# CLASSROOM PRACTICES OF TEACHERS OF BIOLOGY IN SELECTED SECONDARY SCHOOLS IN LUAPULA PROVINCE OF ZAMBIA

By

Kalumba Kasama

A dissertation submitted to the University of Zambia in fulfillment of the requirements of the Degree of Master of Education in Science Education

University of Zambia

Lusaka

(2020)

## COPYRIGHT

## DECLARATION

I, Kalumba Kasama, do here by declare that this dissertation represents my own work and has never been submitted for a degree at the University of Zambia or any other University.

## APPROVAL

This dissertation by Kalumba Kasama is approved as fulfillment of the requirements for the award of the degree of Master of Education in Science Education by the University of Zambia.

Examiner 1…… Signature ……. Date …….

Examiner 2 ……... Signature ……. Date ……

Examiner 3 …… Signature …… Date …….

Chairperson Board of

Examiners ……... Signature ……... Date ……

Supervisor …… Signature ……..…..... Date …...……

## ABSTRACT

The purpose of the study was to explore instructional practices of teachers of biology in selected secondary schools in Luapula Province of Zambia. These schools have recorded low pass rates in School Certificate Examinations in biology for some time now. This is despite several initiatives undertaken by the Government of Zambia to improve the quality of Science and Mathematics education. The following objectives guided the study: to establish the skillfulness of biology teachers' lesson preparation; to determine how teachers of biology conduct their lessons; to determine the extent to which the classroom physical environment is organised for teaching and learning of Biology. Vygotsky's social constructivist theory guided the study. The study employed a descriptive survey design and a qualitative approach. The data collection methods employed were: lesson observations, self-administered questionnaires, document analysis and focus group discussions. The study population comprised three secondary schools and led to the study of 3 heads of departments, 12 teachers of biology and 77 Grade 12 pupils. The participating schools and the respondents were drawn in the study by purposive sampling. However, the grade 12 pupils who participated in the focus group discussions were selected by simple random sampling.

The study established that teachers were inconsistent in the use of curriculum materials – schemes and records of work and lesson plans, and mostly used teacher centred teaching strategies. The study further established that the classroom physical environments were not adequately organised to facilitate effective teaching/learning.

The study makes the following recommendations: The Science Departments of the schools understudy should be preparing schemes of work for the next term in the last two weeks of the ending term so that the HoD can easily monitor progress of the work. They should end their tradition of preparing schemes during the holidays. School administrators should make effort to acquire more ICT facilities and to facilitate integration of ICT in teaching and learning. Teachers in the current study should take responsibility of their professional growth and read widely on curriculum materials and keep abreast with modern trends in pedagogy. The schools in the current study should incorporate learners in creating favourable and active classroom environments.



**Key words**: Classroom practices, biology lessons, lesson preparation, biology teachers, secondary schools, pupils, constructivism, teaching-learning materials, classroom physical environment.

## DEDICATION

This dissertation is dedicated to my dear husband, Martin Chituma Mulenga, without whose support this work would never have been a success; and to our youngest boy, Kasalwe Chituma, who many a time had to endure my absence from home as I pursued this work.

## ACKNOWLEDGEMENTS

I would like to acknowledge with sincere gratitude the following:

My supervisors the late Dr. Partson Shanyinde and Dr. Kabunga Nachiyunde for their expert guidance which saw this work to its successful conclusion. I'm indebted to the late Dr. Shanyinde for accepting to be my supervisor and guided this work from its genesis to report writing. It is indeed saddening that Dr. Shanyinde did not live to see this work to its final conclusion after his overwhelming guidance and encouragement. I'm equally indebted to Dr. Nachiyunde who readily accepted to take over supervision of this work after the demise of the late Dr. Shanyinde. I would also like to thank Dr. P. Nalube, Dr. S. Mbewe, Dr. C. Haambokoma, Dr. B. Nkhata, Dr. G. Kaulu and all the Lecturers in the Department of Mathematics and Science Education for their encouragement, suggestions and valuable critiques during the initial stage of this work. They gave me hope and strength to soldier on with this work.

I'm grateful to my charming friends and course mates, Esther Gondwe and Gladys Kaluba, for the knowledge we shared and for their unwavering moral support. I'm equally grateful to Mr. Kamukwamba Lawrence my course mate for the knowledge we shared and encouragement.

My acknowledgement would not be complete if I didn't thank the participating schools and all the respondents for their time, patience and co-operation.

Lastly but not the least I'm grateful to my husband for his enormous support, help and encouragement in my accomplishing of this task. To my nephew Bwalya Mulenga and our eldest son Mulenga Chituma, I'm grateful for the literature they provided at a time when I needed it most. To the boys, Chansa Chituma and Kasalwe Chituma, I say thank you for your endurance of my long absence from home many a time as I pursued this work. For all my friends and relatives who contributed to the successful completion of this work in various ways, I say thank you. On the whole, to God be the Glory.

## TABLE OF CONTENTS

## LIST OF FIGURES

FIGURE PAGE

## LIST OF TABLES

TABLE PAGE

## LIST OF APPENDICES

**APPENDIX** **PAGE**

## ABBREVIATIONS

| | |
|---|---|
| AIEMS | Action to Improve English, Mathematics and Science |
| BEDMAS | Bachelor of Education in Mathematics and Science |
| CDC | Curriculum Development Centre |
| CPD | Continuing Professional Development |
| COSETCO | Copperbelt Secondary Teachers' College |
| GRZ | Government of Zambia |
| JICA | Japan International Cooperation Agency |
| MESVTEE | Ministry of Education, Science, Vocational Training and Early Education |
| MoE | Ministry of Education |
| MoGE | Ministry of General Education |
| OECD | Organisation for Economic Development Co-operation |
| SBCPD | School Based Continuing Professional Development |
| SMASTE | Strengthening Mathematics, Science and Technology Education |
| SPRINT | School Programme of In-service for the Term |
| STEPS | Strengthening Teachers Performance and Skills |
| TEAL | Teaching Excellence in Adult Education |
| TRCs | Teachers Resource Centres |
| UNESCO | United Nations, Educational, Scientific and Cultural Organisation |
| UNZA | University of Zambia |
| ZAMSTEP | Zambia Mathematics and Science Teachers Education Programme |

ZASE Zambia Association for Science Education

ZATEC Zambia Teacher Education Course

# CHAPTER 1

# INTRODUCTION

## 1.1 Chapter overview

This chapter outlines the background of the study, statement of the problem, purpose of the study, study objectives, research questions, significance of the study, theoretical frame work and operational definitions.

## 1.2 Background to the study

Nations the world over include the subject biology in their curriculum due to its importance in improving a nation's socio-economic well-being and also its importance in the daily lives of individuals (Shihusa & Keraro, 2009; Kevogo, Toili & Mutsotso, 2013; Curriculum Development Centre (CDC), 2013; Albert, Osman & Yangungu, 2014; Kaluku, Ngesu, Gunga & Wachira, 2014). Pupils are expected to acquire and develop desired knowledge, skills, competencies and values for their well-being and to contribute positively to society. Despite this recognition of the subject, studies have indicated low pupil achievement in biology worldwide (Ozcan, 2003; Albert, Osman & Yangungu, 2014; Khatete, Okach, Ondigi, 2014;). The low pupil achievement in biology implies that the objectives of teaching biology are not being realized.

The Zambian government has noted the poor performance in biology, and science subjects in general, as a situation of urgent concern (Ministry of Education, 1996). Table 1.1 shows performance at national level in Biology in School Certificate Examination in the recent past years.

**Table 1.1 School Certificate Examination mean percentage scores for biology**

| **Year** | **% scores** |
|---|---|
| 2015 | 21.59 |
| 2016 | 24.14 |
| 2017 | 26.56 |

**Source: Examination Council of Zambia**

As a result, the Zambian Government, working with co-operating partners, has undertaken several projects and programmes meant to improve performance in science subjects of which biology is a part. To begin with, the Government has acknowledged the importance of Continuing Professional Development (CPD) in content and methodology for teachers in order for them to effectively implement the curriculum. Learning institutions have therefore been encouraged to develop in teachers and teacher educators the spirit of CPD (Curriculum Development Centre, 2013). The project Action to Improve English, Mathematics and Science (AIEMS) was one of the initiatives under taken by the Zambian Government, working with British Council, to improve the quality of science education. Projects to upgrade the qualification of science and mathematics teachers were also under taken. These include: Zambia Mathematics and Science Teacher Education Project (ZAMSTEP), Bachelor of Education in Mathematics and Science (BEDMAS) and Fast Track Teacher Education Course.

### 1.2.1Interventions to improve learner performance in science

#### 1.2.1.1 Zambia Mathematics and Science Teachers Education Project (ZAMSTEP)

In 1988 the Zambian Government through the Ministry of Education (MoE) introduced ZAMSTEP, a programme that was funded by the British Overseas Development Agency (Akpan, 1994; Haambokoma et al, 2002). The programme was intended to improve the teaching of Mathematics and Science in secondary schools by upgrading the qualification of teachers with Secondary Diploma to Secondary Advanced Diploma. The programme was of one-year duration and catered for all the three sciences: biology, chemistry and physics. ZAMSTEP was implemented through two colleges. These were Nkrumah Teachers' College and Copperbelt Secondary Teachers' College (COSETCO). These colleges were initially training pre-service teachers who graduated with Secondary School Teachers' Diploma. These teachers were being trained to teach junior secondary classes. That is, from grades 8 to 9 (UNESCO, 2010). However, due to the critical shortage of science and mathematics teachers, Secondary School Diploma holder teachers found themselves handling senior secondary classes (grades 10 to 12). ZAMSTEP was therefore introduced to offset this imbalance. It was hoped that the programme would equip teachers with adequate knowledge in pedagogy and subject content to handle senior classes effectively. To that effect, teachers specialized in either mathematics or any of the three science subjects: biology, physics and chemistry.

The British council stated in their Project terminal report that ZAMSTEP had made a significant contribution to improvement of the quality of teaching of mathematics, science and technology, and should be maintained, particularly that Zambian personnel attached to the project had gained enough experience to continue it (Haambokoma et al, 2002). However, even though the project helped in improving the quality of science and mathematics teachers the issue of understaffing of science teachers in schools still prevailed. It would seem that the impact of ZAMSTEP in improving the quality of science education in secondary schools was affected by the critical shortage of science teachers. UNESCO (2010) attributes the shortage of teachers in schools to conditions of service in the Ministry of Education which do not compare favourably with those in other sectors within the country and in neighbouring countries. Teachers, therefore, join other sectors. In addition, Kelly (1999) cited the high failure rate of science students in the school of education at the University of Zambia. The institution therefore produces less number of science teachers than it should.

#### 1.2.1.2 Action to Improve English, Mathematics and Science Project (AIEMS)

In the period between 1990 and 2000 the Zambian Government in partnership with the British Government established and equipped teachers resource centres (TRCs) throughout the country. This was done under a Project called AIEMS which was commissioned in 1994 and concluded as a project in 2000 (Haambokoma et al, 2002). As the name suggests, the aim of the project was to improve the teaching and learning of English, Mathematics and Science. The Project established and fully equipped fourteen provincial and seventy-two district teachers' resource centres (Mubanga, 2012). The intended purpose was to have a sustainable and well managed decentralized system of in-service teacher education. In addition to resource centre based workshops, school based workshops were encouraged and teachers' groups were also established as a way of delivering in-service education.

Nkhata and Arden (2000), cited in Haambokoma et al (2002), in their final review of the AIEMS Project reported that among the successes achieved by AIEMS were that it had resulted in teachers using a variety of learning aids and showing greater willingness to use more learner centred approaches, such as group work, and that pupils were more motivated to learn. To the contrary, Knamiller (1999) earlier carried out four case studies in four countries, of which Zambia was a part, to assess the effectiveness of resource centres as a strategy for improving the

quality of education in schools. According to the findings of this study, the expectations placed on TRCs to help teachers develop their capacities to be reflective and flexible, to identify and solve their own problems, to create their own resources and to effectively apply new ideas to teaching and learning were not realized. Knamiller further reported that TRCs did not increase teaching and learning aids in schools.

The effectiveness of AIEMS Project in improving the quality of teaching and learning in schools might have been hampered by the system of in-service provision employed. The AIEMS project used the cascade system of in-service provision which flowed from national to provincial, district, zone and finally school level, and relied heavily on carefully structured modules. It would appear that this approach limited teachers' innovation and creativity and did not necessarily adapt to local needs. As Mubanga (2012) rightly observed the cascade model encouraged dependency on centralized initiatives and the top down approach reinforced the talking/telling approach of in-service. Mubanga (2012) also observed that teachers lacked clarity on the nature and role of the teachers' groups and that they lacked time for group meetings. It would also appear that the project lost momentum after it was concluded as a project in 2000. Workshops at teachers' resource centres reduced. Few teachers visited the TRCs, mainly due to long distances from their schools (Mubanga, 2012; Haambokoma et al, 2002). Also teachers did not prepare teaching/learning materials from resource centres (Knamiller, 1999; Mubanga, 2012). Therefore, it may be reasonably concluded that teachers' resource centres as a means of improving the quality of teaching and learning in schools have been under utilised following the conclusion of the AIEMS Project in 2000.

#### 1.2.1.3 Bachelor of Education in Mathematics and Science (BEDMAS) Project

The BEDMAS project which began in 1998 was initiative by the Department of Mathematics and Science Education at the University of Zambia to upgrade the qualifications of secondary school science and mathematics teachers from Secondary Diploma to Bachelor's Degree. This Project was implemented the Project in partnership with the University of Zambia and the Belgian Government. The BEDMAS project was a three-year in-service degree programme and it was aimed at increasing the number of graduate teachers for mathematics and science in secondary schools. The BEDMAS project gave way to a programme called Bachelor of

Education, Secondary Education (BEDSEC). Teachers with Secondary Diploma continued upgrading to Bachelor's Degree but other disciplines such as Geography were introduced in the programme.

#### 1.2.1.4 Fast-Track Teacher Education Course

The Fast Track Teacher Education Course is another intervention by the Zambian Government aimed at upgrading teachers with Secondary Diploma qualifications to first degree and it is implemented through distance learning mode of delivery (MoE, 2011). This program, which is still on going, was initiated to address the challenge of shortage of qualified teachers for Mathematics and Science in secondary schools. The Programme is being implemented through the University of Zambia (UNZA) and St. Eugene University-daughters of Mary Immaculate (DMI).

The interventions, under discussion, by the Government of Zambia and co-operating partners aimed at improving teaching and learning of mathematics and science have been implemented throughout the country. Luapula Province has also benefited from the interventions. For instance, under the AIEMS project one provincial and five district teachers' resource centres were constructed in Luapula province. However, the participation of teachers in these programmes has not necessarily yielded any significant signs of improvement in the performance of pupils in science subjects in general and biology in particular. This is evidenced by the performance of the schools under study in School Certificate Examinations in Biology as shown in Table 1.2. For ethical reasons the schools' names have been withheld.

**Table 1.2 Biology School Certificate Examination results for the period 2013 to 2017.**

| | | Number of pupils who obtained the grade | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SCHOOL** | **YEAR** | 1 and 2 Distinction | 3 and 4 Merit | 5 and 6 Credit | 7 and 8 Pass | 9 Fail | Total Sat | Pass Percentage (1 – 6) |
| **SCHOOL 1** | 2013 | 12 (1.5%) | 40 (5.0%) | 115 (14.3%) | 286 (35.7%) | 349 (43.5%) | 802 | 20.8 |
| | 2014 | 37 (4.0%) | 72 (8.0%) | 135 (15%) | 327 (36.2%) | 332 (36.8%) | 903 | 27.0 |
| | 2015 | 24 (4.0%) | 51 (8.5%) | 77 (12.8%) | 229 (38.1%) | 220 (36.6%) | 601 | 25.3 |
| | 2016 | 7 (1.8%) | 20 (5.3%) | 55 (14.5%) | 163 (42.9%) | 135 (35.5%) | 380 | 22.0 |
| | 2017 | 7 (1.7%) | 47 (11.3%) | 131 (31.6%) | 147 (35.4%) | 83 (20.0%) | 415 | 44.6 |
| | | | | | | | | |
| **SCHOOL 2** | 2013 | 5 (3.6%) | 6 (4.3%) | 10 (7.1%) | 48 (34.3%) | 71 (50.7%) | 140 | 15.0 |
| | 2014 | 2 (1.4%) | 20 (14.2%) | 24 (17.2%) | 24 (17.2%) | 70 (50%) | 140 | 32.8 |
| | 2015 | 4 (3.0%) | 9 (6.3%) | 23 (16.4%) | 44 (31.4%) | 60 (42.9%) | 140 | 26.0 |
| | 2016 | 4 (2.8%) | 8 (5.7%) | 20 (14.2%) | 46 (32.6%) | 63 (44.7%) | 141 | 22.7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2017 | 1 (0.9%) | 3 (2.7%) | 22 (20.0%) | 43 (39.1%) | 41 (37.3%) | 110 | 24.0 |
| | | | | | | | | |
| **SCHOOL 3** | 2013 | 6 (1.1%) | 33 (5.9%) | 65 (11.6%) | 171 (30.5%) | 286 (50.9%) | 561 | 18.6 |
| | 2014 | 25 (3.9%) | 45 (6.9%) | 81 (12.4%) | 209 (32.1%) | 291 (44.7%) | 651 | 23.2 |
| | 2015 | 12 (1.9%) | 36 (5.6%) | 85 (13.2%) | 220 (34.1%) | 292 (45.3%) | 645 | 20.6 |
| | 2016 | 24 (6.3%) | 54 (14.3%) | 67 (17.7%) | 146 (38.5%) | 88 (23.2%) | 379 | 38.3 |
| | 2017 | 10 (2.5%) | 37 (9.4%) | 70 (17.6%) | 131 (33.0%) | 149 (37.5%) | 397 | 29.5 |

**Source: school guidance and counselling section**

It would seem that the interventions provided by the Zambian Government and cooperating partners to improve learner performance in science subjects were blanket reforms in that they were uniformly applied in all situations. They did not necessarily address specific problems of individual schools. For example, the National Science Centre supplied mobile laboratories to all the three schools in the current study regardless of whether the school had a conventional laboratory or not. If specific needs of individual schools were to be addressed probably school Two, which has no conventional laboratory would have received a higher number of the mobile laboratories than schools One and Three which have five conventional laboratories in place.

This study therefore, takes a different approach where by specific needs of the underperforming schools are pursued. The study specifically investigated classroom practices of biology teachers because many educationists assert that the quality of education that teachers provide to students is highly dependent upon what teachers do in the classroom (Chuda, Prokop & Tuncer, 2007). In the traditional sense, teaching in the classroom simply implies transfer of knowledge from the teacher to the pupils (Allen & Tanner, 2005). However, with advances in technology pupils can

obtain more information, with or without the involvement of the teacher, through mass media (such as television and radio), books and internet. Educationists, therefore, have questioned the desirability of such kind of teaching that is primarily or exclusively informational. Educational theories have also taken a key role in influencing paradigm shift in pedagogy. One such theory is constructivism, which views learning as knowledge construction by the learner (Palmer, 2005; Bada, 2015). Thus, modern trends in pedagogy place the pupil at the centre stage of all learning. The teacher has the major role of guiding the teaching/learning process to mediate learning of the pupils.

The conduct of biology teachers in the classroom is greatly influenced by the teacher's attitude towards the subject (Gbore, 2013). The enthusiasm that a teacher displays towards biology will have a bearing on students' attitude towards the subject, and consequently their performance in the subject. A teacher who shows care and respects and values pupils' opinions as unique individuals will motivate pupils to have interest in the subject. Motivation is a crucial factor in the teaching/learning process (Palmer, 2005).

However, it should be noted that good teacher characteristics will be reflected in how well one plans and prepares for his/her lessons. Effective teaching demands that important decisions on the part of the teacher are made before classroom instructions are carried out. To begin with it should always be borne in the minds of teachers that biology is a life science, therefore, as much as possible classroom instructions should be aligned to the daily encounters of pupils. This will help learners to establish meaning of their classroom experiences such that the subject will not just be useful for the pupils' attainment of academic qualifications but also for personal and social well-being. This in itself will be a motivation for pupils to desire to learn the subject.

With the foregoing it is clear that effective teaching results from interplay of a number of classroom dynamics. Therefore, initiatives to improve the quality of science education may not yield desired outcomes if they fall short of taking into account classroom practices of teachers of science.

