biology only uses charts and draw diagrams on the board **(P_{10}).** ……I don't even know how a model looks like **(G_8).**

4.3.2 Giving context based problem solving activities

To establish this, the study used lesson observation. The study revealed that no participant gave a context based problem solving task to the learners. Therefore, this is an indication that teachers of biology did not implement CBA by giving learners activities in line with the problems that they encounter in their communities in order for them to apply biology content in their everyday life experiences.

4.3 Research question 3: How useful is teachers CBA knowledge in 'O' level biology to the learners?

To determine the usefulness of biology teachers CBA knowledge in 'O' level biology to learners the study focused on the following aspects: the importance of linking biology lessons to learners'

daily life experiences, the benefit of using real life objects or models as teaching aids and the benefits of creating context based problem solving tasks for the learners.

4.4.1 The importance of linking biology lessons to learners everyday life experiences

To establish the importance of linking biology lessons to learners' everyday life experiences, the study mainly used focus group discussion for the learners. Participants (learners) were asked to give the importance of learning biology in line with their everyday life experiences and the following were the responses;

Y_4 said:

…learning biology in line with our everyday life experiences can help us understand difficult topics in biology.

On the other hand, G_7 said:

…if we learn biology in line with everyday life experiences can help us pass biology examination.

In a similar view, P_5 said:

…biology is a good subject and it should be learned in line with our daily life experiences in order to understand biology.

Furthermore, responses from focus group discussion of learners were in agreement with the responses from semi structure interviews for teachers. The participants (teachers) were asked in their opinion to give the importance of linking biology lessons to learners' daily life experiences and the following were the responses;

Teacher A said:

…linking the lesson to learners daily life experience is very important, because it brings about better application of the lesson as this broadens their level of thinking in biology.

Teacher B said:

…it is always important to link biology to daily life experiences because biology is a living subject, therefore all lessons should be linked to real life experiences.

In a similar view, teacher C said:

…biology is a practical subject; therefore, connecting the lessons to learners' daily life experiences can exposes them to massive experiences in biology which they can use to solve biology related problems in future.

Teacher D said:

…It helps learners to appreciate the beauty of nature. This results into an individual to cultivate qualities of conserving nature, among other concepts.

Furthermore, teacher E said:

…It enables learners to know that biology is not only for passing exams but it is also applicable to real life situation.

In a similar view, Teacher F said:

…It can help learners to relate biology lessons with what they experience at home when the lessons are linked to learners daily life experiences.

From these responses it was clear that both teachers and learners acknowledged the importance of linking biology lessons to learners' everyday life experiences in terms of increasing learner attention, motivating learners, helping learners to understand biology concepts and pass examinations.

4.4.2 The benefit of using real life objects or models as teaching aids for the learners

Apart from establishing the importance of linking biology lessons to learners everyday life experience, the study also considered the benefits of using real life objects or models as teaching aids for learners. Focus group discussion with learners revealed that they acknowledged the importance of using real life objects or models as teaching aids during 'O' level biology lessons. The following extracts by learners (P_6, Y_5, G_3 and P_7) act as typical examples:

> ...learning biology can be interesting, because will be able to see the real objects when learning biology **(P_6).** ...real objects can help us understand biology fast **(Y_5).** … I cannot forget biology concepts when real objects are used during biology lessons **(G_3).** ... Can help us pass biology practical examination, because during practical exams real life objects are used **(P_7).**

Furthermore, responses from focus group discussion were clarified by semi structured interviews for teachers. The participants were asked in their opinion to give the benefit of using real life objects or models as teaching Aids during 'O' level biology lessons and the following were the responses;

Teacher A said:

> …learners' attention is drawn to the lesson when actual objects are used.

Teacher B said:

…learners are able to link the lessons easily when they are taught using objects they interact with in the environment.

Teacher C said:

…using real life objects or models when teaching biology stimulates interest to learn more when learners interact with real objects, knowing that it concerns their life.

Teacher D said:

….learners would want to learn the subject more eagerly and easily comprehend what they learn using real life objects or models.

Teacher F said:

…learners tend to broaden their reasoning when they are taught using real life objects or models.

The responses from the participants indicate that they acknowledged the benefits of using real life objects or models as teaching aids for the learners in terms of increasing learners' attention and interest in the lesson, understanding biology concepts and broadening learners reasoning.

4.4.3 The benefits of context based problem solving tasks

To establish the benefits of context based problem solving tasks, the study used semi structured interviews. During interviews, teachers elaborated that context based problem solving tasks can help learners to relate biology lessons to their experiences at home, bring about better

performance in biology, enhance learners self-expression and make learners appreciate the beauty of life and nature. The following extracts by teachers act as typical examples:

Teacher A said:

…real life problem solving activities can bring out better performance as it becomes easier to relate the knowledge acquired during biology lessons with learners' experience at home.

In a similar view, teacher B said:

…the environment that involves learners to tackle real life problem can enhance their self-expression and makes them more comfortable to bring out their real life experiences.

Teacher C said:

…it can expose learners to the actual problems and make them develop critical thinking to sort real life problems.

On the other hand, teacher D said:

…learners will understand the world around them and appreciate the beauty of life and nature.

Teacher E said:

…learners can connect what they learn in the classroom to their life and be able to apply the knowledge to similar problems in future.

Teacher F said:

…for learners to understand biology in line with their day to day life experiences.

Responses from semi structured interviews comprehended with those from focus group discussion with learners. During focus group discussions, learners (Y_9 and G_3) elaborated the following:

…biology can be more practical to learn because the knowledge acquired cannot only be used for passing biology examinations but also can be applied in future to solve biology related problems **(Y_9).** …can help us identify and solve future problems **(G_3).**

It is important to note that both participants acknowledged the benefit of context based problem solving tasks. The key point from the responses was that the knowledge acquired can be used to solve future problems and this is the focus of context based approach, to apply the acquired knowledge in biology to real life situations.