### 1.3 Statement of the problem

The national performance in School Certificate Examination in Biology is still at undesirable levels (Table 1.1). The schools under study are among those that have contributed to the low

mean scores recorded at national level in School Certificate Examination. These schools have recorded low pass rates in Biology in School Certificate examination year after year (Table 1.2). Yet no known study has been under taken to establish what transpires in a biology lesson of these under performing schools in Luapula province.

### 1.4 Purpose of the study

The purpose of the study therefore was to investigate classroom practices of teachers of biology which might be affecting pupil performance in Biology in School Certificate Examination.

### 1.5 Study objectives

The following are the study objectives:

(i) To establish the skillfulness of biology teachers' lesson preparation.
(ii) To determine how teachers of biology conduct their lessons.
(iii) To determine the extent to which the classroom physical environment is organized for teaching and learning of biology.

### 1.6 Research questions

The study was guided by the following research questions:

(i) How skillful are teachers of biology in their lesson preparation?
(ii) How do teachers of biology conduct their lessons?
(iii) To what extent is the classroom physical environment organized for teaching andlearning of biology?

### 1.7 Significance of the study

This study seeks bringing to light classroom practices of biology teachers that affect pupil achievement in biology. The study anticipates making recommendations that the teachers of biology in the targeted schools will find both useful and applicable. The study recommendations may enlighten administrators of the schools under study of their responsibilities that may enhance teacher performance in biology. The study also aims at contributing to the improvement of learner performance in biology in the participating school for the benefit of pupils as well as

schools. In addition, the study may add vital literature to the teaching and learning of Biology at secondary school level.

## 1.8 Theoretical framework

This study is grounded on constructivist theories of learning. While there are varying perspectives of constructivism this study is underpinned by Vygotsky's social-constructivist theory of learning.

### 1.8.1 Constructivism

Constructivism is an educational theory that has dominated recent research in science education (Palmer, 2005). The constructivist view on learning is that students are not passive recipients of knowledge; rather, meaningful learning involves the active construction of knowledge through experience (Palmer, 2005; Taber, 2011; Ultanir, 2012). The proponents of this view contend that the learner uses his/her existing knowledge, beliefs, interests and goals to interpret any new information, and this may result in their ideas becoming modified or revised.

### 1.8.2 Vygotsky's Social Constructivist Theory of Learning

Vygotsky, like other constructivists, views learning as an active process of knowledge construction by the learner. However, unlike Piaget, Vygotsky includes the social aspect of learning (Ivic, 2000). Vygotsky (1978) views learning as a social process and knowledge as a social product. Vygotsky's social constructivist theory places great emphasis on the fundamental role of social interactions on successful cognitive and intellectual growth (Pritchard & Woollard, 2010). To explain the relationship between learning and development Vygotsky developed the concept of the zone of proximal development (ZPD). The zone of proximal development is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978:86). According to this theory the potential for cognitive development and learning is dependent upon transition across the ZPD. If learning has to take place the learner must be helped to move in the ZPD and then beyond it to a new and higher level. From every new and higher level there will be a new ZPD, implying a capacity for more development at every stage (Pritchard & Woollard).

### 1.8.3 Vygotsky's Social-Constructivism and classroom practices of science teachers

Constructivism as a learning theory emphasises the importance of active participation of learners in the teaching and learning process for the learners to construct their own knowledge of the world around them (Richardson, 2003). The theory considers the process of learning to be more important than content. Constructivism therefore represents a shift from teacher-centred to learner-centred classroom practices. Teachers' who employ constructivist approach are expected to engage learners more in practical activities than the traditional lectures. The constructivist approach favours the use of science process skills in teaching and learning. Therefore, learners should be given opportunity to experiment, observe, predict and make inferences. The experiences that learners are exposed to are important in the construction of knowledge. In this regard Palmer (2005) contends that if learning is an active process then effort is needed on the part of the learners, in which case motivation is an intergral factor in knowledge construction.

The theory also values the idea that learners do not come to the classroom as 'empty vessels' (Bada, 2015). According to this theory, the teaching and learning process should be guided by what the student already knows about the subject to be taught. Therefore, teachers using constructivist approach are expected to evaluate the students' prior knowledge of the subject to be taught. According to Palmer (2005) the ideas that students bring to the classroom, in many instances, have been shown to be scientifically inaccurate in which case they have been referred to as 'misconceptions'. Educationists have noted that misconceptions could interfere with learning (Kaulu, 2015). Teachers are therefore, expected to create an enabling learning environment for learners to expose their conceptions and misconceptions.

In addition to the view that knowledge is actively constructed by the learner basing on previous experiences, Vygotsky's Social Constructivism emphasises the importance of a communication-rich learning environment. According to this theory thinking skills develop in children as they interact with more knowledgeable others, especially adults (Pritchard & Woollard, 2010). Teachers employing this approach are expected to engage learners in a lot of group work, paired work as well as group presentations so that learners interact and learn from one another. Teachers are also expected to interact with learners both at group level and individual level. This theory is also in support of remedial work for slow learners. Teachers employing this theory are expected to incorporate in the teaching/learning process interventions to enhance learning. The

term ‘scaffolding’ is used to refer to the kind of support that could be given to learners for them to make progress (Taber, 2011).

With the foregoing, Vygotsky’s social constructivist theory therefore, informs this study of classroom practices that result in effective teaching and learning.

### 1.9 Operational definitions:

**Biology classroom:** environment in which biology lessons are conducted by a teacher to a group of pupils.

**Classroom practices**: teaching strategies and all experiences that teachers provide to learners in order to facilitate learning.

**Curriculum materials**: documents which are used by the teacher in the preparation, implementation and evaluation of the teaching and learning process.

**Junior classes**: grades eight to nine classes.

**Pupil**: refers to learner.

**Secondary school**: a school with grades eighty to twelve classes.

**Senior classes**: grades ten (10) to twelve (12) classes.

**Teaching/learning activities:** all activities provided to pupils in the classroom in order that they actively construct and develop desirable knowledge, skills, values and attitudes.

### 1.10 Organisation of the dissertation

This dissertation comprises six main chapters. Chapter one presents the background to the study and outlines the research objectives. Chapter two reviews relevant literature and provides the theoretical framework underpinning this study. The third chapter provides the methodology employed while chapter four presents the findings of the study. Chapter five discusses the findings while the last chapter presents the conclusion and recommendations.

# CHAPTER 2

# REVIEW OF RELATED LITERATURE

## 2.1 Introduction

This chapter reviews related literature on lesson preparation, how teachers conduct biology lessons and how the classroom physical environment is organised for teaching and learning.

## 2.2 Lesson preparation

Planning for classroom activities is essential for successful teaching and learning (Duncan & Met, 2010; TEAL Center, 2011; Khatete, Okach & Ondigi, 2014;). For quality teaching and learning to occur in any classroom teachers should ensure that lessons are prepared adequately. The level of teacher preparation for classroom activities greatly influences the effectiveness of a lesson. Therefore, teachers ought to make deliberate effort to set aside ample time to prepare for classroom activities. Lesson planning is a fundamental skill that all teachers must develop and own for their success in the classroom (Farooque & Gafoor, 2010). This involves not only careful selection of teaching/learning materials and teaching methods but also ways of arousing and sustaining learner interest throughout the lesson, taking into account the range and type of pupil abilities. In this regard Kyriacou (2007:26) argues that "It is impossible and meaningless to attempt to evaluate the quality of a lesson plan without taking into account how well it meets the needs of the pupils in the context in which it will take place".

The essential tools for a teacher to effectively plan for classroom activities are the following: curriculum, syllabus, schemes of work, records of work and lesson plan (Kaseske, Musingafi, Mhute, & Shupikai, 2015; MoGE, 2016). Kaseske et al (2015) argue that successful teaching and learning requires proper selection and arrangement of classroom instruction and that this takes place in the curriculum, syllabus, scheme of work and lesson plan stages. A curriculum is an overall outline of the subjects to be taught. It includes all the experiences learners are exposed to in the school and by the school (Ellah, 2018). On the other hand, a syllabus is derived from the curriculum and outlines the topics to be taught and learned for a specific period (Kaseske et al, 2015). A lesson plan is a detailed description of a teacher's course of action for an individual

lesson intended to help learners achieve a particular objective (TEAL Centre, 2011). Like lesson plans, records of work are made by the subject teacher as a review of the lesson taught so that informed decisions are made when planning for subsequent lessons. Therefore, records of work are written on a daily basis after every lesson (Ellah, 2018). It is necessary that teachers use all curriculum materials in their planning and preparation for biology lessons for effective lesson delivery. Duncan and Met (2010: 2) share these views and assert that:

> Lesson planning helps ensure that classroom instruction aligns with curriculum goals and objectives and therefore enables students to demonstrate their successful learning on unit or curricular assessments. … Lesson planning – well in advance of the actual class meeting – allows for the luxury of time. Teachers need time to think through their lesson goals and objectives.

Augmenting these views TEAL Center (2011) postulates that lesson plans communicate to learners what they will learn and how they will be assessed, and they help teachers organise content, materials, time, and instructional strategies. In tandem with these views Bin-Hady and Abdulsafi (2018) contend that when a lesson is planned adequately time in the classroom is used efficiently. Khatete et al (2014) equally share these views and observe that lack of adequate planning for lessons often result in fumbling and indecision coupled with disciplinary problems as pupils react accordingly. Dorovolomo, Maebuta and Phan (2010), in a cross sectional study, investigated whether there was a relationship between the quality of lesson planning and the quality of its implementation. The study involved 309 undergraduate students of University of South Pacific, Fiji. The study established that there was a positive relationship between the quality of lesson planning and the quality of lesson delivery.

However, despite the wealth body of knowledge on the importance of these planning tools for effective lesson delivery, studies indicate that teachers do not always use lesson plans for their lesson delivery (Khatete et al, 2014; Dorovolomo et al, 2010; Haambokoma et al, 2002). A study by Haambokoma et al (2002) conducted in the nine provinces of Zambia reveals that teachers of biology did not prepare lesson plans even though they agreed that it was necessary to do so. Investigating pedagogical practices that hamper effective teaching and learning of biology in secondary schools in Migori District of Kenya, Khatete et al (2014) made similar findings.

## 2.3 How teachers of biology conduct lessons

Educational theories on how people learn have influenced a paradigm shift the world over, from teacher centred to pupil centred pedagogical practices. One such theory is constructivism (Taber, 2011). The teacher is no longer considered as custodian of knowledge (Akram & Malik, 2012). The teacher is a facilitator who should guide learners to actively construct their own knowledge of the world around them. In fact, the teacher himself/herself is a learner. To this effect Akram and Malik (2012: 10597) assert that:

> Before modern education was incorporated a student was a passive listener and the teacher was an autonomous body who knew the what, when and how of education. But in recent years the superiority is shifted towards students.

Therefore, science educators are urged to engage pupils in active learning, which is learner centred (Allen & Tanner, 2005). Active learning, which is the opposite of passive learning, engage learners in doing things as well as thinking about what they are doing. As a result, active learning promotes the development of higher order thinking abilities (Altun &Yucel-Toy, 2015). In favour of learner centred pedagogical practices Akram and Malik (2012) contend that the essence of modern education is to awaken the hidden curiosity and interest of the learner in order to develop in the learner basic and essential skills of lifelong learning. Allen and Tanner (2005) share these views and further argue that active learning provides opportunities for learners to connect abstract ideas and real- world applications. To the contrary, in traditional teacher centred teaching methodologies the teacher takes an active role in the teaching and learning process. The pupils take a passive role and receive scientific facts, concepts and principles as given by the teacher without questioning. This encourages rote-learning as pupils take to memorisation of facts (Cimer, 2012). In fact, teacher centred classroom practices promote knowledge acquisition by the teacher who is actively involved in the process of learning (Allen & Tanner, 2005). Science educators are therefore, urged to engage learners in classroom activities that offer learners an opportunity for the development of skill and ability for self-directed learning and inquiry based learning. Also, activities that engage learners in critical thinking. Many studies (Prince, 2004; Michael, 2006; Hoellwarth & Moelter, 2011; Branton, 2012) have shown that active learning strategies promote learner achievement levels.

There is a diverse range of teaching strategies and classroom activities for active learning. These include ICT based learning, class discussion, paired work, small group discussion, collaborative learning group, play, project, presentations, assignment, written class exercise, debate, game, gallery walk and educational tour.

**Class discussion**: A discussion is more conducive to small group settings, however, it can be used to any class size. Class discussion engage learners in critical thinking as they are required to logically evaluate their responses as well as responses of other learners. Learners are expected to analyse issues constructively and intelligently. Therefore, a class discussion is a good follow up activity when the topic has been sufficiently covered (Mckeachie, 2006). A discussion provides a good environment for the teacher to guide and facilitate learning. The benefits of discussion include: learners explore topics of discussion from a diversity of perspectives; it shows respect for students' voices and experiences; it develops habits of collaborative learning; it develops skills of synthesis and integration.

A discussion in **small groups** is even better as it offers higher chances of all learners to participate. Also learners are more likely to express themselves freely in small groups of their peers than in larger groups as is the case with whole class discussions.

**Think-pair-share**: this is an activity whereby learners are given a minute to reflect on the previous lesson, then pair and discuss the lesson with one or more classmates. Finally, each learner shares with the class in a class discussion. During the class discussion the teacher has the opportunity to clarify misconceptions. This activity is useful when students know the background of the subject matter, so that they can identify and relate what they know to others. Therefore, the teacher needs to prepare pupils adequately for the activity. This kind of discussion has several advantages which include the following: all the pupils participate; the teacher is able to assess progress of each learner; it serves time as there is wide coverage of the topic within one lesson; makes the class more interactive; the teacher can observe the learners and evaluate if they understand the material being discussed (Robertson, 2006). However, it is not a good strategy for large classes because it can be time consuming in large class settings.

**Game:** Different class games can be designed by the teacher. Educational games include cross-word puzzle, jigsaw puzzle, problem-solving and computer-based games (Maduka, Olusanya &

Zirawaga, 2017). Educational games enhance teaching and learning in several ways. Undeniably, games create a learning environment which provides learners with fun and entertainment thereby eliminating the monotony of traditional methods of teaching/learning. Therefore, educational games as a teaching/learning strategy help the learner to focus on what is being taught because the learner's interest is easily captured and they tend to concentrate on the lesson. Furthermore, through educational games learners develop a variety of thinking and problem-solving skills which could be used even in social settings outside the classroom (Moursund, 2007). Additionally, educational games as a teaching strategy engage learners actively in the teaching and learning process.

**Debate:** A class debate engages learners in research work because they have to gather information to support their view and explain it to others. It is not only an amusing way of teaching and learning but it offers learners an opportunity to gain experience in making verbal presentations (Darby, 2007). Thus, learners not only master the course content but also improve their speaking abilities. Furthermore, debate used as a teaching/learning strategy has the potential to develop in learners skills for critical thinking and team work (Othman & Zare, 2013). Learners work as an individual and as a team to research, prepare and present a logical argument of critical issues. The learners also develop listening skills as debate activities compel the learner to actively listen to various perspectives.

**ICT enhanced learning:** ICT could be utilised in several ways to enhance teaching and learning. Use of audio-visual aids is one way of enhancing teaching and learning through the use of ICT. Audio-visual aids are teaching aids through which information can be heard and seen simultaneously, for example, a video. Audio-visual aids help in developing and arousing curiosity, creativity, and motivation of the learner (Akram & Malik, 2012). ICT that could be used to enhance teaching and learning in the classroom include internet, radio, projector and computer.

**Practical work:** Practical work plays a vital role in enhancing learners' understanding of scientific concepts and the world around them, more so for abstract concepts (Lai et al, 2012). In the constructivist view of teaching and learning the learners must play an active role and make sense of experiences to construct knowledge of the world around them. Practicals offer learners an opportunity to observe real events. Miller (2004) argues that a real event contains more

information than any representation of it be it video recordings, photographs, pictures or even models. He further opines that when we carry out an activity by ourselves we pay greater attention. Teachers should therefore be engaging learners in a lot of practical work for effective teaching and learning.

Despite the wide range of teaching strategies and instructional activities at the teacher's disposal, many studies (Haambokoma et al, 2002; Mudenda, 2008; Manda, 2012; Baba & Nonaka, 2013; Banda et al, 2014; Chocha, et al, 2014; Namayanga & Sato, 2017) conducted in Zambia have established that teachers are still using traditional, teacher centred classroom practices. These studies have revealed that the use of teacher centred teaching methodologies have contributed to low pupil performance in biology. Haambokoma et al (2002) established that teaching and learning activities used most often in biology classrooms involved teacher asking questions and pupils answering, teacher expositions and teacher demonstrations. Other classroom activities such as role play, project work, listening from guest speakers, under taking field trips, outdoor lessons and games were rarely or never done at all. Mudenda (2008) equally established that learners rarely carried out practical work. He further established that the few practical work learners did were only organized shortly before examinations and were mainly in the form of verification as opposed to investigatory nature. Manda (2012) made similar findings and established that pupil centred teaching methods were rarely used.

Similarly, several studies across the globe (Allen & Tanner, 2005; Fonseca & Conboy, 2006; Cimer, 2012; Khatete et al, 2014; King'aru, 2014) have recorded that teacher centred classroom practices are mostly used in the teaching and learning of biology. Strategies that promote high thinking skills such as practical work, projects and problem solving were rarely used. Khatete et al (2014) investigated pedagogical practices that hamper effective teaching and learning of Biology in secondary schools in Migori district of Kenya. The study report that teachers mostly used lecture and demonstration methods. The study further report that though teachers sometimes used practical work, they mostly avoided it as they lacked the confidence to handle practical work. The researchers attributed teachers' incompetence to handle practical work to inadequate college training. In Kinondoni Municipality, Tanzania, King'aru (2014) investigated factors contributing to poor performance in science subjects, of which biology was a part. The study revealed that poor methodology in science education contributed to the poor performance

in science subjects. These views are supported by Cimer (2012) who earlier made similar findings in Turkey. Cimer (2012) further established that pupils found biology lessons meaningless and irrelevant as what was taught did not relate to their daily lives. The findings of Cimer converge with the revelations of Fonseca and Conboy (2006) in their study "Secondary Students' Perceptions of Factors Affecting Failure in Science in Portugal". It was a cross-sectional study that included all science subjects. The study sample included 346 tenth grade students (214 girls, 132 boys) from eight state sponsored schools in Algarve Region of Southern Portugal. 13% of the students were of mixed nationalities, different from Portuguese. The study established that poor quality of teaching affected pupil achievement and that the science education students received did not prepare them for a scientic-technological society.

### 2.4 Reasons cited for teachers' use of teacher-centred classroom practices

Allen and Tanner (2005) have cited large size classes as contributing factors to teachers' failure to adopt learner centred classroom practices. This is in tandem with the findings of several studies in Zambia, Africa and across the globe (Haambokoma et al, 2002; Amirul et al, 2013; Khatete et al, 2014; Wadesango et al, 2016; Innoow & Moluayonge, 2017; Singh et al 2018). In their research study Yelkpieri et al (2012) investigated the effect of large size classes on effective teaching and learning at the Winneba Campus of University of Education in Ghana. The study established that in large classes it was difficult to organise quizzes and class tests regularly and that it was a problem marking assignments and providing feedback in time. The study further established that in large classes weaker students are not attended to. It cannot be over emphasised that at whatever level of education it is necessary for both the teacher and the learner to know how well lesson objectives are being achieved. Regular assessments and quick feedback inform the teacher and the learner respectively the extent to which lesson objectives are being achieved. Small size classes are known to promote teacher-pupil interaction and to improve the class climate (Bullard, 2011). Therefore, student engagement is enhanced in small size classes and it is unlikely that a student feels disconnected from classroom activities. Bullard (2011) investigated the effects of school enrolment size on student achievement. The study reported that there is a positive effect of small size classes on pupil achievement. Sadly, large size classes is one of the major challenges of the education sector in developing nations and Zambia is no exception.

Other studies (OECD, 2009; Kuzborska, 2011; Xu, 2012; Keraro et al, 2015; Pandian et al, 2018) cite teachers' beliefs to have influence on their classroom practices. Xu (2012) argue that teachers' beliefs about what teaching/learning is will guide everything that they do in the classroom. The beliefs about the nature of teaching and learning include 'direct transmission' and 'constructivism' beliefs (OECD, 2009). Teachers who hold direct transmission view, value transmission of knowledge to pupils in a clear and structured manner, and to give resolvable problems to pupils. On the other hand, teachers holding constructivist view focus on the development of thinking and reasoning processes. Students are therefore, given a chance to find solutions to problems on their own, and students are allowed to play an active role in classroom activities. As such, depending on the teachers' beliefs about what constitutes teaching they will employ either pupil centred or teacher centred classroom practices.

However, other studies (Banda et al, 2014; Chocha et al, 2014) cite teacher incompetence in content and pedagogy as factors hindering teachers' use of learner centred classroom practices. Chocha et al (2014), in their study conducted in the ten provinces of Zambia to assess teacher competence in biology practical work reported that majority teachers lacked basic scientific skills such as correct handling of apparatus, collecting data and interpreting data. Banda et al, (2014) made similar findings in their action research study to assess learner centred science lessons in Zambia. The study concluded that teachers found learner centred way of teaching, such as problem solving method problematic which in turn affected teaching. These findings are in congruent with the findings of other studies the world over (Amirul et al 2013; Khatete et al, 2014; King'aru, 2014). Dambudzo (2015) argues that subject competence is necessary for effective lesson delivery. Teachers need to have good knowledge of the subject they teach in order for them to guide pupils properly in the teaching and learning process. Otherwise teachers may teach wrong concepts to learners. However, Subject content knowledge alone is not enough for effective lesson delivery. Teachers should have the skill to teach the knowledge to be taught to pupils in a way that could be easily understood. Therefore, teachers should demonstrate competence in both the subject matter and in pedagogy. Kleickmann et al (2013) contend that pedagogical content knowledge and subject content knowledge are key components of teacher competence that affect student progress.

Other major reasons cited include inadequate teaching and learning materials and poor attitude of the learners towards the subject (King'aru, 2014). Inadequate materials include text books and laboratory materials. In some cases, Haambokoma et al (2002) reported that laboratories had been turned into ordinary classrooms and that most schools did not have a laboratory assistant. In the absence of laboratory assistants teachers lacked time to prepare lessons adequately due to high teaching loads. Teachers therefore, resort to lecturing and teacher demonstrations as the main teaching methods. Innwoo and Moluayonge (2017) argue that availability of instructional materials has a great impact on classroom practices of science teachers more so for laboratory equipment, chemicals and materials and text books. They further cite laboratory personnel and working conditions in the laboratories to be equally important factors that can influence teaching methods of the science teachers.

On the other hand, there is resistance from learners when teachers use learner-centred teaching strategies (Allen & Tanner, 2005). Pupils generally perceive science subjects as difficult. As a result, pupils have a negative attitude towards science subjects. This scenario could be helped if teachers regularly went for in service training so that they equipped themselves with new and modern methods of teaching science subjects (King'ura, 2014). As Cimer (2012) rightly argues if pupils were not happy with the way biology was taught, they might show disinterest and negative attitude towards the subject and its teaching. Cimer (2012) observes that biology was taught in such a way that teachers reproduced text book information without giving examples from the daily lives of the pupils. Pupils therefore found the subject irrelevant and disinteresting.

The other major reason cited for teachers' use of teacher centred teaching strategies is that the biology syllabus is bulk. Teachers are forced to use teacher centred classroom practices so that the syllabus is completed before examination time.

### 2.5 Organisation of the classroom physical environment

The classroom physical environment is the physical room and its many elements which include: lighting, temperature, ventilation, space, floor, walls, furniture, instructional technologies such as models, pictures, real objects, graphs, maps, chalk boards, notice boards, white boards, projectors, radio, computers and internet (Amirul et al, 2013; Hussain & Suleman, 2014). In the narrowest sense the classroom physical environment refers to the physical structure in which

learning and teaching occurs. However, the term "classroom physical environment" has evolved due to changes in pedagogy (Gonzalez & Kuuskorpi, 2011). The constructivist view of learning has influenced pedagogical shift from focus on knowledge acquisition to focus on knowledge construction by the learner (Bada, 2015). Furthermore, the 21st century has seen rapid social and cultural changes and advances in information and communication technologies (ICT). Such changes, including the integration of ICT in teaching and learning and introduction of internet in schools, have created new expectations of the physical learning environment. Teachers' roles have drastically changed (Kuuskorpi and Gonzalez, 2011; Amirul et al, 2013). The 21st century teacher is a guide, facilitator and learner too. The physical environment should be equipped with facilities to enable learners construct their own knowledge of the world around them through collaborative and cooperative work. Therefore, there is an urgent need for schools and classrooms to be equipped with facilities to cater for the 21st century teaching and learning needs (Gonzalez & Kuuskorpi, 2011). The classroom physical environment has now become a critical component of the learning environment (De Gregori, 2011). Therefore, organisation of the classroom physical environment cannot be delinked from the teacher's classroom practices. For the 21st century classroom, organising the physical learning environment for collaborative and cooperative work is part of what constitutes a teacher's lesson planning and preparation.

Several studies globally indicate that classroom physical environment has profound effect on teaching and learning and educational outcomes (Amirul, et al 2013; Gonzalez & Kuuskorpi, 2011; Lippman, 2010). If well organised the classroom physical environment can support learning in many ways. Amirul et al (2013:1) postulate that "The learning environment can stimulate students to engage in the learning process and can influence the behaviour of students as well as to assist in the development of their skills or cognitive perception". Amirul et al (2013) further contend that the classroom physical environment can have a major influence on the student because a student spends most of the time in a year in the classroom learning environment. Hussain and Suleman (2014) investigated the effect of classroom physical environment on academic achievement of secondary school students. The study established that there was a significant effect of classroom physical environment on the academic achievement scores. The study further revealed that students in classrooms that were well equipped with physical facilities had higher knowledge retention and were more motivated leading to high academic achievement. In congruent with these views Mayor (2000) asserts that the classroom

physical environment influences students learning, participation and involvement in class activities. Gonzalez and Kuuskorpi (2011) carried out a study in collaboration with six European countries over a three-year period to explore 'tomorrow's physical learning environments'. The study established that the teaching space as a whole, furniture and equipment should be relevant to the specific needs of the learners. The study further revealed that the physical learning environment is pivotal to users' desire to develop the schools' operational environment and their need to renew its operational culture. Gonzalez and Kuuskorpi (2011) concluded that significant changes must be made to the physical learning environment to better support users' needs.

The design and setting of the classroom physical environment of the 21st century is envisaged to support learner centered classroom activities and integration of Information and Communication Technologies in the teaching and learning process (Lippman, 2010). However, despite changes in pedagogy and introduction of ICT in teaching and learning in secondary schools classroom physical environments have not evolved to support the envisioned teaching and learning of the 21st century (Lippman, 2010; De Gregori, 2011). De Gregori (2011) has observed that while dramatic changes in technology, educational theory and practice have been accelerating in the United States, the traditional classroom which presents the teacher as custodian of knowledge has survived since the mid-20th century with only minor improvements. In this regard De Gregori argues that the permanence of a single familiar model in classrooms over generations has caused both educators and learners to take the physical learning environment for granted and believe that the place where teaching and learning occurs has little to do with the process of education. Advancing similar views, Wolff (2000) contend that prior to the 1990s most existing learning facilities in the United States were designed to sustain a model of education characterised by teacher-centred instruction.

### 2.6 Continuing professional development (CPD)

Literature indicates that although modern trends in education encourage a paradigm shift from teacher cantered teaching methodologies to pupil centered classroom practices teachers have adhered to traditional methods of teaching. Studies on teaching methodologies used in biology classrooms, mostly, cite teacher incompetence in subject content and pedagogy as one of the main reasons for teachers' adherence to traditional classroom practices.

The Education Policy Document (MoE, 1996) rightly asserts that the knowledge that teachers attain in their pre-service training is not adequate. Teachers are expected to pursue professional growth as a lifelong activity. Furthermore, knowledge is dynamic and teachers are expected to keep abreast with new knowledge in both subject content and pedagogy. It is with this understanding that the Government of Zambia and co-operating partners have, from time to time, initiated programmes and projects to upgrade the qualification of teachers and equip them with adequate knowledge to improve on the quality of education offered to pupils. A number of such programmes intended to improve the quality of science education are explained in detail in section 1.1.1 of this document. The Government of Zambia has also encouraged teachers to take professional growth as a personal responsibility (MoE, 1996). Teachers are expected to improve their knowledge base in subject content and pedagogy through School Based Continuing Professional Development (SBCPD). In the spirit of promoting SBCPD, the Zambian Government introduced an in-service programme called School Programme of In-service for the Term (SPRINT) in 1996 (MoE,1996).

SPRINT activities are organized by the school, basing on local needs, and all teachers at given schools are required to participate (MoE & JICA, 2011). To strengthen SPRINT, the Zambian Government in partnership with the Japanese government introduced other school based in-service programmes which were to be implemented within the SPRINT frame work. Thus, in 2011 a programme called 'Strengthening Teachers' performance and Skills' (STEPS) was introduced (MoE & JICA, 2011). The project was aimed at improving teaching skills and knowledge of subject content for teachers of mathematics and science of grades 8 to12 in all provinces. In the same vein, Strengthening of Mathematics, Science and Technology Education (SMASTE) was piloted in Central province from 2005 to 2007 before rolling it out to other provinces. The programme, SMASTE, was aimed at improving not only the quality of mathematics and science education but also technology education. Through SMASTE 'Lesson Study' was introduced to all provinces. Lesson Study is a teaching approach whereby a small group of teachers collaboratively identify a challenge and plan the lesson (MoE & JICA, 2010). When the lesson is planned one member of the group implements the Demo-Lesson in a real classroom situation while other teachers observe the lesson. Thereafter, teachers meet to make a critique of the lesson. Changes and adjustments are made and a new lesson plan is made. The

revised lesson is again taught to a different class by the same teacher. The lesson is further discussed and amendments made where necessary. The teachers would now adopt the lesson plan for future use. This teaching approach was borrowed from Japan.

### 2.7 Summary of literature review

The literature reviewed in this chapter indicate that curriculum tools for lesson planning are the following: syllabus, schemes of work, records of work and lesson plan (Kaseske et al, 2015; MoGE, 2016). However, the literature reviewed indicates that teachers of biology in most cases do not prepare lesson plans (Haambokoma et al, 2002; Khatete et al, 2014).

The literature reviewed further reveal that learning theories, particularly constructivism, have influenced a pedagogical shift from teacher centred to learner centred teaching methodologies (Palmer, 2005; Bada, 2015). Teachers' roles have changed from that of being custodian of knowledge to that of facilitator and guide in the teaching and learning process. However, the literature reviewed further reveal that majority teachers the world over are still using teacher-centred classroom practices (Haambokoma et al, 2002; Allen & Tanner, 2005; Fonseca & Conboy, 2006; Mudenda, 2008; Manda, 2012; Baba & Nonaka, 2013; Banda et al, 2014; Chocha, et al, 2014; Namayanga & Sato, 2017; Cimer, 2012; Khatete, 2014; King'aru, 2014). Lectures and demonstrations dominate biology classrooms. Studies have revealed several factors as hindrances to teachers' use of learner centred classroom practices. The reasons advanced include the following: overloaded biology curriculum; inadequate teaching/learning materials; large size classes; lack of time to plan for biology lessons due to understaffing; and attitude of learners towards the subject (Haambokoma et al, 2002; Cimer, 2012; Khatete et al, 2014). Other educationists (Allen & Tanner, 2005) have cited learner resistance to learner centred classroom practices arising from their perception of what constitutes teaching and learning. To the contrary, other educationists (Baba & Nonaka, 2017) cite teachers own beliefs about teaching and learning to be influencing their classroom practices. Other studies still (Banda et al, 2014; Chocha et al, 2014) have revealed teacher incompetence in pedagogy and subject content as contributing factors to teachers' failure to use learner centred classroom practices even in situations where resources are available.

The literature reviewed further reveal that the shift in pedagogy, together with advances in technology which has led to the integration of ICT in teaching/learning process and introduction of internet in schools have brought in new expectations of the classroom physical environment. The classroom physical environment of the 21st century is envisaged to support learner engagement in active construction of knowledge through co-operative and collaborative work. Therefore, the classroom physical environment should be facilitated with adequate teaching/learning materials, while space and furniture arrangement should enable collaborative work. Literature reviewed however, indicates that classroom physical environments have not changed to support the envisioned teaching and learning of the 21st century (Lippman, 2010; De Gregori, 2011).

From the literature reviewed it is established that lesson preparation and lesson delivery are inseparable. It is further established that lesson preparation does not only involve consideration of teaching methodologies but also the environment in which teaching/learning occurs. Therefore, organisation of the classroom physical environment is an important component of teachers' classroom practices. However, the literature reviewed does not reveal studies in Zambia that have comprehensively considered the organisation of the classroom physical environment in relation to teachers' classroom practices for the schools understudy. It was therefore found necessary to carry out this study to add to this knowledge base. The next chapter describes the methodology used in this study to answer the three research questions stated earlier on.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction

This chapter outlines the research methods that were employed to collect and analyse data. The chapter describes the research design; study area; target population; study sample; sampling techniques; data collection instruments; data collection procedures; data analysis and data analysis procedures.

## 3.2 Research design

The study employed a qualitative approach and a descriptive survey design. A descriptive research study is concerned with describing the characteristics of an individual, group or situation. It is also referred to as a survey design since it takes into account all the steps involved in a survey concerning a phenomenon (Kothari, 2002). This approach was found suitable because of the following characteristics of surveys which also applied to this research study:

- describes, records, analyses and interprets conditions that exist or existed, in their natural settings;
- gathers data on a one-shot basis and hence is economical and efficient;
- gathers standardised information by using the same instruments and questions for all the participants;
- makes generalisations about, and observes patterns of responses in, the targets of focus. (Cohen, Manion & Morrison, 2007: 171).

## 3.3 Data collection methods

The following methods were used for data collection: questionnaire, observation, document analysis and focus group discussion. This approach of combining the research method is referred to as triangulation and serves to enhance the validity of the research findings (kevogo et al, 2013; Bryman, 2004; Denscombe, 2003; Berg, 2001)

### 3.4 Justification for the research methods employed

#### 3.4.1 Questionnaire

The questionnaire was used to complement the other research methods used in the study because of the advantages that questionnaires have over the other methods (Burns & Bush, 2010). Questionnaires have standardised answers that make it simple to compile data. Furthermore, questionnaires provide opportunity for the respondents to have adequate time to give answers that they have well thought about (Kothari, 2004). Additionally, respondents who are not easily approachable can be reached conveniently.

#### 3.4.2 Focus group discussion

Cohen et al (2007) describe focus groups as contrived settings, whereby a group of participants specifically chosen for the purpose discusses a particular theme or topic, and the interaction within the group leads to data and outcomes. The researcher is a facilitator or moderator. The participants interact with each other rather than with the researcher such that the views of the participants can come out. Focus group discussions provide a relaxed atmosphere and enable participants to freely air their views on the topic being discussed (Bergs, 2001). As this study also involved collection of information from pupils, the method was found appropriate. Pupils might have been intimidated by the one-on-one, face -to-face interview. Group discussions produces data and insights that would not come about without the interaction found in a group setting (Lindlof & Taylor, 2002). The verbalised experiences from other group members stimulate memories, ideas and experiences in participants. Furthermore, focus group discussion provides the opportunity to assess the strength with which an individual holds an opinion (Harding, 2013). The individual may either modify their opinion or defend it if presented with opposing opinions. Additionally, focus group discussion can sometimes reveal shared understandings or common views (Hardings, 2013).

#### 3.4.3 Observation

Observation is suitable for investigating phenomena that can be observed directly. The advantages of observation are that the researcher being an outsider can see phenomenon about a situation, which those involved may take for granted and events are recorded as they occur

(Tichapondwa, 2013). It was therefore found inevitable to employ direct observation of lessons in progress.

### 3.4.4 Document analysis

The analysis of documents was employed to complement the other methods that were used. Tichapondwa (2013) has noted that document analysis helps to fill up the gaps that may be left open by other data collection strategies. Hence, the following documents were analysed: teachers' teaching files, teachers' preparation books and pupils' note books and exercise books.

## 3.5 Study area

The study was conducted in two districts of Luapula Province, namely, Mansa and Samfya. The study targeted three secondary schools of which two are in Mansa district and one in Samfya district. As earlier stated, the names of the schools have been withheld for ethical reasons. Hence, the two schools in Mansa district are pseudo named as School One and School Two respectively. The one in Samfya district is pseudo named as School Three.

## 3.6 Target population

The target population comprised all biology teachers and all grade twelve (12) pupils at the three secondary schools. All the three secondary schools offer co-education. School One and School Three have boarding facilities and cater for both boarder and day pupils. School Two has no boarding facilities but had a limited number of weekly boarders. The weekly boarders had rented accommodation in neighboring communities. The teachers were selected for the study because of the poor performance exhibited by their schools in School Certificate Examinations in Biology. It was for the same reason that pupils formed part of the study population.

## 3.7 study sample

The study targeted Heads of Departments for Natural Sciences and all Biology teachers in the three secondary schools who had taught for atleast two (2) years in their respective schools at the time of the study in order to obtain valuable data (Kosgei, 2013). The study explored classroom practices of teachers of biology in order to establish possible causes of low pass rates in School Certificate Examination in biology for the three schools. Therefore, the teachers who had taught

in these schools for a considerable period of over two years were found to be ideal for the study because they prepared the pupils for the Examinations. In the same vein the study focused on grade 12 pupils who had been in their respective schools for a considerable period of about three years. They were therefore, a rich source of information about classroom practices of the teachers of biology. The Heads of Science Departments formed part of the study sample because they closely supervised the teachers and the Department in general. They were therefore, considered to be a rich source of information regarding the classroom practices of teachers of biology in the schools under study. Hence, the study sample comprised three (3) heads of departments, twelve (12) teachers of biology and seventy-seven (77) Grade 12 pupils.

### 3.8 Sampling procedures

The schools were drawn into the study by purposive sampling. The objectives of the study formed the main basis for the selection criteria which drew secondary schools into the study. The three schools were particularly chosen for the study because of their poor performance in school Certificate Examination in Biology year after year. The three schools also had a good record of their results analysis for School Certificate Examinations. Therefore, there was evidence of their poor performance. Similarly, the teachers were selected by purposive sampling as explained in section 3.5.

The Grade 12 pupils that participated in the study for each school were selected by systematic random sampling to allow for equal chances of being selected for the study. Pieces of paper, each bearing the name of a grade 12 class in a particular school were put in a box. The box was then shaken to allow for random mixing of the pieces of paper. Thereafter, two (2) pieces of paper, each representing a class, were drawn from the box, one after another. The box was always shaken before a draw was made.

### 3.9 Research instruments

This study employed the following instruments for data collection: self-administered questionnaires, lesson observation schedule, focus group discussion guide and document analysis guide.

**(i) Self-administered questionnaires**

The self-administered questionnaires for the teachers, pupils and Heads of Department, are appearing in this report as appendices I, II and III respectively. The questionnaires were developed by the researcher after reading extensively on preparation of questionnaires (Dillman et al, 2014; Shaughnessy et al, 2011; Ader & Mellenbergh, 2008; Cohen et al, 2007; Bryman, 2004; Kothari, 2004). The questionnaires had both closed-ended and open-ended questions and covered all the three research questions stated in section 1.5. Closed ended questions confine the respondent to the subject through the stipulated responses. Open-ended questions enable the researcher to establish what respondents believe, know, like, dislike, and think about the problem under investigation (Tichapondwa, 2003). The flexibility of open ended questions allows respondents to give free responses in which case they are likely to bring out situations or issues that were not anticipated when the questionnaire was designed. Therefore, the two types of questions were used to complement each other.

**(ii) Focus group discussion guide**

The focus group discussions were aimed at obtaining more information on the three research questions in addition to what was obtained from the other research instruments. The discussions were also meant to seek clarification on some observations made in the course of the lesson observations. The researcher, therefore, formulated two different open-ended interview guides, one for the teachers and another for the pupils.

The focus group discussion guide for teachers (appendix IV) addressed all the three research questions. That is, it focused on obtaining information regarding teachers' use of curriculum materials; what teaching methods teachers mostly used and the extent to which the classroom physical environment was facilitated. On the other hand, the interview guide for pupils (appendix V) focused on obtaining information on the classroom activities mostly used in their biology lessons. The group interview guide for pupils was also meant to consolidate information on the display of teaching aids in biology classrooms and laboratories by the teachers. Therefore, the focus group discussion guide for pupils addressed research questions 2 and 3.