4.5 Summary of the Chapter

The findings chapter has shown a number of things as outlined in the following subsections.

4.5.1 Biology teacher's context based approach knowledge in 'O' level biology lesson design

- Two out of six participants showed CBA knowledge in giving real life examples during lesson preparation. On the other hand, 4 out of 6 participants did not show CBA knowledge in giving real life examples during lesson preparation.
    - All participants showed CBA knowledge in designing teaching methods which could engage learners actively in the lesson.
    - No participant prepared a context based problem solving task during 'O' level biology lesson design.

4.5.2 Assessing the implementation of CBA by teachers of biology during lessons

- Two out of six participants linked their lessons to learners' everyday life experiences during the delivery of the lesson. On the hand, four out of six participants did not link their lessons to learners' everyday life experience.
- No participant gave a context based problem solving task to learners during lesson delivery.

4.5.3 Usefulness of biology teachers CBA knowledge in 'O' level biology to learners

- All participants acknowledged the importance of CBA in terms of increasing learner attention, motivating learners, helping learners to understand biology concepts and passing examinations.
- All participants acknowledged the benefits of using local materials/models in terms of increasing learners' attention and interest in the lesson.
- All participants acknowledged the benefits of context based problem solving activities in terms of easily linking the lessons to their experiences at home, applying biology content in daily life situations and appreciating the beauty of life and nature.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 Overview

This chapter discusses the findings of the study as presented in Chapter four. Just like in the previous chapters, the discussion will be done in subsections. Section 5.2: discusses biology teachers' context based approach knowledge in 'O' level biology lesson design, Section 5.3: discusses teachers' implementation of context based approach (CBA) in the teaching of 'O' level biology and Section 5.4: discusses usefulness of teachers context based approach knowledge in 'O' level biology to the learners.

5.2 Research question 1: What knowledge of CBA do teachers of biology have in lesson design?

This sub-section discusses findings on biology teachers CBA knowledge in 'O' level biology lesson design by focusing on the following aspects; using real life examples, teaching methods planned with opportunities for collaborative learning (learners engagement) and preparing context based problem solving tasks for learners.

5.2.1 Use of real life examples

The study revealed that out of 6 participants, only few participants (2) planned for real life objects (real life example) as teaching aids during 'O' level biology lesson design (4.1.1). The majority of the participants (4) did not use any real life example during 'O' level biology lesson design. The findings are similar to those in the study conducted by Ozcan and Gercek (2015) that biology teacher candidates lacked some knowledge about CBA, which could be improved by using the CBA activities in courses at university level. However, the study by Ozcan and Gercek

(2015) investigated only teacher candidates CBA knowledge. The current study targeted in-service biology teachers CBA knowledge in 'O' level biology lesson design. Therefore, it is important to design biology lessons by giving real life examples in order to make the subject relevant to the learners and this was supported by Sozbilir et al., (2007) who said that the basic goal of context based approach is to introduce scientific concepts through examples from daily life. Learners can easily learn those scientific concepts which are related with daily life.

The study further revealed that document analysis of lesson plans did not bring out any statement related to learners' everyday life experiences. For example, the rationale on Figure six, to demonstrate an understanding of animal growth and development was not a real life example; instead it was a repetition of the topic; Growth and development. Another example is on figure 5 on the topic Enzymes; the participant left the provision for sub-topic blank and wrote the sub-topic on the rationale which was not supposed to be the case. There are several industries which use enzymes in various ways. The teacher could have taken advantage of the products of these industries and help the learners to realize the link between the lesson and their everyday life experiences. For example baking powder and yeast contain enzymes; when baking powder and yeast are added to dough, they cause the dough to increase in volume. Therefore, baking powder and yeast as examples of enzymes have a lot of contexts such as: baking bread, pancakes, cakes, scones and so on which the teacher could have referred to. It is important for the teachers of biology to contextualize the lessons by giving learners everyday life examples and this is in harmony with CORD (1999) who argued that contextual learning focuses on multiple aspects of any learning environment and it encourages teachers to design lessons that include many different forms of experience in working toward the desired learning outcomes. Therefore, in

such an environment, students discover meaningful relationships between abstract ideas and practical applications of content in the context of the real life situations.

5.2.2. Teaching methods planned with opportunities for collaborative learning

The study revealed that all the teachers had CBA knowledge in designing teaching methods that could engage learners actively in the lesson and help them connect the lessons to their real life experiences. One of the reasons could be that all the biology teachers were using the district common schemes of work for biology 5090 which contained collaborative learning methods. If it was not so, probably the findings could have been different. Nevertheless, the findings from document analysis of schemes of work and lesson plans were consistent, for more information refer to sub-section 4.1.2. he findings are in line with Social constructivist theory of Vygotsky (1978) who emphasized that context based learning is a pedagogical methodology that centers on both the social context of the learning environment and the real, concrete context. The approach is based on the firm conviction that learning is a social activity and context in which learning is based on a dual axis: on the one hand, the context is the social situation of learning whereby knowledge is acquired, processed, and produced through collaboration and use rather than direct dissemination; on the other hand, the context must be an engagement with a real life task whereby knowledge interfaces with an actual, empirical reality. Both axes initiate a move away from passive learning in the traditional classroom situation.

Additionally, Vygotsky (1978) asserted that classrooms that practice constructivist activities empower the learners to gain access to their experiences and beliefs that reshape their prior knowledge in the light of the applied course content. This is supported by Taconis and Jochems (2013) that learning is understood as a process in which learners construct their own meanings from their experiences, rather than acquiring knowledge by ‘copying’ it from other sources. In a

similar view, Ozcan and Gercek (2015) stated that CBA towards learning refers to doing by learning rather than delivering theoretical knowledge. It aims at connecting theoretical knowledge with daily life through concrete examples from the nearest environment or through learners' analysis of the examples related to the concepts at hand. From document analysis of schemes of work and lesson plans (Table 1) it is clear that the majority of participants planned at least one teaching method which can engage learners actively in the lesson and help realize the link between lesson and their everyday life experiences.

5.2.3 Preparation of Context based problem solving tasks

The results of the study established that no participant planned for a context based problem solving task for the learners. This implies that teachers lacked CBA knowledge in the design of context based problem solving activities for the learners. The finding is not consistent with that of Uzunboylu (2012) who examined the process of creating context based problems by teacher candidates. The study revealed that teacher candidates could develop context based problems even though they were accustomed to traditional problems. On the other hand, the current study targeted in-service biology teachers and the study established that no participant prepared a context based problem solving activity for the learners. Furthermore, in the researchers view, the reason why the study by Uzunboylu (2012) revealed that teacher candidates could develop context based problem solving task is because they had guidelines to follow. However, regardless of using the guidelines the teacher candidates were still accustomed to traditional way of teaching.

In addition, the study further revealed that even the three participants out of six who responded to the question on how a context based problem solving task can be created during semi structured interviews, they did not explain clearly how a context based problem solving task can

be created in line with learners daily life experiences, instead the tasks they proposed to be context based looked like any other task from biology text books (4.1.3). For example teacher A cited that learners should be given research based assignment for example discuss the transmission, treatment and impact of HIV/AIDs. Teachers F cited that learners should be taken to a field trip and ask them to identify living and non-living organisms. Therefore, the proposed tasks from the participants are not context based problem solving tasks and are contrary to the study by Uzunboylu (2012) who asserted that a context based problem solving task should contain a scenario, event or story that the major character is the learner and the problem should make learners feel the principles related to real life. Furthermore, the finding of the current study is also contrary to that of Scott et al., (2007) who emphasized that learners understanding of scientific concepts is stimulated by the use of questions and problems from real world contexts as starting points for developing a 'need' to learn about science.

5.2 Research question 2: How do teachers of biology implement CBA in the teaching of 'O' level biology?

5.3.1 Connecting biology lessons to learners everyday life experiences

The study revealed that out of 6 participants, only 2 participants linked the lessons to learners' everyday life experiences. For more information refer to responses on sub-section 4.2.1. However, it is important to note that even those participants who linked the lessons to learners' everyday life experiences did not engage learners in the lesson to help them realize the link between the lesson and their everyday life experiences. This implies that teachers were still adapted to passive way of teaching. The findings are not in harmony with those of Yerrick et al., (1997) who asserted that both implementing context based curricula in schools and creating context based learning environments in classrooms critically depend on teachers. Teachers are

critical factors in creating the desired learning environments, which can help learners connect the lessons to their everyday life experiences. On the other hand, the finding of the current study seems to be in harmony with that of Sadler (2009) who indicated that a couple of recent studies focus on the impact of context based approaches on teaching and the behavior of teachers: Several of these studies revealed that it was difficult to let teachers engage with an approach of science instruction beyond the traditional procedure. Though the current study did not investigate the behavior of biology teachers, it showed that only two participants out of six explained with context, but they did not engage learners during their lessons.

Furthermore, the majority of participants (Teachers B, C, D and E) did not link the lesson to learner's everyday life experiences during 'O' level biology lessons. These findings were consistent with those of Fullan (2004) who asserted that teachers generally do not implement an innovation exactly the way it was originally described in curriculum documents and this was supported by Wieringa et al., (2011) who contended that when teachers interpret an innovation their practical knowledge which is an integration of experiential knowledge, formal knowledge and personal beliefs acts as a filter. Therefore, although in 2013 the Zambian ordinary level biology syllabus (5090) was reviewed with the aim of linking biology to real life situations of learners, the majority of participants did not link their lessons to learners' everyday life experiences. There is need for future studies on CBA to investigate the challenges biology teachers still encounter in linking their lessons to learners' everyday life experiences, so that the study might bring out challenges teachers of biology encounter in linking their lessons to learners everyday life experiences.

Furthermore, findings from semi structured interviews for biology teachers indicated that biology teachers had the content of biology but did not connect the content in line with learners' real life situation. The findings are contrary to CBA and so inconsistent with emphasis by Wieringa, et al., (2011) who stated that the use of context based teaching is to provide a better understanding of the teaching content, which is the starting point for meaningful learning and a teacher should act as a facilitator and should create a learning environment that could help learners discover, investigate and realize the importance of the lesson to their real life situations.

Besides, responses from semi structured interviews seemed to be theoretical (content only) and were different from the responses that came from the study by Ozcan and Gercek (2015); in this study participants suggested the following desired contexts: learners to bring a piece of meat while studying enzymes from their homes to make it visual and related to daily life, visiting bakery while studying yeast and using rubber bands to explain the movement of muscles. Furthermore, all the participants' suggested desired contexts that could help learners to link the lessons to their everyday life experience through their involvement in providing the specimens for the lessons from home. For example a learner to bring a piece of meat from home for an experiment at school, provides a link between the learners' everyday life experience and the biology lessons on enzymes.