**(iii) Lesson observation schedule**

The lesson observation schedule was developed by the researcher and it addressed all the three research questions (appendix VI). It was aimed at providing information on how teachers conducted their lessons: the teaching methods, classroom activities and teaching aids used; classroom interactions amongst pupils and between pupils and teachers and pupil involvement in lesson activities. The Lesson Observation Schedule was designed such that it had provision for the researcher to indicate comments in the schedule. The researcher also had a note book in which extra comments were being made during lesson observation. Lesson observation was also enhanced by use of audio and visual recording instruments.

(iv) **Document analysis guide**

The document analysis guide was formulated by the researcher and mainly addressed research questions 1 and 2 (appendix VII). It complemented the other research instruments that were employed. The instrument had provision for the researcher to make comments on the findings. The documents analysed were teaching files, teachers' note books and pupils note books and exercise books. Analysis of the teaching files was aimed at consolidating information on availability of the syllabus, schemes of work, records of work and lesson plans. It also provided opportunity to analyse the quality of the contents of the latter three documents. Analysis of the teachers' note books provided opportunity to examine the quality of the notes given to the learners. On the other hand, analysis of pupils note books and exercise books enabled the researcher to examine how much attention teachers paid to pupils' written work and assess the quality of pupils' written work.

**3.10 Data collection procedure**

Data were collected in term 3 of the school calendar, between September and October in 2016. Prior to the actual data collection, a pilot study was done at St. Clements, in Mansa District, to examine the suitability of the research instruments for data collection. The pilot study enabled the researcher to amend the research instruments to remove ambiguity from some sections. For example, as some pupils attempted the questionnaire they also worked on parts that were meant for the researcher. Therefore, the instrument was amended to improve on clarity. The pilot study involved 35 pupils, 3 teachers of biology and one Head of Science Department.

The actual study began with School One. Permission was sought from the head teacher of School One by way of an introductory letter from the Provincial Education Office. The procedure was done even in the other two schools on day one of the researcher's presence in the school. After seeking permission from the head teacher of the school, the researcher was introduced to the head of science department. Arrangements for lesson observations were made with the help of the HOD in all the three schools. Distribution and collection of the questionnaires from the teachers was also done with the help of the HOD. The teachers were given one week to complete the questionnaire. The pupils were only given a day for fear that if they were left with the questionnaires for a longer time, they could end up losing them.

On the first day of the researcher's visit to the school arrangements for lesson observations were made with the teachers of biology from the study sample who volunteered to be observed. There were no lesson observations made on the first visit to any of the schools as this day was only used to explain the purpose of the research and making arrangements for lesson observations. Questionnaires were however distributed to the HOD and teachers on the first visit. Questionnaires were distributed to the pupils in each school at the end of the first lesson that was observed. The purpose for the questionnaire was explained to the pupils as well as the confidentiality of the activity. The pupils were therefore appealed to for sincerity in completing the questionnaire.

Focus group discussions for both teachers and pupils respectively were conducted after lesson observations were over. The researcher found it necessary to conduct focus group interviews for each of the schools when lesson observation was over so that the researcher could have the opportunity to seek clarification on issues that the researcher didn't anticipate but which arose in the course of lesson observation. In this case the researcher amended the instrument to include items that came about from lesson observation. The focus group discussion for teachers was held separately from that for pupils in all the schools.

The teaching files and teachers note books were collected from the teachers for document analysis when all the three lessons scheduled for observation were done. The researcher was allowed to keep the files over the weekend so that there was ample time to analyse the contents

of the documents. As for pupils, note books/exercise books were collected at random from those who volunteered at the end of the first lesson that was observed. For gender balance, five were collected from boys and five from girls. The researcher spent time in school to examine the books so that they were given back to the pupils in the shortest possible time so as not to deprive them of their study time.

The 12 teachers who participated in the study were given the codes TR1, TR2, TR3, TR4, TR5, TR6, TR7, TR8, TR9, TR10, TR11, and TR12 for ethical reasons. TR stands for teacher and the serial number for the questionnaire formed the last part of the code.

### 3.11 Data analysis and procedures

Data were mainly analysed through qualitative techniques. Qualitative data were obtained from the open-ended sections of the questionnaire, focus group discussions, document analyses and lesson observations. Qualitative analysis is more concerned with meaning (Bryman, 2004). Therefore, the study employed content analysis as the main technique to analyse qualitative data. Sandelowski (2000) refers to content analysis as the method of choice for analysing qualitative data. In the initial stages of the analysis the audio recorded responses from the focus group discussions were manually transcribed by the researcher. As a way of becoming more familiar with the data the researcher found it suitable to manually transcribe the focus group discussions as opposed to using computer assisted techniques (Bloomberg & Volpe, 2012). The transcripts and all data sets, from the questionnaires, document analyses and lesson observations were reviewed repeatedly to establish categories and themes until the most significant ones emerged. This process of categorising data repeatedly to establish themes and sub-themes is referred to as coding the data (Denscombe, 2003). Regularities and variations within and across data categories were then compared. Comparisons were also made of the study findings and the literature reviewed. The comparisons gave meaning to the findings (Bloomberg & Volpe, 2012) and conclusions were made in relation to the research questions.

Although the study employed a qualitative approach it was found necessary to also employ simple quantitative techniques for data analysis because closed-ended sections of the

questionnaire for both teachers and pupils yielded quantitative data. The simple quantitative technique employed involved counting the number of times a particular response was given. Tallies were used to establish frequency of a particular response. The frequency counts were converted into percentages and tables were used to summarise the data (Tables 4.1; 4.2; 4.3). The frequency counts supplemented the qualitative data (Bloomberg & Volpe, 2012).

### 3.12 Interpretation of the findings

Interpretation of the findings was fused with data analysis. It is common in qualitative data analysis that interpretation and analysis are fused because words themselves are interpretations and are to be interpreted (Cohen et al, 2007).

### 3.11 Trustworthiness of the findings

Trustworthiness of the findings was enhanced by using more than one research method (kevogo et al, 2013; Bryman, 2004; Denscombe, 2003; Berg, 2001). Furthermore, all focus group discussions were audio recorded, played back several times and transcribed. Audio recording uncovers subtle cues and bits of information that would otherwise elude the listener (Shank, 2000). Additionally, all lesson observations were video recorded. Each of the recordings was played back several times, and transcribed to identify the teaching methods, teaching /learning activities, teaching materials used and the classroom interactions. The recordings were a supplement to the notes recorded in the lesson observation schedule by the researcher.

### 3.12 Limitations of the study

The schools under study had on average class enrolment of 77 pupils as evidenced by class registers. However, at the time of the study class size had temporarily reduced, and ranged from 28 to 44 pupils per class due to non-payment of school fees. This researcher therefore, was not able to witness what really transpired in a biology classroom of 77 pupils when the class was in full attendance. This situation might have its own limitation on the findings more so that large class size was cited by the teachers to be a factor hindering their use of pupil-centered teaching strategies.

### 3.13 Ethical considerations

At the beginning of the study the purpose was explained to the participants so that consent was sought from them, making their participation voluntary. To observe confidentiality, the respondents did not disclose their identity on questionnaires. In the same vein, the true identity of the participating schools has not been revealed. In addition, the researcher obtained approval to carry out the research study from the UNZA Humanities and Social Sciences Research Ethics Committee. The researcher also obtained an introductory letter to the schools from the Provincial Education Office.

# CHAPTER 4

# PRESENTATION OF RESEARCH FINDINGS

## 4.1 Introduction

This chapter presents the findings of the study. The findings have been presented under sub-headings drawn from the Research Objectives which were as follows:

(i) To establish the skillfulness of biology teachers' lesson preparation.
(ii) To establish how teachers of biology conduct their lessons.
(iii) To determine the extent to which the classroom physical environment is organised for teaching and learning of biology.

## 4.2 Skillfulness of biology teachers' lesson preparation

The finding of the first research objective were presented under the following sub-headings: use of curriculum materials for lesson preparation and preparation of teaching aids.

### 4.2.1 Use of curriculum materials for lesson preparation

#### (i) Syllabus

Analysis of the content of the teaching files for all the six teachers whose lessons were observed revealed that the biology syllabus was available in the teaching files. Equally, the topics and objectives of the schemes of work were in line with the syllabus. This was augmented by the findings obtained from the teachers during group interviews. All the 6 teachers agreed that they prepared Schemes of Work using the biology syllabus.

#### (ii) Schemes of work

It was learnt that the Schemes of Work were prepared on a termly basis during the holidays or at the beginning of a term by the teachers. The trend was the same for all the three schools. The Heads of Department allocated to individual teachers respective grades for which to prepare the schemes of work. To that effect schools Two and Three had the schemes of work in their files for the term when the study was being carried out as well as for the previous two terms. For School

One, the schemes of work for the previous two terms were available in the files but schemes for the particular term when the study was being conducted were not available. The explanation was that the school had run out of tonner for printing. From focus group discussion it was learnt that in all the three schools the trend was that once teachers prepared the schemes, they were given to the school secretaries for typing.

Commenting on the preparation of Schemes of Work, respondent TR3 of School One said the following:

> We always prepare the Schemes of Work. What usually happens is that towards closing, the H.O.D will tell us to prepare the Schemes of Work for a given Grade, say for grade 12s or 11s. We prepare during the holidays or before and leave work with the secretaries.

However, TR1 of the same School One seemingly disagreed with the colleague and added as follows:

> Normally, the instructions are given by the H.O.D to have the work done before the end of a term. To be specific, I can say during the last week of a term. Instructions are given that we do the preparations. But of course we respond differently. The submissions are supposed to be done in the first week of a term but the way we respond is not always positive. Some members make late submissions.

The respondent went on to say:

> Like what has happened this term none of us has the schemes of work despite the preparations that were done by various teachers. And what has contributed to that is the problem we faced as a school. We do not have ink for the printer. That has a negative impact on our part.

As for school Two the respondents indicated that they had no problems with preparation and printing of schemes of work. Similarly, respondent in School Three indicated that they had no

problem with the preparations of schemes of work only that sometimes they were delayed due to lack of tonner for printing.

From the responses it would seem that although teachers for the three schools generally indicated that they had no challenges in the preparation of Schemes of Work, they in actual sense experienced some problems, such as lack of co-operation from some teachers and shortage of printing materials. Late submissions of drafts of Schemes of Work resulted in teachers having to begin the term without copies of Schemes of Work. This was particularly true for school One. As was the case, Schemes of work for School One were never printed till the end of the term at the time the study was being undertaken.

Asked in a group interview whether the teachers of biology were managing to finish the biology syllabus before examinations, the teachers responded in the negative. To this effect TR8 lamented:

"Madam I have never completed the biology syllabus ever since I started work".

However, analysis of the Schemes of Work in the teaching files revealed that related topics were sequenced one after the other. Also, as mentioned earlier, the topics and objectives were in line with the syllabus content.

**(iii) Records of work**

The findings were that two out of twelve teachers stated that they did not refer to records of work when preparing for biology lessons, while one stated that she/he referred to records of work sometimes. However, nine teachers stated that they referred to records of work always in their lesson planning. The two teachers who stated that they did not refer to the records of work in their lesson planning gave the reason that records of work were written after teaching was already done. Hence, TR4 responded as follows:

"I do not refer to records of work in that this is a summary of what has been done in class. I usually record what has been done after the lesson".

The TR6 wrote:

"No, because work covered in a week is recorded on a Friday of that particular week".

For the ten (10) respondents who stated that they used records of work during lesson planning, the reason cited by most of them was that records of work offered them guidance as to which topic was taught so that they knew where to start from for the next lesson. Hence, TR7 wrote:

"I use records of work to know where I should start from or where I ended the previous lesson".

Five other teachers from the three schools gave a similar response. TR5 however cited a different reason as she/he stated:

"I refer to records of work during lesson planning to connect the lesson to the previous ones. Pupils should have pre-requisite knowledge before learning a new lesson".

Only TR11 indicated that she/he used records of work to reflect on the previous lesson and hence stated:

"This is done to make reflections on how best teaching and learning process was conducted".

The findings from document analysis of teaching files and group interviews for teachers indicated that teachers prepared records of work. The Heads of Department checked the teaching files fortnightly. The findings from group interviews further revealed that a good number of teachers, 10 out of 12, referred to records of work during lesson planning. A good number of teachers, 8 out of 12, referred to records of work mainly to take note of the work that was covered in the previous lesson so that they were guided on the next topic to teach. Few teachers, 1 out of 12, used the records of work to link the previous lesson to the next lesson so that pupils had pre-requisite knowledge. Few teachers still, 1out of 12, used the records of work to reflect on the previous lesson. It was also learnt that some teachers prepared records of work at the end of the week, on a Friday. Ideally, records of work are supposed to be prepared soon after a lesson is taught in order to effectively evaluate the lesson.

**(iv) Lesson plan**

Items 1-3 of Section A1 of the teacher questionnaire (Table 4.1) sought to find out if teachers prepared lesson plans for their biology lessons.

The findings were that nine out of twelve agreed with item 1 which stated that there was an adequately prepared lesson plan for each biology lesson while three out of twelve disagreed with

the assertion. The teachers were consistent in their response to item no. 2 which stated that for each biology classroom a different lesson plan was prepared even if the topic and Grade were the same. The majority of the teachers, eight out twelve, agreed with the statement while four out of twelve disagreed with the statement. The teachers consolidated their responses to items 1 and 2 when majority of them, eleven out of twelve, disagreed with item 3 which asserted that only one lesson plan was prepared per week for each biology classroom. It was only one teacher out of twelve who agreed with this assertion.

These findings showed that majority teachers (75%) prepared lesson plans for each of their biology lessons while a few (25%) did not always prepare lesson plans for their biology lessons. From document analysis of lesson plans and lesson observation it was clear that the lesson plan contents were in line with the schemes of work and the syllabus. The lesson activities too were logically sequenced. However, document analysis revealed that in most cases lessons were not evaluated. For the few lessons that were evaluated common statements were "the lesson was taught as scheduled" or "objectives were achieved".

**Table 4.1 Teachers' views on their lesson preparations**

KEY: SA – Strongly Agree; A – Agree; UN – Undecided; SD – Strongly Disagree; D – Disagree

| S/No. | Statements on biology lesson planning and preparation | FREQUENCY (%) | | | | |
|---|---|---|---|---|---|---|
| | | SA | A | UN | SD | D |
| 1 | For each of my biology lessons there is an adequately prepared lesson plan. | 2 (16.7) | 7 (58.3) | 0 (0) | 0 (0) | 3 (25.0) |
| 2 | For each biology lesson I prepare a different lesson plan even if the grade and topic are the same. | 1 (8.3) | 7 (58.3) | 0 (0) | 0 (0) | 4 (33.4) |
| 3 | For a particular biology lesson I only prepare one lesson plan per week. | 0 (0) | 1 (8.3) | 0 (0) | 4 (33.4) | 7 (58.3) |
| 4 | Teaching materials are adequately available in the department for my | 1 | 1 | 0 | 0 | 10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | use during lesson preparation. | (8.3) | (8.3) | (0) | (0) | (83.4) |
| 5 | I effectively and consistently make use of the teaching and learning materials in the Department for my lesson preparations. | 3 (25.0) | 7 (58.3) | 1 (8.3) | 0 (0) | 1 (8.3) |
| 6 | The Science Department is poorly equipped with teaching/learning materials for my lesson preparation. | 3 (25.0) | 5 (41.7) | 0 (0) | 0 (0) | 4 (33.3) |
| 7 | I make my own teaching/learning aids from available local resources for my biology lessons. | 3 (25.0) | 9 (75) | 0 (0) | 0 (0) | 0 (0) |
| 8 | Most of my biology lessons lack teaching/learning aids | 0 (0) | 1 (8.3) | 2 (16.7) | 0 (0) | 9 (75) |
| 9 | I effectively use the reference books available in the department for my lesson preparations. | 5 (41.7) | 7 (58.3) | 0 (0) | 0 (0) | 0 (0) |

From the questionnaire for teachers (Appendix I, section A2, item 3) as well as from focus group discussions (Appendix III) it was learnt that teachers in all the three schools encountered the following challenges in planning for biology lessons: inadequate reference books, lack of teaching/learning materials and time factor mainly due to overloaded time table. One teacher from School One particularly cited the topic “transpiration”, that materials for constructing the potometer were not available in the laboratory. However, two teachers from school one also added that they lacked adequate lesson plan templates. It was leant from focus group discussion that the Head of department facilitated the printing and multiplying of the form. However, it was not mandatory that teachers used the template. Plain papers and thick books could also be used for lesson planning. A lesson plan template is designed by the department to make lesson planning easier. All the essential components of a lesson plan are included as sub-headings such that during lesson planning teachers only fill in the form.

### 4.2.2 preparation of teaching aids for biology lessons

Findings from the questionnaire for teachers and from focus group discussions revealed that the science departments in all the three schools understudy were poorly stocked with teaching and learning materials (Table 4.2). Therefore, teachers mostly made teaching aids from locally available resources. To this effect, Table 4.2 shows that 8 out of 12 teachers agreed with the statement that the Science Department was poorly stocked with teaching and learning resources while four disagreed with the statement. Out of the 8 teachers that agreed with the statement, 3 belonged to School One, 2 belonged to School Two and the other 3 belonged to School Three. On the other hand, all the twelve teachers agreed with the statement that they made their own teaching/learning aids from available resources. To this effect, the majority of teachers, nine out of twelve, disagreed with the statement that most of the lessons for their biology classrooms lacked teaching/learning aids, only one (from School Three) out of twelve agreed with the statement while two were not sure (all from School two). The findings from the teachers also revealed that majority of the teachers (ten) made use of the few resources that were available in the Science Department; 1 teacher from School One disagreed with the statement while 1 teacher from School Three was not sure of using the few resources that were available in the department.

Although teachers generally indicated that they made teaching aids from available local resources, analysis of the lesson plans in the teaching files revealed that the teaching aids mostly made were charts in the form of diagrams. This was also evident from lesson observations as charts were used in most lessons.

## 4.3 How teachers of biology conduct their lessons

The findings of the second research objective were presented under the following sub-headings: teaching methods used in biology lessons, teaching methods used in the lessons that were observed and use of teaching/learning aids in biology lessons.

### 4.3.1 Teaching methods used in biology lessons

Table 4.2 shows findings from teachers on teaching methods used in biology lessons.