5.3.2 Giving learners' context based problem solving activities

The study revealed that no participant gave a context based problem solving activity to the learners during 'O' level biology lesson observation. It is important to expose learners to problems that they encounter in their everyday life experiences and this is supported by Pintrich and Schunk (1996) who explained that in solving the problems that occurred in the surroundings, learners can discuss, help each other and share experiences with the learning community thus

giving rise to curiosity. Curiosity in turn will increase students' interest in learning, so students are more motivated to learn actively. Rose (2009) also confirmed that one's success in learning is dependent upon the environment of learning and the activity is best facilitated through a process of problem solving in collaboration with peers, relations, or teachers. Intellectual development depends greatly on the social situation of learning and how interactions with teachers, relations, and peers around the learner occur. However, findings from both lesson observation and document analysis on the preparation of context based problem solving activities seems to be similar and this implies that teachers could not create context based problem solving activities for the learners.

5.3 Research question 3: How useful is teachers CBA knowledge in 'O' level biology to the learners?

5.4.1 The importance of linking biology lessons to learners daily life experience

The findings of the study showed that biology teachers CBA knowledge is useful to learners in terms of increasing learner attention, motivating learners, helping learners to understand biology concepts and pass examinations. The responses from participants were in agreement with Wieringa et al., (2011) who asserted that the use of context based teaching are to provide a better understanding of the teaching content, which is the starting point for meaningful learning. This is expected to improve learners' motivation, provide easier learning, develop a sense of curiosity about nature, develop students' positive attitudes towards science and the scientific view of the world. In addition, the findings were further supported by an experimental study done by Jelena, Milica and Ljubisa (2016) that the use of context based teaching directly contributed to the better quantity and quality of knowledge. Through context based teaching, students connect the given content with everyday life experience, also students are able to assess the value of learning and

connect it with the previously acquired knowledge, in order to build their own system of knowledge. Therefore, it is important for biology teachers to link their lessons to learners' daily life experiences for meaningful learning.

For example; during focus group discussion, the learners' cited that biology is a good subject and it should be learned in line with our daily life experiences in order to understand biology and pass examination. The response was in line with De Jong (2008) who asserted that results from the studies are generally in favour of context based education, because the understanding of scientific concepts obtained from these approaches is good compared to traditional approaches and the interest, motivation and attitude towards science of learners is usually improved in context based education. Therefore, it is important to link biology lessons to learners' everyday life situations for easy application of the content to their everyday life experiences.

5.4.2 The benefit of using real life objects or models as teaching aids for the learners

The study revealed that both participants acknowledged the importance of linking the lessons to learners' everyday life experiences by using real life objects or models during 'O' level biology lessons in terms of increasing learners attention, interest to the lesson, understanding biology concepts and broadening learners reasoning (Subsection 4.3.2.). The finding is in line with earlier literature by Alonge (1983) who viewed improvisation (use of local materials) as not only the production of import substitution of materials or real thing, rather it is an activity in promoting curiosity, alertness, endurance and perseverance, all of which are indispensable to science, scientists and learning as a whole. In a similar view, Johnson (2000) asserted that local materials (real life objects) make teaching biological concepts more interesting to both learners and teachers in the classroom. Local materials help biology and other science learners to realize

that science has to do with ordinary things and will possibly motivate them to carry out experiments and learning activities themselves using such improvised materials. However, the findings of the current study and the reviewed literature have shown that it is important for biology educators to use real life objects or models in the teaching and learning of biology.

5.4.3 The benefits of context based problem solving tasks to learners

The study revealed that use of context based problem solving tasks is beneficial to learners in terms of helping learners to relate biology lessons to their experiences at home, could bring about better performance in biology, enhance learners self-expression, appreciate the beauty of nature and learners could apply the acquired biology knowledge to solve future problems . For more information refer to the responses in sub-section 4.3.3. The responses were in line with the study by Mukhopadhyay (2013) who stated that in the context of learning science, when students are given problems or identify problems by themselves, they examine the situation and search for the solutions of those following the guidelines of problem based learning. Problem based learning in science typically encourages learners' scientific habits of mind and increases learners' interest towards science. Available literature has also shown that context based problem solving activities can help students develop skills and transfer to real life scenarios. The concrete contexts and consequences presented in context based problem solving activities allow learning to become more profound and durable. For example, if students work together to address a dispute within the school, they may develop lifelong skills related to negotiation and as long as the problem's context applies to and out of class situation, learners should be able to build skills they can use again (Sternberg, 2001).

5. 5 Summary of the chapter

The chapter discussed the findings of the study on implementation of context based approach in the teaching of 'O' level biology. It became apparent that teachers showed CBA knowledge in designing teaching methods that could engage learners in the lesson. However, only few teachers (2) showed CBA knowledge in giving real life examples during 'O' level biology lesson design, the majority of the teachers (4) did not show CBA knowledge in giving real life examples during biology lesson design. None of the teachers showed CBA knowledge in preparing context based problem solving tasks for the learners. In terms of assessing how teachers of biology implement CBA in the teaching of 'O' level biology, it was noted that teachers did not implement CBA in their lessons, except in few cases (2) were participants gave real life examples. Finally, it became apparent that teachers CBA knowledge in 'O' level biology was useful to the learners in terms of increasing learner attention, motivating learners, helping them to understand biology concepts and pass examinations.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Overview

This chapter provides the conclusions and recommendation of this study which investigated the implementation of context based approach in the teaching of 'O' level biology. The conclusions are in line with the research questions.

6.2 Conclusions

The study explored the implementation of context based approach in the teaching of 'O' level biology. In terms of the teachers CBA knowledge in 'O' level biology lesson design, the study showed that the majority of biology teachers lacked CBA knowledge in giving real life examples and preparing context based problem solving tasks during lesson design. On the other hand, the study revealed that all the teachers showed CBA knowledge in preparing teaching methods which could engage learners actively in the lesson. The common teaching methods that could engage learners in the lesson that were revealed by the study comprised: Group work, discussion and experiment.

In terms of assessing how teachers of biology implemented CBA during 'O' level biology lessons, the study revealed that majority of the teachers did not implement CBA by giving real life examples, engaging learners in the lesson and giving learners context based problem solving tasks.

In response to research objective three that sought to address the usefulness of teachers CBA knowledge to the learners, the study revealed that all participants acknowledged the usefulness of

teachers CBA knowledge to the learners in terms of: increasing learner attention, motivating learners, helping learners to understand biology concepts and pass examinations.

6.3 Recommendations

i. Teachers of biology to provide learners with sufficient opportunities to link biology concepts to everyday life experiences.

ii. There is need for teachers of biology to develop knowledge and skills during CPD on how to link their lessons to learners' everyday life experiences by using real life objects as teaching Aids from the learners nearest environment.

iii. There is need for workshops through ZASE for teachers of biology on how to link biology content to learners' everyday life experiences in Kafue district.

6.4 For future research

i. Future research should attempt to investigate the difficulties biology teachers face in the preparation of context based problem solving activities for their learners.

ii. Need an experimental study on the preparation of context based problem solving tasks by in-service biology teachers by providing guidelines to one group of biology teachers and the other group without guidelines, so that the findings of the study can clarify if biology teachers need guidelines or not in the preparation of context based problem solving tasks for the learners.

iii. There is need to extend this study to more than one district in order to have a large sampler of participants.

REFERENCES

Alonge, E. I. (1979). *The use of locally available materials for school chemistry in Nigeria*. (Doctoral dissertation). University of East Anglia, Norwich.

Ary, M., Jacobs, L.C., & Sorensen, C. (2010). *Introduction to Research in Education*. Wadsworth: Canada.

Avargil, S., Herscovitz, O., & Dori J. Y. (2011). Teaching Thinking Skills in Context-Based Learning: Teachers' Challenges and Assessment Knowledge, *Journal of Science Education Technology,* 21(2), 207–225.

Baxter, P., & Jack, S. (2008). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*, 13(4), 544-556.

Bennett, J., Lubben, F., & Hogarth, S. (2007). Bringing Science to Life: A Synthesis of the Research Evidence on the Effects of Context Based and STS Approaches to Science Teaching. *Science Education,* 91, 347-370.

Borko, H., & Putnam, R. T. (1995). Expanding a teacher's knowledge base: A cognitive psychological perspective on professional development. *Professional development in education: New paradigms & practices* (pp. 35-66). NY: Teachers College Press.

Braund, M., Bennett, I., Hampden-Thompson, G. (2013). Teaching approach and success in A-biology: Comparing student attainment in context-based, concept-based and mixed approaches to

teaching A-level biology. *Report to the Nuffield Foundation.* York: Department of Education, University of York.

Burton, J. & Carroll, M. (2001). Journal writing as an aid to self-awareness, autonomy, and collaborative learning. In J. Burton & M. Carroll (Ed.). *Journal writing* (pp.1-7).

Bulte , A.W., Hanna, B., Westbroek , H.B., de Jong,O. &Pilot,A. (2006).A Research Approach to Designing Chemistry Education using Authentic Practices as Contexts. *International Journal of Science Education,* 28:9, 1063-1086.

Chama, S. (2019). *Teachers Competencies in the design and delivery of chemistry practical work.* Lusaka: Masters dissertation, University of Zambia.

Creswell, J.W., (2012). *Educational Research; planning, conducting and evaluating quantitative and qualitative research (4th ed)*. Boston: Pearson Education.

Creswell, J.W & Plano, V.L., (2011). *Designing and conducting mixed method research (2nd Ed)*. Los Angeles: SAGE publication.

Creswell, J.W., (2008). *Educational Research; planning, conducting and evaluating quantitative and qualitative research (3rd ed)*. Upper saddle River: NJ: Merrill.

Creswell, J., W. (2007). *Research design; Qualitative and mixed methods approaches*. London: Sage.

Curriculum Development Centre CDC, (2013). *Secondary school biology syllabus*. Lusaka: Ministry of Education.

Curriculum Development Centre CDC. (2000). *High school biology syllabus***.** Lusaka: Ministry of Education.

Center for Occupational Research and Development CORD, (1999). *Teaching science contextually*. Retrieved 16.10.2011 from: http://www.cord.org/Teaching science Contextually.pdf

De Jong, O. (2008). *Context based chemical education*. Netherlands: Utrecht University.

De Vos, W., & Reiding, J. (1999). Public understanding of science as a separate subject in secondary schools in the Netherlands. *International Journal of Science Education*, 21, 711–719.

Denzin, N., & Lincoln, Y. (Eds.) (2005). *Handbook of qualitative research* (3rd ed). Thousand Oaks, CA: Sage.

De Putter-Smits, L. G. A., Taconis, R., Jochems, W., & Van Driel, J. (2012). An analysis of teaching competence in science teachers involved in the design of context-based curriculum materials. *International Journal of Science Education*, *34*(5), 701–721.

Eilks, I., Parchmann, I., Grasel, C., & Ralle, B. (2004). Changing teachers' attitudes and professional skills by involving teachers into projects of curriculum innovation in Germany. *Quality in practice oriented Research in Science Education,* Aachen: Shaker, 29-40.

Ernest, P. (1999). *Social Constructivism as a Philosophy of Mathematics: Radical Constructivism*. London: The falmer press.

Examination council of Zambia. (2016). *Examination performance review,* Lusaka: ECZ.

Finkelstein, N. (2005) Learning Physics in Context: A study of student learning about electricity and magnetism. *International Journal for Science Education,* **27**, 1187-1209.