**Table 4.2 Teachers views on teaching methods employed in biology lessons**

| Teaching/learning activity | Percentage (%) | | | | | |
|---|---|---|---|---|---|---|
| | Not Stated | Always | Often | Some-times | Rarely | Never |
| 1. Teacher asking questions, pupils answering. | 0.0 | 58.3 | 25.0 | 16.7 | 0.0 | 0.0 |
| 2. Teacher talking, pupils listening. | 0.0 | 57.1 | 18.2 | 75.3 | 7.8 | 2.6 |
| 3. Teacher giving class exercise to pupils to be done individually. | 8.3 | 0.0 | 41.7 | 41.7 | 8.3 | 0.0 |
| 4. Teacher conducting lesson outside the classroom and using natural environment as a teaching aid. | 0.0 | 0.0 | 8.3 | 33.3 | 41.7 | 16.7 |
| 5. Teacher taking pupils out for an educational tour. | 8.3 | 0.0 | 0.0 | 16.7 | 33.3 | 41.7 |
| 6. Teacher giving pupils tasks for research for a given period of time. | 00 | 8.3 | 33.3 | 41.8 | 8.3 | 8.3 |
| 7. Teacher conducting experiment while pupils watch. | 0.0 | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 |
| 8. Teacher conducting experiment and involving pupils. | 0.0 | 0.0 | 58.3 | 41.7 | 0.0 | 0.0 |
| 9. Teacher engaging pupils to debate on a given topic. | 0.0 | 0.0 | 25.0 | 16.7 | 16.7 | 41.6 |
| 10. Teacher engaging pupils in quiz on a given topic. | 0.0 | 0.0 | 16.7 | 33.3 | 41.7 | 8.3 |
| 11. Teacher asking questions and writing pupils' responses on the chalk board. The responses are discussed. | 0.0 | 16.7 | 25.0 | 50.0 | 8.3 | 0.0 |
| 12. Teacher writing notes on the chalk board for pupils to copy. | 0.0 | 33.3 | 41.7 | 25.0 | 0.0 | 0.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13. Teacher giving work to pupils to discuss in pairs. | 8.3 | 8.3 | 16.7 | 33.4 | 25.0 | 0.0 |
| 14. Teacher giving work to pupils to discuss in small groups. | 0.0 | 16.7 | 66.6 | 16.7 | 0.0 | 0.0 |
| 15. Teacher asking individual pupils to present their group work to the class. | 0.0 | 33.3 | 25 | 41.7 | 0.0 | 0.0 |
| 16.Teacher discussing work with pupils in class | 0.0 | 16.7 | 16.7 | 66.6 | 0.0 | 0.0 |
| 17. Teacher engaging pupils in hands on activities in the classroom. | 0.0 | 16.7 | 16.7 | 66.6 | 0.0 | 0.0 |
| 18. Teacher engaging pupils in hands on activities in the laboratory. | 0.0 | 16.7 | 8.3 | 33.3 | 41.7 | 16.2 |
| 19. Teacher assigning pupils to act roles on a given topic. | 0.0 | 0.0 | 8.3 | 0.0 | 58.3 | 33.4 |
| 20. Teacher conducting lessons from the laboratory. | 0.0 | 16.7 | 8.3 | 33.3 | 41.7 | 16.2 |
| 21. Teacher marking pupils' work in their exercise books. | 0.0 | 33.4 | 33.4 | 33.4 | 0.0 | 0.0 |
| 22. Teacher engaging slow learners in extra classroom activities. | 0.0 | 0.0 | 16.7 | 58.3 | 16.7 | 8.3 |
| 23. Teacher using models/ charts/ pictures/ or real objects during biology lessons. | 0.0 | 48.1 | 10.3 | 11.7 | 6.5 | 23.4 |
| 24. Teacher engaging pupils in practical work to discover knowledge on their own. | 0.0 | 0.0 | 25.0 | 41.6 | 16.7 | 16.7 |

Table 4.2 shows that teaching methods used most often in the teaching and learning of Biology were whole class discussions (91.7%), question and answer (83.3%), pupils working in small groups (75.0%) and pupils copying notes from the chalk board (75.0%). The findings also showed that teachers used teaching aids in most of their classroom activities (75%). A fairly

good number of the teachers indicated that the following were also in frequent use: teachers marking pupils' work (66.8%), pupils making presentations to the whole class (58.3%) and teacher demonstrations with pupils participating (58.3%).

Findings from teachers also revealed that the following were either rarely or never used at all: hands on activities, debate, and use of laboratory for lessons, quiz, remedial work, outdoor activities, role play and educational tours.

Table 4.3 shows findings from pupils on teaching methods used in biology lessons.

**Table 4.3 Pupils' views on teaching methods employed in biology lessons**

| **Teaching/learning activity** | **Percentage (%)** | | | | | |
|---|---|---|---|---|---|---|
| | Not Stated | Always | Often | Some-times | Rarely | Never |
| 1. Teacher asking questions, pupils answering | 0.0 | 62.3 | 10.4 | 11.7 | 3.9 | 11.7 |
| 2. Teacher talking, pupils listening | 0.0 | 57.1 | 18.2 | 7.8 | 2.6 | 14.3 |
| 3. Teacher giving individual class exercises | 1.3 | 48.1 | 23.4 | 10.3 | 5.2 | 11.7 |
| 4. Teacher conducting lesson outside the classroom and uses the natural environment as a teaching aid. | 2.5 | 24.7 | 7.8 | 16.9 | 16.9 | 31.1 |
| 5. Teacher organising educational tour | 9.0 | 27.3 | 2.6 | 5.2 | 11.7 | 44.2 |
| 6. Teacher giving pupils tasks for research for a given period of time. | 1.3 | 37.7 | 12.9 | 13.0 | 15.6 | 19.5 |
| 7. Teacher conducting experiment while pupils watch. | 3.9 | 27.3 | 10.4 | 9.1 | 11.7 | 37.7 |
| 8. Teacher conducting experiment and involving pupils. | 2.6 | 50.6 | 5.2 | 10.4 | 7.8 | 23.4 |
| 9. Teacher engaging pupils to debate on a given topic. | 7.8 | 20.8 | 15.5 | 5.2 | 7.8 | 42.9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10. Teacher engaging pupils in quiz on a given topic. | | | | | | |
| 11. Teacher asking questions and writing pupils' responses on the chalk board. The responses are discussed. | 1.3 | 59.7 | 9.1 | 7.8 | 5.2 | 16.9 |
| 12. Teacher writing notes on the chalk board for pupils to copy. | 0.0 | 57.1 | 11.7 | 5.2 | 3.9 | 22.1 |
| 13. Teacher giving work to pupils to discuss in pairs. | 7.8 | 45.1 | 11.7 | 13.0 | 6.6 | 15.8 |
| 14. Teacher giving work to pupils to discuss in small groups. | 7.8 | 40.3 | 12.9 | 15.6 | 5.2 | 18.2 |
| 15. Teacher asking individual pupils to present their group work to the class. | 6.5 | 33.8 | 11.7 | 14.3 | 9.1 | 24.6 |
| 16. Teacher discussing work with pupils in class. | 3.8 | 57.1 | 6.5 | 10.4 | 6.5 | 15.6 |
| 17. Teacher engaging pupils in hands on activities in the classroom. | 3.9 | 35.1 | 10.4 | 16.9 | 10.4 | 23.4 |
| 18. Teacher engaging pupils in hands on activities in the laboratory. | 2.6 | 27.3 | 9.1 | 11.7 | 9.1 | 40.2 |
| 19. Teacher assigning pupils to act roles on a given topic. | 11.6 | 16.9 | 15.6 | 10.4 | 18.2 | 27.3 |
| 20. Teacher conducting lessons from the laboratory. | 7.8 | 24.7 | 14.3 | 18.2 | 7.8 | 27.3 |
| 21. Teacher marking pupils' work in their exercise books. | 3.9 | 45.5 | 12.9 | 7.8 | 9.1 | 20.8 |
| 22. Teacher engaging slow learners in extra classroom activities. | 2.6 | 35.1 | 12.9 | 13.0 | 3.9 | 32.5 |
| 23. Teacher using model/real object/pictures | 0.0 | 48.1 | 10.3 | 11.7 | 6.5 | 23.4 |
| 24. Teacher engaging pupils in practical work to discover knowledge on their own. | 14.3 | 29.8 | 3.9 | 13.0 | 6.5 | 32.5 |

The submissions from the pupils gave a slightly different scenario from that given by the teachers. Table 4.3 shows that the teaching methods used often in Biology classrooms involved lectures (75.3%), question and answer (72.7%), class exercises (71.5%), brainstorming (68.8%), pupils copying notes from the chalk board (68.8%) and whole class discussions (63.6%). A fairly good number of pupils indicated that the following activities were also in frequent use: teacher marking pupils' books (58.4%) and teacher using teaching aids (58.4%). Findings from pupils also indicated that the following were either rarely used or never used at all: using the laboratory for lessons, debate, hands on activities, outdoor activities, role play, field trips and quiz.

The views of the teachers and those of the pupils on teaching methods used are converging on the use of question and answer and whole class discussions. They are also in agreement that teachers regularly give notes to pupils using the chalk board. Contrary to the submission of teachers, pupils submitted that lecture and brainstorming methods were also used in biology lessons. However, from focus group discussions teachers in all the three schools admitted that they often used lecture method to facilitate wide syllabus coverage. Teachers in all the three schools equally agreed that they often used brain storming as a way of establishing how much learners knew about a given topic.

### 4.3.2 Teaching methods employed in the biology lessons that were observed

A total of 17 biology lessons were observed from the three schools under study. The teaching methods used for the lessons observed were lecture, question and answer, group work, whole class discussion, experimentation and pupil presentations. The frequency with which these methods were used was as indicated in Figure 4.1. Out of a total of 17 lessons that were observed lecture and question and answer were used in 14 of the lessons; group work was used in 8 of the lessons; whole class discussion was used in 7 of the lessons. The least teaching methods used were practical work and pupil presentation which were used in 4 and 3 lessons respectively.

It was, however, observed that very few pupils participated in classroom activities that needed pupils to express themselves. As such class discussions were very much teacher dominated. They were more of lectures than discussions. Also, very few pupils participated in answering questions and doing work in the small groups so formed. Mostly, the small groups were formed by asking pupils to join their neighbours. Therefore, the teachers did not necessarily control the

formation of groups. It was very common in these biology classrooms to see groups of 'all boys' and 'all girls'.

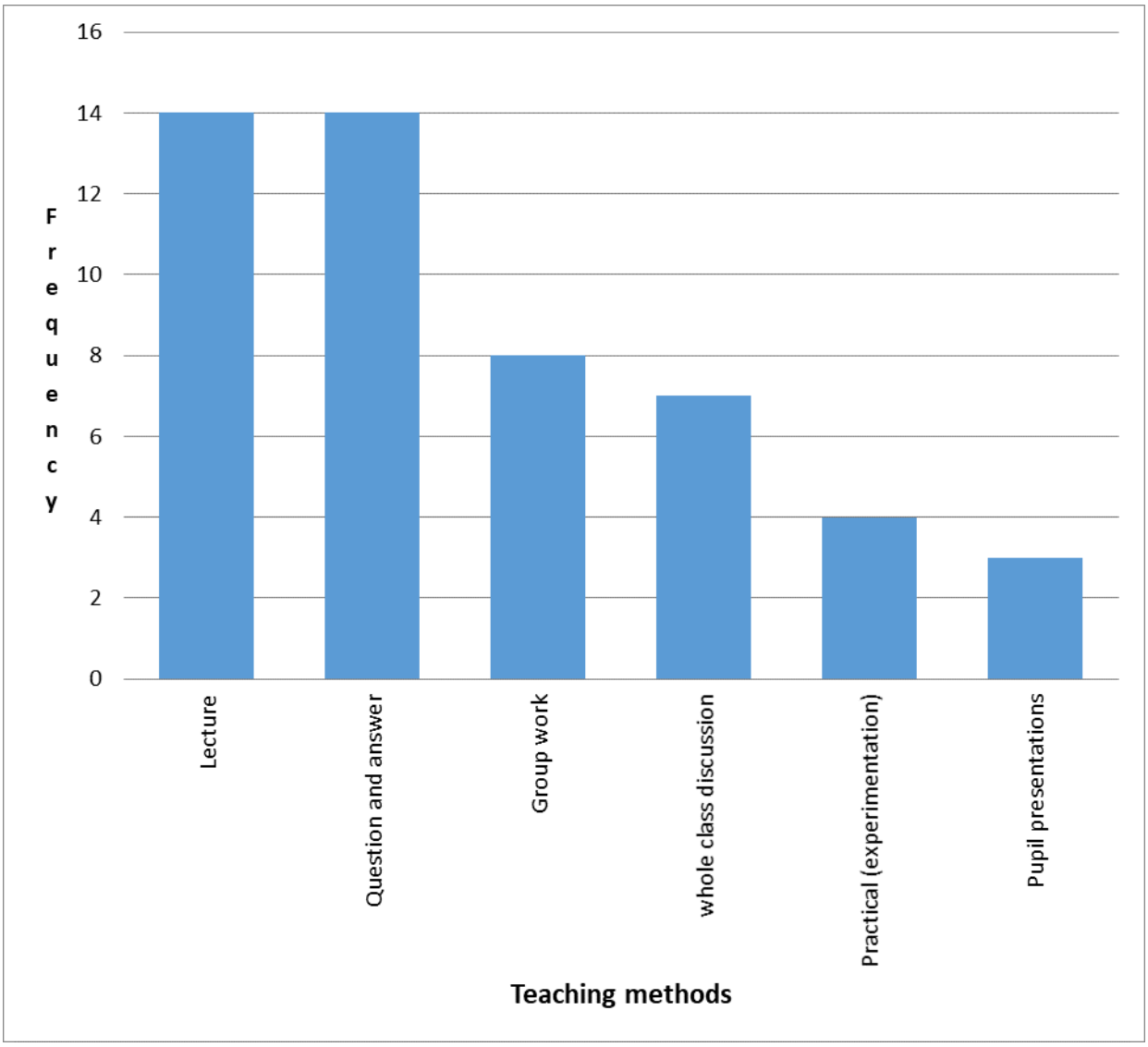


**Figure 4.1 Teaching methods used in biology classrooms that were observed**

Teachers cited a number of reasons for their regular use of teacher-centred teaching methods. Notably, from all the three schools, were the following: overloaded syllabus, large size classes,

limited teaching/learning materials, misconception of what learning is by learners and learner attitude.

**(i) Over loaded syllabus**

The teachers submitted that the biology syllabus was bulk. Therefore, in an attempt to complete the syllabus before examinations commence, they tended to use lectures, question and answer and teacher demonstrations as the main teaching methods. To this effect, TR2 commented as follows:

> For me I normally use these methods due to time limitation. If you look at the biology syllabus itself, it is overloaded. So if we happen to be doing what is required of us, like using those other activities, we would require a lot of time to complete the syllabus.

In the same vein TR3 said:

Biology is a bulk subject in terms of content hence teacher exposition is mostly used in order to cover enough content in the syllabus.

**(ii) Large size classes**

In addition to the overloaded biology syllabus some teachers cited large size classes as another factor limiting the use of other teaching and learning activities. One teacher from school 1 wrote:

"Whole class discussions help cover more work within the lesson time especially that pupils are too many in classes. In some instances, the number of pupils per class is as high as 90."

**(iii) Limited teaching/learning materials**

Other teachers further cited lack of teaching aids as a hindering factor in the use of certain teaching and learning activities, for TR9 stated:

> The over use of the same teaching and learning activities is due to lack of proper teaching aids. Laboratory work is not done regularly because the department is poorly equipped with learning and teaching resources such as text books and laboratory apparatus.

Supporting this view TR12 wrote:

> Teacher demonstrations with pupils participating are most appropriate when teaching and learning aids are limited, but still I allow pupils to participate as much as possible for better acquisition of knowledge.

**(iv) Learners' misconception about learning and the role of the teacher**

It was also learnt that teachers were forced to use teaching/learning activities such as lectures due to certain beliefs held by pupils. Pupils viewed teaching and learning as a process of receiving knowledge from the teacher. This belief by pupils was acknowledged by teachers from all the three schools and it was well understood when TR 2 lamented:

> For group work madam it is a good method. But apart from being time consuming, pupils also have a negative attitude towards group work. And the reason they give is that a teacher (who engages learners in activities such as group work or assignment) is just getting information from them without the teacher giving them information they expect from him or her.

**(v) Learners' attitude**

It was further learnt that teachers were forced to use same teaching methods due to poor response by learners when certain other activities were employed. Teachers from all the three schools submitted that very few learners participated when teachers employed oral questioning. Teachers also lamented that majority of the pupils did not respond positively when given homework, project or assignment tasks. Thus, TR11 explained that when homework, assignment or project tasks were given to the pupils, very few did the work. The rest would simply copy from the few that did the work. In addition, TR1 of School One had this to say:

> When you talk of over usage of the lecture method in our teaching of biology, in certain instances we just use it because not every pupil participates. You might ask a question and you find that only two or so pupils would know what is required. So you just feel you are wasting time

> to cover more topics by involving the class where only one person is participating. So you cross over to lecture method as the easiest way of off-loading the information to the pupils.

This disposition of learners not being enthusiastic to participate in answering questions in class was also noted during lesson observations in all the three schools studied. It was even further noted during whole class discussions in one observation that not more than five pupils out of the whole class participated actively and willingly. In one lesson observed in school 1, in an attempt to force learners to participate, the teacher had to put her foot down that she would not continue with the lesson until majority of the pupils put up their hands to answer the question she had asked. However, this yielded negligible improvement as still very few learners put their hands up to volunteer for answers.

On the part of learners, they gave various reasons as to why they showed unwillingness to participate in question and answer and class discussion tasks. During focus group discussions the learners advanced the following reasons as to why they were not willing to answer questions in class: language barrier, lack of understanding of biological terms, pupil personality, teacher attitude, and improper teacher-pupil relationships. The learners submitted that they mostly experienced language barrier. They said they found it difficult to express themselves in English Language which made them feel so shy to take part in class discussions. One learner from school 1 put it as follows:

“I think the language is a big problem. If you don’t have any idea or you don’t know exactly what the teacher says in English Language, you can’t answer a question.”

Another learner from school 2 stated as follows:

“Sometimes it is lack of vocabulary to use when answering a question.”

In support of these views one learner from school 3 responded:

“Others, it’s just that they feel shy. It’s because of language problem.”

Another learner from the same school was quick to consolidate the friend’s response and added;

“They feel shy that classmates will laugh at them because of language problem.”

The use of difficult biological terms in biology classrooms was another reason cited by learners for their reluctance to participate in answering questions. A pupil from school 3 had this to say:

“The problem that we are facing as pupils is that of language problem. You find that, like in biology, the teacher uses difficult biological terms which we fail to understand.”

Another pupil from the same school added:

“Sometimes, we don’t understand questions properly. Words in biology are difficult. When a teacher asks a question, there are some words which are very difficult to understand.”

Learners further blamed teachers on their reluctance to answer questions in class stating that some teachers were unfriendly. It seemed like the attitude of some teachers discouraged learners from participating in certain activities in biology classrooms. One learner from school 2 commented:

“Sometimes it is because of the kind of teacher who is teaching. Some teachers are not friendly so we fear to ask them questions.”

Another pupil from school 3 commented:

> In some instances, we can’t say that it is only the pupils to blame, even the teachers are to blame. There are some teachers who are rude to the pupils. When you are trying to ask a question and a teacher answers you very harshly, almost telling you that you don’t ask that question because it is not important.

Other pupils persisted in blaming the teachers accusing male teachers of improper relationships with female learners. They went further and equally mentioned the improper relationship of male learners and female learners. Pupils explained that their friends who were involved in such relationships usually felt shy to participate in classroom activities because they feared to make mistakes in the presence of their partners.

Apart from putting forth teacher related reasons for their reluctant participation in biology classes, pupils were also quick to mention that they were also failing to take part in biology classes out of their own personalities. They said some did not just want to talk or volunteer for

anything in classrooms. They said that was their own personality. One pupil from school 2 commented thus:

> Madam, what I can say about lack of volunteering to answer questions in class by some friends is that some of them just don't want to. They may know the answer but they don't want to raise their hands to volunteer for answers. So I may say that for some, that is the way they are. They don't want to answer even if they may know the answer to a question. But for others, even if they don't know the answer correctly, they are able to contribute something.

### 4.3.3 Use of teaching and learning aids in biology lessons

It was learnt from content analysis of lesson plans in the teaching files and lesson observations that the most frequently used teaching aids, in addition to the chalk-board, in biology lessons were charts in the form of diagrams. Other teaching aids such as models, real specimens, slides and pictures were rarely or never used at all. Table 4.4 shows findings from lesson observations on the type of teaching aids used in biology lessons.

**Table 4.4 Type of teaching aids used in biology lessons during lesson observation**

| **Type of teaching/ learning aid** | **Number of lessons in which the type of teaching/ learning aid was used** | **Percentage usage for each type of teaching/ learning aid** | **Total number of lessons observed** |
|---|---|---|---|
| Chart | 9 lessons | 52.9 | 17 |
| Work-sheet | 2 lessons | 11.8 | |
| Model | 1 lessons | 5.9 | |
| Real specimen | 5 lessons | 29.4 | |

Table 4.4 shows that out of a total number of 17 lessons observed charts were used in 9 lessons (52.9%). Out of the 9 lessons involving the use of charts in 5 lessons charts were the only teaching aids other than the chalk board. On the other hand, real specimens were used in a total of 5 lessons out of 17 lessons (29.4). Worksheets were used in 2 lessons (11.8%). The least used teaching aid for the lessons that were observed were models as only one lesson used a model representing total percentage of 5.9%.

During lesson observation, it was noted that in most cases teaching aids taken to the classroom were not effectively used. For instance, in one lesson observed in School 3, a very attractive model of deoxyribonucleic acid (DNA) was taken to the classroom by the teacher for use as a teaching aid. However, the good model was only shown to the class for under two minutes and that was all for the whole lesson.

In another lesson in School 1, one of the lesson objectives was to compare insect and wind pollinated flowers. However, the teacher only brought to the classroom real specimens of insect pollinated flowers, which could not even go round among pupils. For wind pollinated flowers, the teacher came with a chart, but the chart was not even used in the lesson. In this lesson the teacher talked for a good part of the lesson. The comparison of wind and insect pollinated flowers was done by the teacher while pupils passively listened and copied notes from the chalk board.

During focus group discussion when teachers were asked to review their lessons, TR1 was asked to explain why a chart was preferred in the lesson instead of real objects. The teacher's response was thus: "Madam, I actually laboured to conduct the lesson. It was the first time I was teaching that topic."

### 4.4 The extent to which the classroom physical environment is organised for teaching and learning of biology

The third research objective focused on the physical environment of biology classrooms. The study focused on aspects of the physical environment for which the teacher may have direct control. Thus, findings are presented under the following sub headings: classroom cleanliness,

display of teaching/learning resources and use of Information Communication Technologies (ICT) in teaching and learning.

Organisation of the physical environment in all the three schools under study was more or less the same. The study revealed the following:

### 4.4.1 Classroom cleanliness

The state of the rooms in all the three schools under study was below standard in terms of cleanliness and this stood true for both classrooms and laboratories. The windows were dirty, the floors and desks were very dusty. The floors were merely swept but mopping would have probably helped to clear the dust. The roofs were not free from cobwebs. The walls were dirty with a lot of graffiti, save for School 2 which was newly painted.

### 4.4.2 Display of teaching and learning materials in classrooms

During lesson observation it was noted that neither classrooms nor laboratories displayed teaching/learning materials such as posters, charts, models and apparatus. During focus group discussion for teachers and for that for pupils, effort was made to find out why the situation was like that. Strange enough, in all the three schools, the response was that pupils went away with the teaching aids once displayed. To this effect TR1 lamented:

> Pupils' behaviour towards poster, charts or models displayed in classrooms and laboratories is not good. Even if I were to take a chart in there, before the end of the day if I happen to forget to take it back, it will be gone. They will take it home and use it for other things such as covering their books.

TR2 augmented these views as follows:

> I have actually placed a grade 10 class on punishment on account of theft of charts. There were some charts in the chemistry laboratory. However, a grade 10 class was taken to the laboratory so that they could allow a GCE class to learn from their classroom. By the time they were leaving the laboratory, they had removed all

> the charts and the class has been placed on punishment on that account.

In support of these views TR3 lamented:

> Pupils remove charts from classrooms. We can't therefore leave charts in the classrooms because most of the classrooms, if not all, are not locked. Even if they could be locked, pupils still take charts during the commotion of going out at the end of lessons. Sometimes, they may not take them on the first day. They may allow a chart to stay for a day or two but definitely it may not last long. As such, we usually just display them during the lessons.

The pupils in all the three schools confirmed the submissions of the teachers during focus group discussions. They confirmed that pupils went away with the chats and sometimes used them to cover their books. One pupil from school three was however quick to put the blame on the teachers as she/he commented:

"It is just the teachers who lack seriousness because there is no way they can give in to pupils. If they wanted it could be done".

### 4.4.3 Use of Information and Communication Technologies (ICT) in teaching and learning

In all the classrooms and laboratories where lessons were observed, there were no indications for provision to use ICT. For instance, the electrical sockets were either vandalized or non-functional.

With the introduction of ICT in the curriculum, some schools have put in place computer laboratories, as was the case with School 1. However, it would seem that computer laboratories were only used for computer lessons. As it were, none of the biology lessons observed included the use of ICT.

# CHAPTER 5

# DISCUSSION OF FINDINGS

## 5.1 Introduction

This chapter discusses the study findings according to the research questions. The research questions were as follows:

(i) How skillful are teachers of biology in their lesson preparation?
(ii) How do teachers of biology conduct their biology lessons?
(iii)To what extent is the classroom physical environment organised for teaching and learning of biology?

## 5.2 Skillfulness of teachers of biology in their lesson preparation

This section discusses the skillfulness of teachers of biology in their lesson preparation by considering teachers' use of curriculum materials. The other aspect considered was the preparation of teaching materials for biology lessons.

### 5.2.1 Teachers' use of curriculum materials for lesson preparation

The study found that teachers in all the three schools studied generally used the biology syllabus, schemes of work, records of work and lesson plans in their preparation for biology lessons. However, it was observed that there were inconsistencies in the usage of these curriculum materials.

A scheme of work is a breakdown of the syllabus in smaller units to be covered in a specified period of time so that teaching is orderly and systematic (Kaseske et al, 2015). A scheme of work is therefore an important guide for the teacher, without which lessons cannot be effectively delivered. At the time of scheming a teacher takes into account a number of factors such as the season, availability of teaching aids, pre-requisite knowledge of the pupils and length of the topic. For instance, with careful scheming, a topic involving the use of flowering plants would be schemed for a term and week when such plants are in season so that specimens for teaching aids would easily be secured. Similarly, some topics will require knowledge of previous topics as a

prerequisite without which pupils may find problems to fully comprehend the information. Furthermore, at the time of scheming, there is need for careful consideration of the length of the topic regarding the objectives to be covered so that appropriate number of periods are allotted to the teaching of that topic. Thus, adequate preparation of schemes of work enables effective lesson planning and consequently effective lesson delivery in the classroom. Emphasising the importance of preparing schemes of work, Kaseske et al (2015: 58) assert that "The scheme of work is very important to the teacher in that it guides him in planning the unit of instruction and consequently the daily lessons in line with the time available for each topic in the term."

Considering the importance of schemes of work, it may be argued that the lack of consistency in the usage of schemes of work by the teachers in the schools under study might have been hampering effective lesson delivery. This could be a contributing factor to low pupil performance and consequently low pass rates in School Certificate Examination. Ellah (2018) contend that schemes of work are important in effective implementation of the curriculum.

The study equally revealed that teachers in the study did not always use lesson plans. A lesson plan is a document that outlines classroom activities and how they shall be accomplished (Jensen, 2001; TEAL Centre, 2011). The lesson objectives, teaching strategies and classroom activities are clearly stated. Also, the time to be spent on each lesson activity is clearly indicated. Therefore, the use of lesson plans enables the smooth flow of lesson activities as the teacher is guided on what ought to be done at each stage of the teaching and learning process in the classroom (Dorovolomo et al, 2010). In this way there is efficient usage of time in the classroom as the teacher does not halt the lesson to think about what activity to do next. Lesson activities are selected and carefully sequenced during lesson planning. Similarly, loss of time in the classroom is minimized in the sense that lesson planning provides the teacher with opportunity to think through the lesson and establish what teaching materials shall be needed and prepare them in advance (TEAL Centre, 2011; Bin-Hardy & Abdulsafi, 2018). It is such planning that enhances the effectiveness of a lesson. Furthermore, lesson planning ensures that classroom instruction aligns with curriculum goals and objectives (Duncan & Met, 2010; Farooque & Gafoor, 2010). At the planning stage the teacher, using schemes of work, makes a careful selection of the objectives to be achieved in the lesson. Undeniably, such careful selection of objectives would not occur without adequate lesson planning. In addition, lesson objectives will

only be realised if the teacher has adequate knowledge of the topic to be taught. In this regard lesson planning provides the teacher with opportunity to weigh his/her knowledge of subject matter against the objectives of the lesson so that the teacher takes the necessary steps to acquire adequate knowledge on the topic. In this way the teacher prepares to face the class with confidence. The teacher's confidence will not only gain more respect from the learners but reduce on discipline problems and help the learners to feel more relaxed and open to learning (Rodriguez-Gallego, 2007)). In this way teaching and learning is promoted.

Lesson planning also enables the teacher to take into account individual needs of the learners in the choice of teaching strategies, teaching materials and lesson activities. Through the use of lesson plans teachers are at liberty to adapt their lessons to suit their classroom situation. The quality of a lesson depends on how well it meets the needs of the learners (Kyriacou 2007; Alagoa et al, 2015).

With the foregoing, the fact that teachers in the study did not always prepare lesson plans implies that biology lessons in the schools under study had shortfalls. Lesson delivery of the teachers of biology in the study was not always preceded by careful lesson planning. One would reasonably argue that biology lessons in the schools understudy did not always make effective use of time in the classroom. Additionally, teachers did not always make the best choice of teaching strategies and teaching/learning materials in relation to lesson objectives and needs of the learners. Thus, teachers generally entered the classroom unprepared for effective lesson delivery (Kaseske et al, 2015). Such practices could have a negative impact on learner achievement. Lesson planning is a fundamental skill that all teachers must appreciate, develop and own for quality work in the classroom (Farooque & Gafoor, 2010).

Teachers submitted that they were not managing to complete the syllabus as it was very bulk. One would therefore, reasonably believe that it was the more reason teachers needed to prepare their lessons adequately to maximise on effective usage of time in the classroom so that both learner achievement and syllabus coverage were enhanced. This submission on its own basically implies that the teachers have not been fully preparing pupils to face the examinations with confidence. It may go without saying therefore that the teachers' failure to fully complete the syllabus coverage let alone fully prepare pupils to undertake the examinations was the preparation of pupils to fail. Yet year in year out, the situation was repeating itself thereby

painting the school with a bad image of poor results in Biology. Being a science subject which is a requirement in most tertiary training institutions, a further argument can be advanced that the teacher was preparing pupils to fail in life let alone rendering school attendance with less meaning.

The revelation of this study that teachers did not attach great importance to preparation of lesson plans for their biology lessons is similar to the findings of other studies. The study by Haambokoma et al (2002) conducted in the nine provinces of Zambia revealed that teachers of biology did not prepare lesson plans even though they agreed that it was necessary to do so. Investigating pedagogical practices that hamper effective teaching and learning of biology in secondary schools in Migori district of Kenya, Khatete et al (2014) reports that most teachers made no attempt to plan for their lessons and that they were not managing to complete the syllabus. He further argues that "lack of such planning may result in haphazard teaching which leads to jumbling up of facts and end up confusing the learners". Dorovolomo et al (2010) similarly, observe that lesson planning is often neglected and that if done, teachers focus on content delivery rather than planning of educational experiences to meet learners needs. Moreover, it is important for the teacher to make review of a lesson once it is taught. In so doing a teacher is able to fill up the gaps in subsequent lessons to promote learning. That teachers in the current study did not mostly review their lessons was a gap which might have been impacting negatively on the effectiveness of their lessons.

Findings on the use of records of work indicated that majority teachers of biology in the schools understudy did not have a good understanding of the importance of records of work. As a result, this curriculum tool was underutilised. Majority teachers only used the records of work to take note of what topic to teach in the next lesson. Other teachers hardly used the records of work citing that they are written after a lesson has been conducted. Indeed, records of work are meant to be written after a lesson has been conducted. This is because ideally, other than noting what was taught, records of work are a review of the lesson that was taught. The progress and challenges of a lesson are evaluated in relation to the lesson objectives, teaching materials, teaching strategies, time and learner participation. In this regard records of work are expected to inform planning and preparation for subsequent lessons. Therefore, at the time of planning a lesson, the record of work for the previous lesson should be referred to so that informed

decisions are made to enhance effectiveness of the lesson being planned. Hence, records of work are written soon after a lesson has been taught, unlike what was revealed in the study whereby teachers of biology in the three schools prepared records of work at the end of a week. That teachers of biology in the study did not use records of work in this manner implied that biology lessons were not effectively planned. As such, experiences of both the teacher and the pupils from the previous lessons were not taken into account. Ellah (2018) argues that records of work, just like schemes of work, are important for effective curriculum implementation. It would seem that majority teachers of biology in the schools under study lacked adequate knowledge on the use of records of work. Bin-Hady and Abdulsafi (2018) contend that good teachers evaluate their lessons, record challenges that hamper them from achieving lesson objectives and amend their teaching techniques daily to promote achievement of lesson objectives.

### 5.2.2 Preparation of teaching materials for biology lessons

Teachers of biology in all the three schools understudy mostly prepared charts for teaching aids. Even for lessons which needed real objects that could easily be secured from the local environment, most of the teachers in the study opted to prepare charts in the form of diagrams. Teachers hardly prepared real specimens, models, pictures and slides for their biology lessons. This showed lack of creativity to use resources in the local environment to prepare a variety of teaching aids for their biology lessons.

From the constructivist perspective, teaching/learning is based on providing meaningful experience to learners. Experience in this sense implies interaction of learners with events, objects or phenomenon in the universe (Millar, 2004). Therefore, skillful lesson preparation in the constructivist sense implies creation of opportunities for learners to have a wide range of experiences with their environment. This involves creativeness on the part of the teacher to bring to the classroom resources that engage learners in meaningful activities for the development of critical thinking and problem solving skills (Alton & Yucel-Toy, 2015). That teachers of biology in the study based their lesson planning and preparation on chats showed lack of skill in their planning. Furthermore, constructivism demands meticulous lesson planning, taking into account the evaluation of previous lessons (Tam, 2000). However, the teachers of biology in the three schools understudy did not always prepare lesson plans. Therefore, their lessons lacked skillful planning.

### 5.3 How teachers of biology conduct their lessons

This section discusses the teaching methods and teaching/learning activities used in biology lessons. It further discusses the extent to which teaching materials were used in biology lessons.

#### 5.3.1 Teaching methods used in biology lessons

The teaching methods used in biology lessons were teacher-centred. Teachers dominated the lessons through their expositions and did not employ a variety of teaching methods. Going by the findings of the study, it could be argued that the manner in which Biology was taught in the schools understudy greatly contributed to the low performance of pupils. It would seem that the teachers of biology in their lesson delivery overlooked a number of factors that were necessary for effective teaching and learning. Although teachers cited lack of teaching and learning materials as a reason that made them predominantly use teacher-centred teaching strategies and classroom activities, it was evident teachers employed these strategies even in situations where they could have used a variety of other methods. For instance, in one lesson observed in School One, the lesson title was 'vegetative propagation' and the subtitle was 'artificial propagation'. In such a lesson one would have expected the use of real objects and practical work. However, other than the chalk board, the teaching aid in the lesson was a chart showing 'budding' and 'grafting' as examples of artificial vegetative propagation. The teacher carried out a great lengthy explanation of the lesson while pupils passively listened. And this was the trend in most of the biology lessons observed. Pupils were mostly listeners. However, in many instances such kind of teaching does not inspire learning and consequently learners profit little from the lessons (Allen & Tanner, 2005; Muzumara, 2008). Constructivism, the theory underpinning this study holds that knowledge construction is an active process. Each learner constructs his/her own understandings basing on experiences. Therefore, 'hands-on' activities should be promoted in the teaching/learning process to enhance knowledge construction by learners (Palmer, 2005). Furthermore, children enjoy and learn more when they are actively involved than when they are passive listeners (Bada, 2015).

The teacher justified the use of teacher exposition citing that she/he was teaching the topic for the first time. However, this was a teacher who had been in service as secondary school teacher for more than five years. It could therefore not be understood well to be told that the teacher was

teaching such a topic for the first time when the syllabus had remained unchanged. Thus, what could be interpreted from the response was that teachers made careful selection of topics to be taught to the pupils. It appeared there were topics teachers found complicated and therefore avoided teaching them for fear of embarrassing themselves before the pupils. Such a scenario is in accord with the findings of other studies conducted by scholars in Zambia such as Haambokoma et al (2002) and Manda (2012) which indicate that teachers find some topics difficult to teach.

Going by the dominance of the teachers in delivery of lessons in Biology, it can be said that classroom interactions were limited in biology classrooms of the schools understudy. However, when classroom interactions are limited, classroom experiences of pupils which might facilitate teaching and learning are affected negatively and very likely limits pupils' understanding of ideas. But classroom interactions serve to enrich the learning environment so that pupils feel free and have the desire to learn. A skillful teacher endeavours to capitalize on pupils' desire to learn. It is highly likely that classroom interactions will make pupils bring out unscientific concepts which could either be corrected by fellow pupils or the teacher. Constructivism, as a learning theory, holds that children come to the classroom with preconceived ideas about the world around them (Taber, 2011). Thus, learners come to the classroom with their own ideas about a topic. These are ideas either developed spontaneously or acquired from other sources such as family, friends and media. These ideas are often inconsistent with the knowledge presented in the curriculum and are termed as misconceptions (Palmer, 2005). The meaning that a learner will construct from classroom experiences or from teaching is dependent on the conceptions and misconceptions that exist in the learner's cognitive structure about the topic. Studies have indicated that misconceptions interfere with learning (Kaulu 2015). If effective learning has to take place, the misconceptions possessed by pupils have to be cleared. Therefore, in every lesson the teacher should diagnose learners' prior knowledge and channel that towards the target knowledge in the curriculum. Where teaching is not designed to closely build upon a learner's current state of knowledge, the results are misinterpretations, failure to make links and making inappropriate links.

It is out of this understanding that teachers should always endeavour to promote classroom interactions in their lessons. Furthermore, when learners become aware of their misconceptions they are motivated and compelled to listen attentively to instructional explanations. In the same

vein classroom activities are more beneficial to the learner if they are designed to suit the learner's needs. But this is only possible if the teacher knows the prior knowledge of the learners and their misunderstandings on the topic (Rodicio & Sanchoz, 2010). Furthermore, it is in this regard that constructivism, as a learning theory, places greater emphasis on 'hands-on' teaching whereby the teacher seeks to guide learning by supporting knowledge-construction process.

Question and answer is an effective method for pupils to expose their conceptions on a topic. However, the findings of this research study were that very few pupils participated during question and answer class sessions in the schools understudy. Therefore, while other studies have found question and answer to be a pupil centred teaching method (Nkoya, 2008), it was not the case for biology classrooms in the schools understudy. There were very few pupils that were responding to questions and in most cases teachers ended up answering their own questions. It can therefore be argued that pupils were not exposing most of their conceptions and misconceptions during biology lessons in the schools under study which in a way hampered effective teaching and learning.

Other than teachers dominating biology lessons, it was also noted during lesson observations that in most cases pupils' good responses did not elicit their motivation from the teacher. The teacher would just accept the answer as correct without necessarily giving a word of praise to motivate the pupils. But according to constructivism the theory underpinning this study, motivation strategies should be an integral part of the teaching and learning process (Palmer, 2005; Bell & Black et al, 2004). As Palmer (2005) rightly argues, motivation is needed throughout the whole process of knowledge construction by learners considering that learning is an active process which requires effort on the part of the learner.

The fact that teachers in the current study used limited teaching strategies implied that individual differences were not taken care of. The teaching and learning activities that were found to be in common use in biology lessons might not have suited the intellectual ability of all the pupils and might not have been the learning preferences of all the pupils. Research has revealed that pupils have their preferred styles of learning (Rani and Shukla, 2012).

Findings of this study revealing that teachers in the schools under study did not take into account individual differences of the pupils in their lesson planning and preparation conforms with the

observation made by Yero (2010) in America. Yero assert that there is little evidence that majority of American teachers consider individual differences during lesson planning or actual teaching despite volumes of educational research revealing that individual differences exist among learners.

The argument that is advanced consolidates the fact that lessons have to be learner centred and care should be taken to cater for individual differences. In addition, the wide range of topics in the biology syllabus implies that not one particular teaching method is appropriate for all the topics. Therefore, teachers needed to consider the topic to be taught in their choice of teaching methods and accordingly their choice of teaching/learning activities well in advance. Employing a variety of teaching methods in biology classrooms also serves to arouse and sustain learner interest. Advancing a similar argument, Khatete et al (2014: 2) states the following:

> Teaching involves creating, enriching, maintaining and adapting instruction to achieve the objectives of the subject, capture and sustain interest and engage students in building biological understanding. Teachers have a wide variety of instructional strategies at their discretion.

Naturally, Biology as a science is a subject that is practiced in the daily life of each and every individual. Teachers need therefore to engage pupils in a lot of practical work for pupils to acquire science process skills (Mwangu & Sibanda, 2017). The use of experimentation regularly in biology lessons also promotes understanding of concepts and retention of knowledge, motivates pupils and enables them to link class work to their daily lives (Branton, 2012). However, the fact that biology was taught in abstract in the schools under study translates into alienating the subject from the pupils' daily lives. Pupils were therefore, not being helped to see the use of the subject in their daily lives. Constructivism holds that learners develop ownership of knowledge which they construct through experience and collaboration with others and that learners are able to relate the knowledge they construct to their daily encounters (Bada, 2015).