Fullan, M. (2007). *The new meaning of educational change (4th ed.)*. New York: Teachers College press.

Gercek, C. & Ozcan, O (2015) *Views of Biology teacher candidates about context based approach*. Turkey: Hacettepe University.

Gerring, J. (2004). What Is a Case Study and What Is It Good for? *The American Political Science Review,* 98(2), 341-354.

Glynn, S., & Koballa, T. R. (2005). The contextual teaching and learning instructional approach. Exemplary science: *Best practices in professional development*: Arlington, VA: National Science Teachers Association Press.

Gredler, M. E. (1997). *Learning and instruction: Theory into practice (3rd ed*). Upper Saddle River, NJ: Prentice-Hall.

Gilbert, J. K. (2006). On the nature of "context" in chemical education. *International Journal of Science Education,* 28(9), 957–976 International, 8(1), 1-7.

Haambokoma, C. (2007) "Nature and causes of learning difficulties in Genetics at high school level in Zambia." *Journal of international development and cooperation,* 13 (1), 1-9.

Hancock, D. R., & Algozzine, B. (2006). *Doing case study research: A practical guide for beginning researchers.* New York: Teachers College Press

Hashweh, M. Z. (2005). Teacher pedagogical constructions: A reconfiguration of pedagogical Content knowledge. *Teachers and Teaching,* 11(3), 273-292.

Hefferman, C. (2013). *Qualitative Research Approach*. www.explorable.com (Accessed 2 August 2016)

Hofstein, A., & Kesner, M. (2006). Industrial chemistry and school chemistry: Making chemistry studies more relevant. *International Journal of Science Education,* 28(9), 1017–1039.

Hobden, P. (1998). The role of routine problem tasks in science teaching. *International handbook of science*: South Africa.

Holbrook, J. (2014). A context-based approach to science teaching. *Journal of Baltic Science Education.* 13 (2), 1648–3898.

Howes, R., (2000). *Corporate environmental accounting: accounting for environmentally sustainable profit. In: Simon, S., Proops, J. (Eds*.), Greening the Accounts. Edward Elgar, Cheltenham, pp. 223e246.

Jelena, D., Milica, G.P., & Ljubisa, Z.S. (2016). The Application of Context-Based Teaching in the Realization of the Program Content "The Decline of Pollinators. *Journal of Subject Didactics:* Vol. 1, No. 1, 51-63, DOI: 10.5281/zenodo.55476.

Johnson, S. I. (1994). *Improvisation and low-cost production for science education, concepts and information.* A paper presented at room 803, during school of science seminar series at FCE Kano on 30th Sept, 1994.

Kazeni, M.M.M. (2012*). Comparative effectiveness of context-based and traditional teaching approaches in enhancing learner performance in life sciences.* Pretoria. PhD thesis, University of Pretoria.

Kim, B. (2001). *Social Constructivism; emerging perspectives on learning, teaching, and technology.* USA: University of Georgia.

King, D.T., & Ritchie, S.M. (2013) Academic Success in Context-Based Chemistry: Demonstrating fluid transitions between concepts and context. *International Journal for Science Education*, **35**, 1159-1182.

Kukla, A. (2000). *Social Constructivism and the Philosophy of Science*. New York: Routledge.

Kukliansky, I. & Eshach, H. (2014). Evaluating a Contextual Based Course on Data Analysis for Physics Laboratory. *Journal Science Education Technology. 23(1), 108–115*.

Kumar, K. (1987). *Conducting focus group interviews in developing countries.* A.I.D. Program Design and Evaluation Methodology Report No. 8. Washington, D.C.: U.S. Agency for International Development.

Labudde, P. (2008). The role of constructivism in science education: yesterday, today, and tomorrow. *Four decades in research of science education - from curriculum development to quality improvement* (p. 139-156). M • unster, Germany: Waxmann Verlag.

Marshall, C. & Rossman, G.B. (201 1). *Designing qualitative research (5th ed)*. Thousand Oaks, California: SAGE publication.

McMahon, M. (1997). *Social Constructivism and the World Wide Web - A Paradigm for Learning*; Paper presented at the ASCILITE conference. Perth, Australia.

Ministry of Education (1996) *Educating our future*. Lusaka: Ministry of Education.

Mwanza, F. (2011). *Pupils understanding of saponification and its application to everyday life*. Lusaka: University of Zambia.

Mukhopadhyay, R. (2013). *Problem solving in science learning-some important considerations of a teacher.* Kolkata: St, Xaviers college.

O'Leary, Z. (2012). *The essential Guide to doing your research project. London*: Sage publications Ltd.

Nkwi, P., Nyamongo, I., & Ryan, G. (2001). *Field Research into Social Issues: Methodological Guidelines*. Walnut Creek, CA: Alta Mira Press.

Pate, P.E. (2003). *Implementing Contextual Teaching and Learning: Case Study of Rhonda, a High School Mathematics Novice Teacher*. University of Georgia: Research.

Patton, Q. M (2002). *Qualitative research and evaluation methods (3rd ed)*. London: Sage publications.

Pintrich, P. R., & Schunk D. H. (1996). *Motivation in education: Theory, research, and applications*. Englewood Cliffs, NJ: Merrill/Prentice Hall.

Ramsden, J. M. (1997). How does a context-based approach influence understanding of key chemical ideas at 16+? *International Journal of Science Education, 19(6), 697 – 710.*

Roth, W.-M. &. McGinn, M. K. (1997). Towards a new perspective on problem solving. *Canadian Journal of Education, 22,* 18-32.

Rose, D. (2009). *Weaving philosophy into the fabric of cultural life.* Discourse, 9(1), 165–182

Sadler, D. (2009). Situated learning in science education: Socio-scientific issues at school level in Zambia. *Journal of international development and cooperation, 13.*

Schunk, D. H. (2012). Learning theories: An educational perspective (6th ed). Boston: Pearson education Inc.

Scott, P., Asoko, H., & Leach, J. (2007). Student conceptions and conceptual learning in science: Review of strategies. *Research in physics learning. Theoretical issues and empirical studies.* .pp. 310-329). Kiel, Germany: IPN—Institute for Science Education.

Sidhu, K.S. (2013). *Methodology of Research in Education*. New Delhi: Sterling Publishers Private Limited.

Sozbilir, M., Sadi, S., Kutu, H., & Yıldırım, A. (2007). Context-Based Teaching in Chemistry Education and Its Applications in the World: *National Chemistry Education Congress*, 108- 116.

Stolk, M.J., Bulte, A.M.W., Jong, O. de, & Pilot, A. (2009) towards a framework for the International handbook of Science Education, Dordrecht: Springer Press, 69-80.

Strauss, A., & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (2nd ed). Thousand Oaks, London, New Delhi: Sage Publications.

Strauss, A.L., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newberry Park, CA: Sage.

Sternberg, R. J. (2001). Teaching problem solving as a way of life. In A. L. Costa (ed.), Developing minds*: A resource book for teaching thinking (3rd Ed).* Alexandria, VA: Association for Supervision and Curriculum Development.

Taconis, R., & Jochems, W. M. G. (2013). Mapping context based learning environments: The construction of an instrument. *Learning Environments Research*, *16*(3), 437–462.

Uzunboylu, H. (2012). *The process of creating context based problems by teacher candidates: social and behavioral sciences.* Turkey: Hacettepe University.

Vos, M. A. J., Taconis, R., Jochems, W. M., & Pilot, A. (2011). Classroom implementation of context-based chemistry education by teachers: The relation between experiences of teachers and the design of materials. *International Journal of Science Education, 33(10), 1407–1432.*

Vygotsky, L.S. (1978). *Mind and society: The development of higher mental processes*. Cambridge, MA: Harvard University Press. Washington, DC: UNESCO, 2001.

White, C.J. (2005) *Research a Practical Guide*. Pretoria: Ithuthuko Investments.

Wieringa, N., Janssen, F. J., & Van Driel, J. H. (2011). Biology Teachers Designing Context-Based Lessons for Their Classroom Practice-The importance of rules-of-thumb. *International Journal of Science Education, 33(17), 2437-2462.*

Yerrick, R., Parke, H., & Nugent, J. (1997). Struggling to promote deeply rooted change: The 'filtering effect' of teachers' beliefs on understanding transformational views of teaching science. *Journal of Science Education, 81, 137–159.*

Yin, R. K. (2012). *Applications of case study research* (3rd ed). Thousand Oaks, London: Sage publication.

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.*)*. Los Angeles, CA: Sage.

Yin, R. K. (2003). *Case study research: Design and methods*. Thousand Oaks, CA: Sage.

APPENDICES

APPENDIX A: Questionnaire for biology teachers

Semi structured interviews was used to collect qualitative data from the biology teachers using a questionnaire (Creswell, 2009).

Dear Respondent,

I am a postgraduate student at the University of Zambia pursuing a Master of education in Science Education Degree. This questionnaire is designed to collect data on **implementation of context based approach in the teaching of 'O' level biology**. The data collected will be used for academic purposes. You are also assured that the information you supply will be treated with the greatest confidentiality, anonymity and privacy.

Demographic Data

District: _____ Teacher: _____

School:_____ Sex:_____ Age:_____

QUESTIONS

1. Name at least three teaching methods that can help learners make connections with their daily life experiences? Justify your answer.

   _____

   _____

   _____

2. What do you think is the benefit of creating a learning environment during 'O' level biology lessons that enables;

i. Learners tackle real life problems?

_____

_____

_____

ii. Learners engage actively in the lesson through collaboration?

_____

_____

_____

3. In your opinion, why is it important to link biology lessons to learner's daily life experiences?

_____

_____

_____

4. Teaching using real life examples provides a rationale for learning, helping learners know why they learn biology. True or False? Justify your answer.

_____

_____

_____

5. Choose any topic from 'O' level biology syllabus and briefly explain how you can connect the topic to the real life experience of the leaners?

_____

_____

_____

6. Describe how you can teach ‘O’ level biology effectively to learners who wonder about the relevance of studying biology?

_____

_____

_____

7. Explain how you can create a context based problem solving task in ‘O’ level biology that relates to learners real life experiences?

_____

_____

_____

APPENDIX B: Observation schedule for biology teachers

The observation schedule was used to collect data regarding how teachers of biology implement Context based approach in the teaching of 'O' level biology. It was based on three indicators: Giving everyday real life examples, student engagement (collaboration) and context based problem solving tasks.

Demographic data

School: _____

Subject: _____ Grade: _____

Topic/ Subtopic: _____ Teacher: _____

Descriptors	Evidence	Comments
Lesson introduction linking the lesson to learner's everyday life experience.		
Examples given relate to learner's real life experiences.		
Any real life object used as a teaching Aid.		
Using leaner centred approach to deliver science lessons.		
Teacher acting as a facilitator during the lesson.		

Teaching methods used promoting collaborative learning.		
Engaging learners in solving real life problems.		

APPENDIX C: Document Analysis Schedule for biology lesson plans and schemes of work

The document analysis schedule helped the researcher to analyze the schemes of work and the lesson plan on the research question; what knowledge of CBA do teachers of biology have in lesson design? **Using three indicators**: Giving everyday real life examples, student engagement (collaboration) and context based problem solving tasks.