The teachers however claimed that the Biology syllabus has too many topics and cited this as one of the reasons for their use of limited classroom activities. This revelation is in tandem with the findings of other studies (Cimer, 2012; Alagoa, 2015). Given this scenario, it could then be

argued that pupils learnt very little from their lessons. What would follow from little understanding of information in lessons might be the commitment of pupils to memorisation of facts and concepts so that they can pass their examinations. Lack of skill in science processes might impact negatively on pupils' performance in School Certificate Examination in Biology which also examines learners' acquisition of science process skills. Thus, if pupils were not well equipped in the classroom with these skills it may follow that they cannot perform well in the examinations. Indeed, results in School Certificate examination in the schools under study were not impressive as shown in Table 1.2.

Another reason teachers cited for their use of limited classroom activities, which were teacher centred, was that pupils were not willing to participate in classroom activities. Teachers further lamented that pupils were not willing to do homework and assignments. The teachers of biology in all the three schools interpreted this as a negative attitude towards learning. This unwillingness of pupils to participate in classroom activities was also observed during lesson observations. Contrary to the teachers' views, however, pupils were quick to submit that one of the reasons for not participating actively in classroom activities was their inadequacy in English Language. It was observed that very few pupils could speak confidently in English language and to a large extent English language proved a barrier to communication with their teachers. Due to language barrier therefore, pupils failed to volunteer answers and in most cases feared to speak in English Language lest they be laughed at by their friends if they made grammatical errors. This revelation by the pupils in the current study that they faced language barrier has been acknowledged by other studies (Mudenda, 2008; Manda, 2012).

Strangely, the issue of language barrier by pupils was something that teachers in all the three schools acknowledged. But one would tend to think that the fact that teachers had identified the issue of language barrier in their pupils could have been the more reason to vary teaching strategies and classroom activities in their biology lessons so as to offset this problem. This situation could make one conclude that the way biology was taught in the schools understudy negatively affected pupils' performance and the low pass rates that were continuously recorded year after year in Biology School Certificate Examination. The importance of language cannot be over emphasised. It is the medium through which a teacher reaches out to the pupils. Kampamba (2013: 66) argues that "Since the student does not learn in isolation, language is a primary form

of interaction through which teachers transmit skills to the learner". Dillon and Osborne (2012: 135) hold similar views and argue that:

> Language is central in everyday life since it is one of the tools for understanding the world around us, communicating with peers, expressing our ideas and developing our knowledge…Scientific knowledge is thus dependent inextricably on language and language is also central to our ability to think.

As such, pupils stand to lose out if they manifest incompetence in the language of instruction in the classroom. This would result in communication breakdown let alone failure to learn. In view of this, remedial measures should have included supplementing theory with use of a variety of classroom activities, use of a lot of audio-visual aids and experimentation to promote understanding and knowledge retention by the pupils.

In addition to communication breakdown, pupils in all the three schools cited the use of difficult biological terms by teachers as another hindrance to their participation in classroom activities. They complained that the use of difficult biological terms prevented them from understanding questions properly. Kampamba (2013) also argues that science has a vocabulary which is subject specific, and that some words when used in science do not have the same meaning as they are used in everyday language. This learning difficult is compounded by the fact that pupils are required to switch from one language to the other within the three science disciplines. As such, she advises that teachers should ensure that new biological terms in the lesson are explained at the beginning of the lesson. Oyoo (2018) shares these views and argues that: "This transformation of everyday words' meanings when used in the science context is one reason that even learners who speak the language of learning and teaching fluently sometimes struggle to tell the meanings of everyday words when used in science". Additionally, Kampamba (2013) argues that teachers should be explaining the lesson objectives to the pupils at the beginning of each lesson so that pupils are guided on the focus of the lesson. However, none of the lessons observed in the study included explaining lesson objectives to the pupils. But if pupils were given lesson objectives, it could help in their comprehension of information in the lesson. That use of difficult biological terms has affected teaching and learning of biology in secondary

schools is a view that has been reported by other studies (Mudenda, 2008; Cimer, 2012; Manda, 2012)

The other reason that pupils advanced for their reluctance to participate in Biology lessons was teachers' hostility. According to pupils in all the schools understudy, some teachers were not showing friendliness to pupils in their lessons. According to pupils, teachers of biology in the current study responded to pupils' questions in a way that discouraged them from further participation. This revelation is in tandem with the findings of Manda (2012). But this kind of learning atmosphere cannot inspire pupils to participate in lessons be it biology or any other. When a teacher is unfriendly to the pupils, a strange environment is created but more often than not, the environment created acts as a barrier to teaching and learning. Contrary to constructivism, the theory on which this study is grounded, pupils are encouraged to question, challenge and formulate their ideas, opinions and conclusions. The theory further emphasises on the need for a communication rich environment in which pupils are given opportunities to interact with the teacher and fellow pupils in order to facilitate construction of knowledge by the pupil (Ultanir, 2012; Palmer, 2005). In tandem with these views Akram and Malik (2012) assert that in modern education superiority in the classroom has shifted towards learners. The learners should be given confidence to ask, inquire and explore.

The other reason cited by teachers to justify their failure to use pupil centred teaching methodologies was the large class sizes. A number of studies (Haambokoma et al, 2002; Cimer, 2012; Amirul et al, 2013; Khatete et al, 2014) have revealed that most teachers across Africa have cited large size classes as a hindrance to pupil centred teaching and learning activities. However, Haambokoma et al (2002) argue that interactive teaching methodologies could be used even in large classes and was quick to note that in some cases, teachers simply did not have the competence to use active learning approaches. Allen and Tanner (2005) and Nkoya (2008) also advance the same view that interactive teaching methodologies can be employed even in large classes. This researcher shares this view. For instance, in the current study, although teachers cited large class sizes as a reason for their failure to employ pupil – directed activities, it is worth mentioning that at the time this study was being conducted the class sizes ranged from 14 to 44 in all the three schools understudy. This was so because most pupils were not reporting for school due to non-payment of school fees. Yet the teachers used teaching activities that involved

teacher exposition and demonstrations. In this case, therefore, the issue of class size does not arise. It all boils down on the planning and innovativeness of the teacher. A teacher who plans well for his/her class, issues of class size will have little bearing on the participation of pupils in the lesson.

But it would also seem that one of the contributing factors to teachers' failure to use pupil-centred teaching/learning activities was their lack of adequate knowledge in pedagogy and subject content. What was seen in all the observed lessons was that teachers mainly offloaded text book information without necessarily narrowing down the lessons to the daily lives of the pupils. They did not bother to bring out examples from living organisms and biological activities well known to pupils or allow pupils to do so. Even where biological phenomena could be explored and studied from the natural environment around the school, the teachers preferred to have indoor lessons and used charts for teaching aids instead of real objects. As such charts turned out to be the main teaching aids. However, relating lessons to real life phenomena is one way of motivating learners to concentrate and participate in science lessons (Palmer, 2005).

It can be argued therefore that these teaching methodologies are what make the subject appear very abstract to pupils and contribute to low pupil achievement. Investigating what makes biology learning difficult in Turkey, Cimer (2012: 66) made similar findings and makes similar arguments:

> …This indicates that in biology lessons, teachers just talk and transfer theoretical knowledge and do not provide examples from daily life… A lack of understanding the relationship between what was taught in the class and students' daily lives makes learning biology hard for students.

Many other studies (Haambokoma et al, 2002; Mudenda, 2008; Manda, 2012; Alam et al, 2014; Chocha et al, 2014; Khatete et al, 2014; Alagoa et al, 2015) have made similar findings and report teacher in-competencies in skill and knowledge of both the subject matter and pedagogy. It can therefore be asserted that lack of adequate knowledge and skill in the subject content and pedagogy might be contributing factors to low pupil achievement in biology in School Certificate Examination for the schools understudy. Other studies attribute teacher incompetence

to lack of adequate training in colleges. Mweshi (2007) studied the use of the Process Skills Approach by ZATEC students in selected Basic schools of Kitwe district in Zambia. The study revealed that while students understood the theoretical meaning of the Process Skills Approach, the college training did not equip them with adequate practical experience to use the approach in the classroom. Alam et al (2014) explored in-service teacher perception of their competencies in delivery of biology lessons at secondary school level in Pakistan. The study revealed that teachers felt they were incompetent in using problem solving method due to absence of training in problem solving teaching methodology in their pre-service and in-service training.

### 5.3.2 The extent to which teaching/learning materials were used in biology classrooms

It was noted in Section 5.2.2 that teachers of biology in the schools under study mainly made charts for teaching aids. This implied that the main teaching aids in biology classrooms were charts in the form of diagrams. Effiong (2015) refers to teaching aids as all materials that help or are capable of complementing the teacher's effort in teaching/learning process and contends that teaching materials make teaching and learning process interesting and enhances the memory of pupils. Teaching aids help to clarify biological concepts and processes and are likely to clear the biological misconceptions of pupils which might interfere with learning. Therefore, it was envisaged that as much as possible teachers of biology in the schools under study should endeavour to use a variety of teaching aids given the high failure rate in School Certificate Examination.

As such, teaching materials should include real specimens, slides, pictures, work sheets, magazines, newspapers and models other than diagrams. It can therefore be said that the use of charts in biology classrooms as the main teaching materials as was revealed in the current study distanced the subject from the daily encounters of the pupils. Further, it does not help pupils to link the subject to their daily lives making pupils believe that the subject is merely for passing examinations. The failure by pupils to link the subject to their daily lives is compounded by failure of biology teachers to employ outdoor activities and educational tours. Yet such activities could avail pupils opportunities to observe biological phenomena in their natural set up.

The study also revealed that in some cases teachers failed to effectively use teaching aids even when they were available. This might have been due to inadequate knowledge on the topic being

taught or incompetence in teaching methodology. It was noted in Section 4.3.3 how a teacher in School three failed to effectively use a model of DNA in the classroom despite having carried the model to the classroom. The model was a very interesting, brightly coloured and well-made structure of deoxyribonucleic acid (DNA). The pupils were excited, and there was no doubt that the minds of pupils had been captured. Sadly, the teacher only showed the model to the class for less than two minutes. Thereafter, it was teacher exposition and the model was not used any more for the rest of the lesson. Thus, the objective of taking the model to the class was not fully exploited. It could be that the teacher lacked adequate knowledge on the structure of DNA and consequently lacked confidence to use the model in the classroom. It could also be that the teacher did not take time to prepare adequately for the lesson.

Similarly, it was noted in Section 4.3.3 that a teacher in school one failed to use real specimens that were locally available in the school environment. In this case too, it would seem that the teacher did not prepare adequately for the lesson. One of the lesson objectives for that particular lesson was to compare insect and wind pollinated flowers. The ideal situation one would have expected was to see the teacher avail the pupils real specimens of both types of flowers. But the teacher only brought real specimen of insect pollinated flowers which could not even go round all the pupils. For wind pollinated flowers, the teacher came with a chart which was not even used in the lesson. This lesson which had all the opportunities of hands-on activities ended up being very much teacher exposition. The comparison of wind and insect pollinated flowers was done by the teacher while pupils passively listened. It was even doubted whether pupils were following the lesson because they continuously took down notes which the teacher put on the board in the course of his explanations. In this case, it was visible the teacher failed to effectively use real specimens as teaching aids.

From the constructivist perspective, prior knowledge of learners is central to teaching and learning (Bada, 2015; Palmer, 2005). The prior knowledge of learners is what guides the learning process for the constructivist teacher. Therefore, teachers using this approach are expected to use a variety of teaching strategies so that learners are helped to expose their conceptions on a topic. When learners expose their conceptions, it is expected that the teacher will guide the learning process by engaging learners in classroom activities that should help learners to discard unscientific ideas or misconceptions. Furthermore, knowledge construction according to

constructivism is an active process (Glasersfeld, 1989; Tam, 2000; Ultanir, 2012). Therefore, meaningful learning involves engaging learners in 'hands on' and 'minds on' activities so that the learners themselves actively construct knowledge. However, the teachers of biology in the three schools understudy relied on lecturers and teacher demonstrations. Learners were rarely engaged in practical work and problem solving activities. Furthermore, from the constructivist perspective, learning is a social process (Ivic, 2000; Zhao et al, 2005). Teachers using this approach are expected to enhance by employing activities that involve pupil – pupil interactions such projects, group work, paired work, whole class discussions and class presentations. Learners are expected to construct knowledge through interactions with more capable peers. Therefore, the groups so formed in biology classrooms should not be mere groups whereby the teacher simply asks pupils to join their neighbours as was observed in the three schools understudy. These academic groups should comprise pupils of mixed abilities if the learners are to benefit from the group interactions. Therefore, the manner in which the groups were formed in the schools understudy may not be effective in promoting learning. It can therefore, be safely concluded that the way teachers of biology in the schools understudy conducted their lessons was not effective for construction of desired knowledge in line with the biology curriculum.

### 5.4 The extent to which the classroom physical environment is organised for teaching and learning of biology

The 21st century classroom physical environments are envisioned as places that support learner engagement in self-directed and co-operative learning activities. To this effect, the 21st century classroom physical environment is envisioned to be a place that is re-organised from time to time to suit learners needs and mediate learning (Lippman, 2010). By implication, organisation of the classroom physical environment is part and parcel of the classroom practices of the 21st century teacher. Constructivism, as a learning theory, has created new expectations of the classroom physical environment and consequently new roles of both the teacher and the learner (Tam, 2000).

This study, therefore, discusses aspects of the classroom physical environment for which the teacher may have direct control. In this case the following aspects of the classroom physical environment are discussed: cleanliness of the classroom, display of teaching/learning materials and use of ICT in teaching and learning.

### 5.4.1 Cleanliness of classrooms

The state of the classrooms and laboratories in all the three schools was below the expected standard. The windows were dirt, floors and desks were very dusty and roofs were full of cobwebs. The walls were dirty save for school 3 which was newly painted. The state of the classrooms and laboratories was far from being attractive. This gave the impression that not much attention was being given to the classrooms as learning environments.

The extent of negligence observed in the classrooms and laboratories, as teaching and learning environments, might have affected the sense of ownership that pupils developed for the school and their classes. In many circumstances, the physical environment of the classroom is known to affect the behaviour of the pupils. Bucholz and Sheffler (2009) support this argument as they assert that the physical environment of a classroom plays a part in the sense of ownership that pupils feel for their school and more specifically their class. Bucholz and Sheffler (2009) further argue that neat and well decorated classrooms provide warmth and help to promote a sense of comfort and security to the pupils. Suleman and Hussain (2014) share these views and assert that "Students perform well in an optimistic classroom atmosphere and an environment in which they feel secure, safe, cared for and involved".

Learning environments should therefore be inviting and motivating to learners, unlike what was observed in the current study. In School 1 generally pupils carelessly threw litter in their classrooms during their learning time. On the other hand, although pupils were blamed for throwing litter indiscriminately in the classrooms, not a single classroom had bins of any kind for disposal of litter. The negligence given to the classrooms in the current study was at variance with the curriculum objectives. The focus of the curriculum is the development of the entire personality of the pupil. Teaching and learning is therefore meant to develop not only factual knowledge and skills but also to influence attitudes, affect changes in behaviour and develop emotional, spiritual, social, physical and affective aspects of all pupils for personal fulfillment and good of society (MoE, 2000; MESVTEE, 2013).

### 5.4.2 Display of teaching and learning materials

The display of teaching and learning materials in the classrooms and laboratories was not done in all the three schools under study on account of pupils removing them once displayed. However,

teachers should endeavour to change the mindset of pupils as opposed to giving in to the misconduct of pupils. The pupils should be helped to develop a positive attitude and care for school property. They should also be helped to develop a sense of ownership for school property.

The schools could have arrested the identified bad situation and ensured they fostered good behaviour among pupils. One surest way was to begin by putting up rules and regulations and applying them firmly. Pupils were going to behave according to how schools wanted them to behave. The misbehaviour of pupils towards teaching and learning materials might be a reflection of ineffective classroom management skills applied by the teachers. Many scholars (Kibera & Kimokoti, 2007; Hussain & Suleman, 2014) assert that classroom management is a critical part of effective and successful classroom instruction. Thus, considering the crucial role of the classroom physical environment in the teaching and learning process, it is imperative that a solution is found as opposed to giving up. The learning environment should be facilitated at all costs. In this regard Hussain and Suleman (2014:72) argue that:

> To ensure a favourable classroom environment, it should be well equipped and facilitated…Physical facilities should be provided as they are helpful in improving the overall performance of the school.

It should be noted that a display of teaching and learning materials in the classroom enables pupils to learn on their own in their spare time. It also promotes pupil – pupil interaction, enhances learning for poorly sighted learners and enables individual learners to consolidate what was learnt during the lesson, especially the slow learners.

This study revealed that the schools under study lacked adequate textbooks for learners. Therefore, the fact that the classrooms were bare in terms of teaching and learning materials implied that pupils had little or no educational materials with which to consolidate classroom work. This might explain the many blank spaces observed in the pupils' note books. The study revealed that 6 in every 10 note books for pupils studied had blank spaces. Basically, blank spaces denoted information blank and this was not a good way to foster learning. Rather it was a recipe for poor performance in examinations at the end of the day.

A closer look at most of the blank spaces in the pupils' books indicated that they were for diagrams. This indicated that pupils failed to complete drawing diagrams at the time the teacher was in session with them. But if such diagrams were left in classrooms and laboratories, pupils would find space in their own time to complete drawing them. Private study should be encouraged at all times especially for pupils who are preparing for final examinations. But such studies could be encouraged and supported by enriching the learning environment with study materials. Furthermore, a display of teaching/learning materials such as models, pictures, graphs and specimens creates an active learning environment for learners to construct knowledge on their own. Constructivism, the theory underpinning this study, holds that both the learner and the environment should be active for effective knowledge construction by the learner (Bada, 2015). The failure to create 'talking' classrooms in the schools under study resulted in a passive learning environment which falls short of expectations of a 21st century classroom physical environment. An argument can therefore, be advanced that the passive learning environments in the schools understudy neither promoted knowledge construction nor retention of knowledge by the learners and therefore, contributed to poor performance in School Certificate Examination.

It would also appear that school administrators did not support their teachers to create conducive and active learning environments. While chalk boards were present in all the classrooms and in all the laboratories in all the schools under study none of the schools had notice boards nor white boards. The lack of notice boards in classrooms and laboratories in the schools under study might be one reason as to why these rooms were bare. As Amirul et al (2013: 6) assert; "lack of completeness of educational equipment will lower motivation and creativity of teachers and students as well as limiting learning and teaching activities". Beyond this, advancement in technology has brought in new teaching tools such as white boards. Therefore, schools should keep up with technology to boost the morale of teachers and also attract the attention of pupils thereby enhance teaching and learning.

### 5.4.3 Information and communication technologies (ICT)

None of the three schools under study displayed provision for use of ICT in both classrooms and laboratories. Although some schools like School One had computer laboratories, it would seem that computer laboratories were only used for computer lessons in line with the revised curriculum which included computer studies as a subject to be taught in schools. Teachers,

however, mentioned that some departments in the schools had laptops which they could access if they intended to use them. In addition, teachers also mentioned that some of them had personal laptops which they could also use if they wanted. But teachers admitted that generally they did not use computers in their teaching and learning of biology.

This admission was generally visible in all the schools under study and there were several factors that would inhibit the inclusion of ICT in the teaching and learning process. Classroom spaces were limited due to large class sizes. The facilities to support the use of ICT in biology classrooms were either lacking or inadequate. These included power sockets and tables. It was also clear that computers were not adequate in the schools. The computer laboratory, for School One had a tight schedule for the junior classes whose subject combination included Computer Studies. But even for School One, the computer laboratory was small and could therefore not accommodate the large classes if all pupils were in attendance. On the other hand, it would appear that teachers lacked adequate knowledge and skill to incorporate ICT in the teaching and learning of biology.