Demographic data

School: _____ Teacher: _____

Subject: _____ Grade: _____

SCHEMES OF WORK	
Descriptors	**Comments**
Are teaching methods planned with opportunities for collaborative learning?	
Are teaching methods illustrating the informal opportunities for collaborative learning?	
Do the teaching strategies illustrate context based approach?	
LESSON PLAN	
Descriptors	Comments
Is the lesson linked to learners	

everyday life experiences? Rationale Lesson introduction Lesson development	
Are the lesson activities illustrating context based problem solving tasks?	
Are the teaching methods engaging learners to solve real life problems?	
Are the examples given linked to learners real life experiences?	
Is there any real life object prepared as a teaching Aid for the learners? local material or model(s)	

APPENDIX D: Focus Group discussion Guide for 'O' level biology learners

The **Focus Group Discussion Guide** helped the researcher to collect data on two objectives: To assess how teachers of biology implement CBA in the teaching of 'O' level Biology and to determine the usefulness of teachers' CBA knowledge in 'O' level biology to learners.

Demographic data

Group code: _____ School: _____

No. of group participants: _____ Date of discussion: _____

1. Does your biology teacher engage you in any of the following teaching methods during biology lessons?

i. Experiments

ii. Discussion

iii. Field trip

iv. Group work

2. Does your biology teacher explain throughout the lesson without engaging you in the lesson?
3. Do you learn biology using real life objects (local materials) or models?
4. Does your biology teacher explain the importance of each topic in biology to your real life situations during lessons?
5. Does your biology teacher move around the class to provide help to you during experiment, group work or discussion?
6. In your opinion, what are the benefits of learning biology using real life objects (local materials) or models during lessons?

7. What do you think is the benefit of a teacher engaging you in the lesson by giving you tasks related to the problems you encounter in your community?
8. In your opinion, what are the benefits of biology teachers giving you examples in line with your real life experiences?

APPENDIX E: Ethical Clearance

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

Great East Road | P.O. Box 32379 | Lusaka 10101 | **Tel:** +260-211-290 258/291 777
Fax: +260-1-290 258/253 952 | **Email:** director@drgs.unza.zm | **Website:** www.unza.zm

Approval of Study

21st May, 2019

REF NO. HSSREC: 2019-JAN-028

Mr. Alfred Miyambo
University of Zambia
School of Education
Department of Science Education
Box 32379
LUSAKA

Dear Ms. Moonga Mr. Miyambo,

RE: "IMPLEMENTATION OF CONTEXT BASED APPROACH IN THE TEACHING OF 'O' LEVEL BIOLOGY IN SELECTED SECONDARY SCHOOLS IN KAFUE DISTRICT"

Reference is made to your resubmission. The University of Zambia Humanities and Social Sciences Research Ethics Committee IRB resolved to approve this study and your participation as Principal Investigator for a period of one year.

Review Type	**Ordinary /Expedited Review**	**Approval No. REF No. HSSREC: 2019-JAN-028**
Approval and Expiry Date	Approval Date: 21st May, 2019	Expiry Date: 20th May, 2020
Protocol Version and Date	Version-Nil	20th May, 2020
Information Sheet, Consent Forms and Dates	• English.	To be provided
Consent form ID and Date	Version	To be provided
Recruitment Materials	Nil	Nil

1

There are specific conditions that will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved by an application for an amendment prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address or methodology and methods. Many modifications entail minimal risk adjustments to a protocol and/or consent form and can be made on an Expedited basis (via the IRB Chair). Some examples are: format changes, correcting spelling errors, adding key personnel, minor changes to questionnaires, recruiting and changes, and so forth. Other, more substantive changes, especially those that may alter the risk-benefit ratio, may require Full Board review and approval. In all cases, except where noted above regarding subject safety, any changes to any protocol document or procedure must first be approved by the IRB before they can be implemented.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by The University of Zambia Humanities and Social Sciences Research Ethics Committee IRB must be filled in and submitted to us. There is a penalty of K500.00 for failure to submit the report.
- The University of Zambia Humanities and Social Sciences Research Ethics Committee IRB does not "stamp" approval letters, consent forms or study documents unless requested for in writing. This is because the approval letter clearly indicates the documents approved by the IRB as well as other elements and conditions of approval.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of The University of Zambia Humanities and Social Sciences Research Ethics Committee (IRB), we would like to wish you all the success as you carry out your study.

Yours faithfully,

Dr. Jason Mwanza
BA, MSoc, Sc., PhD
CHAIRPERSON
THE UNIVERSITY OF ZAMBIA HUMANITIES AND
SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE IRB

cc: Director, Directorate of Research and Graduate Studies
Assistant Director (Research), Directorate of Research and Graduate Studies
Assistant Registrar (Research), Directorate of Research and Graduate Studies
Senior Administrative Officer (Research), Directorate of Research and Graduate Studies

3

APPENDIX F: Participant's Consent form

1. I have discussed the research project to be undertaken by **Miyambo Alfred** regarding **"Implementation of context based approach in the teaching of 'O' level biology in selected secondary schools in Kafue district"** whose purpose is to investigate the implementation of context based approach by teachers in 'O' level Biology in the selected secondary schools in Kafue district.

2. I fully understand the purpose and give approval to participate by:

- Being observed
- Being interviewed (Open ended written interview)

3. My participation, however, is on condition that:

- Authority has been given for the research to be done in this school
- I can ask the researcher or his supervisor(s) any questions about the study
- The only people who will see the information will be the researcher and his supervisor(s)
- There will be no written reports in which the school and I could be identified
- I can withdraw from being involved at any stage without having to give any reasons

Thank you

Participant's signature: _____

Date:_____