These findings are similar to the findings of many other studies in Zambia and across the globe (Lippman, 2010; De Gregori, 2011; Gonzalez & Kuuskorpi, 2011; Mwewa & Ndhlovu, 2013; Hussain & Suleman, 2014; Kumwenda, 2017). Kumwenda (2017) investigated the effect of Computer Assisted Lessons on learner performance on Genetics in three districts of Solwezi in Zambia. The study revealed that Computer Assisted Learning has not been supported nor exploited in Zambia. These findings are in tandem with the findings of Mwewa and Ndlovu (2013) who earlier assessed the availability and use of ICT by Secondary school teachers of Mathematics and Science in North-Western and Copperbelt Provinces of Zambia. These studies also reveal that majority teachers do not have adequate knowledge to incorporate ICT in the teaching and learning process. Hussain and Suleman (2014) equally contend that teachers are not trained properly for the effective utilisation of educational technologies. Lippman (2010) observes that one reason technologies are not being fully integrated into educational programmes is that the design of the physical environment does not support the integration of technology. Lippman (2010) further argues that ICT of today has not been planned around any specific pedagogy, but rather, assumed to be integrated into any and all instructional settings. Gonzalez and Kuuskorpi (2011) observe that despite changes in pedagogy and widespread use of ICT in

classrooms and school places, the physical learning environment has not yet changed in keeping up with this evolution. De Gregori (2011) makes similar observations. Suleman and Hussain (2014) share this views and further observe that in most developing countries educational technologies are not utilised effectively because the items supplied to schools are of low quality and less quantity. Kumwenda (2017) is in congruent with these views as he established that there are very limited ICT facilities in schools.

The study clearly revealed that ICT has not been integrated into the teaching and learning of biology in the schools under study. But the integration of ICT in teaching and learning improves the quality of learning and educational outcomes (Aleksander, 2012; Kumwenda, 2017). With the poor performance noted in the schools under study in School Certificate Examination it would be of great use to incorporate ICT in teaching and learning. Moreover, constructivism supports the integration of ICT in teaching and learning to provide learners with greater autonomy in their learning process (Tam, 2000).

As educationists have argued the quality of education provided to pupils is to a large extent dependent on what teachers do in the classroom (Chuda et al, 2007). This implies that the learning experiences provided to pupils in the classroom is crucial to pupil performance. Constructivism, the theory underpinning this study, views learning as knowledge construction by the learner. The teacher is a guide who should provide pupils with the opportunities to explore their environments to facilitate learning. In line with this theory, therefore, it can be conclusively argued that experimentation is cardinal for effective teaching and learning in biology classrooms. Vygotsky's Social constructivism on learning highlights the importance of social interactions in the classroom. By this theory, it is understood that learning in the classroom is facilitated by interactions of the learner with fellow pupils and the teacher. But such critical interactions cannot just come about. They are a result of careful lesson preparation and planning whereby the teacher takes into account the lesson objectives, the teaching strategies, the level and ability of the pupils and individual differences. That the lessons in the study fell short of such adequate preparations may explain the high failure rate in School Certificate Examination.

# CHAPTER SIX

# Conclusions and recommendations

This chapter makes conclusions and recommendations basing on the major findings of the study.

## 6.1 Conclusions

The conclusions are based on the following research objectives:

- The skillfulness of biology teachers' lesson preparation.
- How teachers of biology conduct their lessons.
- The extent to which the classroom physical environment is organised for teaching and learning of biology.

### 6.1.1 The skillfulness of biology teachers' lesson preparation

The study established that teachers of biology in the schools under study were not consistent with the use of schemes of work, records of work and lesson plans in their planning and preparation for biology lessons. The main challenges in the preparation of schemes of work were lack of printing materials such as toner and lack of cooperation from some teachers. As for lesson plans, the study established that teachers' failure to use lesson plans in most of their biology lessons was a result of teachers' lack of commitment to prepare lesson plans. The study further established that majority teachers lacked adequate knowledge on the use of records of work. Additionally, the study established that the teaching aids that teachers in the current study mostly prepared were charts in the form of diagrams. The study concluded that lesson planning in the schools under study lacked skillfulness as teachers did not take into account the principles of constructivism, the theory under pinning this study.

### 6.1.2 How teachers of biology conduct their lessons

The study established that the teaching methods mostly used were question and answer, lectures, teacher demonstrations, and group work. However, though group work was used, the study established that very few learners were participating in the work mainly due to language barrier. The study further established that pupils rarely did experiments and laboratories were rarely used

for lessons. In addition, the study established that teachers did not engage learners in educational tours nor outdoor activities. Furthermore, the study established that the main classroom activities for learners in the schools under study were listening from the teacher and copying notes from the chalk board. Additionally, the study established that the main teaching aids in biology lessons in the current study were charts in the form of diagrams.

The study concluded that teachers of biology in the current study took center stage of their biology lessons while learners played a passive role. Therefore, biology lessons in the schools under study were teacher centred.

### 6.1.3 The extent to which the classroom physical environment is organised for teaching and learning of biology

The study established that in the schools under study classrooms were below standard in terms of cleanliness. The study further established that classrooms were generally bare structures in that teachers did not display teaching aids in the classrooms. The study also established that teachers in the current study did not integrate ICT in the teaching of biology.

## 6.2 Recommendations

Basing on the study findings the following recommendations are made:

1. Biology teachers in the schools under study should take keen interest in lesson preparation. They should prepare and plan their lessons adequately by using all curriculum tools.
2. The Science Departments of the schools under study should break away from their tradition of preparing schemes during the holidays. They should be preparing schemes during the last two weeks of the term so that HODs can easily monitor progress of the work.
3. Individual teachers of biology in the current study should take responsibility of their professional growth. They should take keen interest to read widely and learn more on curriculum tools and keep abreast with modern trends in pedagogy.

4. Heads of the Science Departments in the schools under study should use School Based Continuing Professional Development (SBCPD) for teachers to share knowledge on curriculum tools and to keep abreast with new trends in pedagogy.

5. Teachers in the current study should incorporate remedial work for learners in their teaching and learning process.

6. The teachers in the current study should break away from the traditional seating arrangement of furniture in rows and columns. Seating arrangement should reflect lesson activities.

7. Teachers of biology in the schools under study should make every effort to make the classroom physical environment active by equipping the classrooms with teaching and learning materials.

8. The teachers in the schools understudy should involve learners in creating favourable and active classroom physical environments. This will help the learners to develop a sense of belonging and ownership for their classrooms.

9. The school administrators should make effort to acquire more ICT facilities to facilitate the integration of ICT in teaching and learning.

10. Other researchers should conduct a similar study in other poor performing secondary schools using a larger sample so that the findings could be generalised.

## REFERENCES


Adigun, F. A., Madu, S. and Okulaja, A. A. (2015). *Effects of Computer based instructional strategy on student academic achievement in senior secondary school biology in Ogun state Nigeria.* Atlantic Journal of Education and Humanities Studies, 1(1), 1 – 7.

Ageyev, V., Gindis, B., Kozulin, A. and Miller, S. (2003). *Vygotsky's Educational Theory and Practice in Cultural Context.* Cambridge: Cambridge University Press.

Ahmad, C. N., Abdullah, M. F. N., Adam, M., Amirul, N. J., Noh, N. M., and Yahya, A (2013). *The physical classroom learning Environment*: a paper presented to the 2nd International Higher Education Teaching and Learning Conference in Malaysia.

Akpan, B. B. (1994*). Implementing Science and Technology Education for All: Guide to Better Policy and Practice for teachers.* Commonwealth Secretariat.

Akram, S. and Malik, K. S. (2012). *The Use of Audio-Visual Aids for Effective Teaching of Biology at Secondary School Level.* Elixir Leadership Management Journal, 50(2012), 10597 – 10605.

Alagoa, J. K., Daworije, P. S., Enaregha, E.S. and Eremasi Y. B. (2015). *Factors Affecting the Teaching and Learning of Biology in Kolokuma/Opokuma Local Government Area, Bayesa State, Nigeria.* International Journal of Current Research in Bio-Sciences and Plant Biology, 2 (4): 151 – 156.

Albert, O. O., Osman, A. and Yangungu, A. (2014*). An investigation into factors that influence performance in KCSE biology in selected secondary schools in Nyakach district, Kisumu County, Kenya.* Journal of Education and Human Development, 3(2), 957 – 977.

Allen, D. and Tanner, K. (2005). *Infusing Active Learning into the Large – enrollment Biology Class: Seven Strategies, from the simple to the complex*. Cell Biology Education, 4, 262 – 268.

Al-Tarawneh, A. M. (2016). *The Effectiveness of Education Games on Scientific Concepts Acquisition in First Grade Students in Science.* Journal of Education and Practice, 7(3), 31 – 37. Http://www.iiste.org, retrieved 21/02/20.

Altun, A. and Yucel-Toy, B. (2015). *The Method of Teaching Course Based on Constructivist Learning Approach: An Action Research*. Journal of Education and Training Studies, 3(6), 248 – 270.

Bada, O. S. (2015). *Constructivism Learning Theory: A Paradigm for Teaching and Learning*. Journal of Research and Method in Education, 5(6), 66 – 70.

Banda, B., Kazuyoshi, N., Mudenda, V. and Tindi, E. (2014). *Towards Learner Centred Science Lessons in Zambia: An Experience of Problem Solving Approach in Biology Lessons. Zambia* Journal of Teacher Professional Growth, 2(1), 86 – 92.

Baumert, J., Besser, M., Elsner, J., Kleickmann, T., Krauss, S., Kunter, M. and Richter, D. (2013). *Teachers' Content Knowledge and Pedagogical Content Knowledge: The Role of Structural Differences in Teacher Education*. Journal of Teacher Education, 64(1), 90 – 106.

Berg B. L. (2001). *Qualitative Research Methods for The Social Sciences,* 4th edition. London: Allyn and Bacon.

Berger, K.S. (1986). *The Developing Person through Child and Adolescence*. New York: Worth Publishers, Inc.

Bin-Hady, R. W. and Abdulsafi, A. S. T. (2018). *How Can I prepare an Ideal Lesson Plan?* International journal of English and Education, 7 (4), 275 – 279.

Black, P., Harrison, C., Lee, C., Marshall, B., and William, D. (2004). *The Nature and Value of Formative Assessment for Learning.* London: Kings College London School of Education.

Branton, A., R. (2012). The Effects of Teaching Style on Students Learning of DNA. Unpublished Master's Thesis.

Bryman A. (2004). *Social Research Methods*. New York: Oxford University Press.

Bucholz, J. L. and Shuffler, J. L. (2009). *Creating a warm and Inclusive Classroom Environment: Planning for All Children to Feel Welcome,* Electronic Journal for Inclusive Education, 2 (4), 1 – 13.

Bullard, C. C. (2011). *The Effects of School Enrolment Size on Student Achievement*, Unpublished Master's Thesis, Georgetown University.

Carin A. A. and Sund B. R. (1970). *Teaching Modern Science*. Columbus, Ohio: Bell and Howell Company.

Chuda J., Prokop, P., and Tuncer, G. (2007). *Slovakian Students' Attitudes toward Biology*. Eurasia Journal of Mathematics, Science and Technology of Education, 3(4), 287-295.

Chocha, S., E., Namayanga, K., C. and Ndhlovu, H., G. (2014). *Teaching Science Practically: An Assessment of Teacher Competences on O-Level Biology Practical Work in Zambia*. Zambia Journal of Teacher Professional Growth, 2(1), 26 – 38.

Cohen, L., Manion, L. and Morrison, K. (2007). *Research Methods in Education*, 6th edition. New York: Routledge.

Conboy, E., J. and Fonseca, J., M. (2006). *Secondary Student Perceptions of Factors Effecting Failure in Science in Portugal*. Eurasia Journal of Mathematics, Science and Technology Education, 2(2), 82 – 95.

Cimer A., (2012). *What makes biology learning difficult and effective: Students views.* Educational Research and Reviews, 7(3), 66 – 71.

Dambudzo, I., I. (2015). *Curriculum Issues: Teaching and Learning for Sustainable Development in Developing Countries: Zimbabwe Case Study*. Journal of Education and Learning, 4 (1), 11 – 24.

Darby, M. (2007). Debate: *A Teaching-Learning Strategy for Developing Confidence in Communication and Critical Thinking*. Journal of Dental Hygiene, 81(4), 1 – 10.

De Gregori, A. (2011). *Reimagining the Classroom: Opportunities to link Recent Advances in Pedagogy to Physical Settings*. www.mcgraw-hillresearchfoundation.org, retrieved 05/05/16,

Denscombe M. (2003). *The Good Research Guide for small-scale social projects*, 2nd Edition. Berkshire: Open University Press.

Dillon, J. and Osborne, J. (2010). *Good Practice in Science Teaching: What research has to say.* New York: Open University Press.

Dorovolomo, J., Maebuta J. and Phan, H. P. (2010). *Lesson Planning and Quality Delivery. Do they relate?* The International Journal of Learning, 17(3), 447 – 455.

Duncan, G. and Met, M. (2010). *STARTALK: From paper to practice.* Maryland, National Foreign Language Center.

Ellah, B., O. (2018*). Schemes and Records of Work: Implications for Subject Teachers*. Paper presented at the Capacity Building Workshop for Teachers, Wadata, Nigeria, 24th January.

Esia-Donkoh, K., Ofusu-Dwamena, E., Namale, M. and Yelkpieri, D (2012). *Effects of Large Class size on Effective Teaching and learning at the Winneba Campus of the University of Education, Ghana.* US – China Education Review, 3, 319 – 332.

Farooque, U. T. K. and Gafoor, A. K. (2010). *Ways to Improve Lesson Planning: A Student Perspective.* Paper presented at the International Seminar Conference, India, 1st to 3rd November, 2010.

Gambari A. I. (2014). *Improving Secondary School Students' Achievements and Retention in Biology Through Video-based Multimedia Instruction.* InSight: A journal of Scholarly Teaching: Vol. 9, 78-89.

Haambokoma C., Nkhata B., Kostyuk V. S., Chabalengula V., Mbewe S., Tabakamulumu M., Ndhlovu Z. B., Mushanga R. and Nthani R. (2002). *Strengthening of Mathematics, Science and Technology Education in Zambian Secondary Schools*: Baseline Study Report, MoE and JICA, Lusaka.

Harding, J. (2013). *Qualitative analysis from start to finish*, London, SAGE.

Hoellwarth, C. and Moelter, M. J. (2011). *The Implications of a Robust Curriculum in Introductory Mechanics.* American Journal of Physics, 79, 540.

Hove, J., Kurebwa, M. and Wadesango, N. (2016). *Effects of Large of Large Class Size on Effective Curriculum Implementation*. International Journal of Educational Sciences, 12(2), 173 – 183.

Hussain, I. and Suleman, Q. (2014). *Effects of Classroom Physical Environment on the Academic Achievement Scores of Secondary Students in Kohat division, Pakistan*, International Journal of Learning and Development, 4(2), 71 – 82.

Innwoo, P. and Muluayonge, E. G. (2017). *Effect of Challenges with Class Size, Classroom Management and Availability of Instructional Resources on Science teachers' teaching Practices in Secondary Schools.* Journal of Science Education.

Ivic, I. (2000). *Lev S. Vygotsky (1896 – 1934).* Paris: UNESCO, International Bureau of Education.

Kaluku E. N., Ngesu L. M., Gunga S., and Wachira L. (2014). *Some Determinants of Students Performance in Biology in KCSE: A Case of Central Division of Machakos District*. International Journal of Innovative Research and Studies. Vol. 3(1), 174 – 186.

Kampamba, R. C. (2013). *The Role of Language of Science in the Teaching and Learning of Science.* Zambia Journal of Teacher Professional Growth (ZJTPG), 1(1), 66 – 86.

Kaseske, E. K., Mhute, I., Musingafi, M. C. C. and Shupikai, Z. (2015). *Planning to Teach: Interrogating the link among the Curricula, the syllabi, Schemes and Lesson Plans in the Teaching Process*. Journal of Education and Practice, 6(9), 54 – 59.

Kaulu G. (2015). *Physics Student Teachers' Misconceptions and Performance in Basic Electronics*: A case of the University of Zambia; Paper presented at the University of Zambia – Hiroshima Research Dissemination workshop. Lusaka, 19th August.

Kelly J. M. (1999). *The origins and development of education in Zambia: from pre-colonial times to 1996*. Lusaka: Zambia Educational Publishing house.

Kevogo N., Toili W. and Mutsotso S. (2013). *Effect of General Computer Use on Secondary School Students' Performance in Biology*, Greener Journal of Computer Sciences, 1(1), 016 – 030.

Khatete, D. W., Okach, A. E., and Ondigi, S. R. (2014). *Pedagogical Practices that hamper Effective Teaching and Learning of Biology in Secondary Schools in Migori District, Kenya.* North American Open Educational Research Journal, 1(1), 1 – 12.

Khatoon, M., Alam, M. T., Bukhari, M. A. and Mashtaq, M. (2014). *In-service Teachers' Perception about Their Competencies in delivery of biology lessons.* International Journal of Asian Social Science. 4(7), 820 – 834.

Kibera L. W. and Kimokoti A. (2007). *Fundamentals of Sociology of Education with Reference to Africa.* Nairobi: University of Nairobi press.

King'aru, J., M. (2014). *Factors Contributing to Poor Performance of Science Subjects: A Case of Secondary Schools in Kawe Division, Kinon Doni Municipality*. Unpublished Master's Dissertation.

Kosgei A. (2013). *Influence of teacher characteristics on students' academic achievement among secondary schools*. Journal of Education and Practice, 4(3), 72 – 86.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. New Delhi: New Age International (P) limited, Publishers.

Knamiller, G. W. (1999). *Teacher Resource Centres in Developing Countries: An Effective Strategy for Improving the Quality of Education in Schools.* New York: Waxmann Verlag GmbH.

Kumwenda, E (2017). *Effect of Computer-Assisted Learning (CAL) in Three Secondary Schools of Solwezi District, Zambia.* Zambia Journal of Teacher Professional Growth, 3(20), 1 – 15.

Gonzalez, N. C. and Kuuskorpi, M. (2011). *The future of the physical learning environment: school facilities that support the user*, Organisation for Economic Co-operation Development (OECD), CELE Exchange 2011/11.

Keraro, F. N. and Shihusa, H. (2009) *Using Advance Organisers to Enhance Biology*. Eurasia Journal of mathematics, Science and Technology of Education, 5(4), 413-420.

Kuzborska, I. I. (2015). *Links between Teachers' Beliefs and Practices and Research on Reading.* Reading in a Foreign language, 23(1), 102 – 128.

Kyriacou, C. (2007). *Essential Teaching Skills*. United Kingdom: Nelson Thornes Limited.

Lee, G. W., Yu, H., Lai, Y. and Lin, Y. K. (2012*). Impact of Biology Laboratory Courses on Students' Science Performance and Views about Laboratory Courses in General: Innovative Measurements and Analyses.* Journal of Biological Education, 46(3), 1 – 7.

Lindlof, T.R. and Taylor, B.C. (2002*). Qualitative Communication Research Methods*. Thousand Oaks, CA: SAGE.

Lippman, P. C. (2010). *Can the physical environment have an impact on the learning environment?* Organisation for Economic Co-operation Development, CELE Exchange.

Maduka, T., Olusanya, A.I. and Zirawaga, S. V. (2017). *Gaming in Education: Using Games as a Support Tool to Teach History.* Journal of Education and Practice, 8(15), 55 – 64. Http://www.iiste.org, retrieved 21/02/20.

Manda, K., (2012). *Learning Difficulties Grade 12 Pupils Experience in Biology:* The Case of Selected Secondary Schools in Samfya District of Zambia. Unpublished Master's Thesis.

Mckeachie, W. J. and Svinicki, M. (2006). *Teaching Tips: Strategies, Research, and Theory for College and University Teachers*. Belmont, CA, Wadsworth.

Michael, J. (2006). *Where is the Evidence that Active Learning Works?* Active Advances in Physiology Education, 30(4), 159 – 167.

Millar, R. (2004). *High School Science Laboratories: Role and Vision.* Washington, DC. National Academy of Sciences.

Ministry of Education (1996). *Educating Our Future: National Policy on Education*, Lusaka: Government Printers.

Ministry of Education and Japan International Co-operation Agency, (2010). *School Based Continuing Professional development (SBCPD) Through Lesson Study: Implementation Guidelines.* Lusaka: Standards and Curriculum.

Ministry of Education and Japan International Co-operation Agency (2010). *School Based Continuing Professional Development (SBCPD) Through Lesson Study: Management Skills Book*. Lusaka: Standards and Curriculum.

Ministry of Education and Japan International Corporation Agency (2011). *Strengthening Teachers' Performance and Skills (STEPS) Through School Based Continuing Professional Development*: Project Booklet. Lusaka: Standards and Curriculum.

Ministry of Education, Science, Vocational Training and Early Education, *Education Sector National Implementation Framework III, 2011-2015: Implementing the Sixth National Development Plan*. Lusaka: Ministry of Education, Science, Vocational Training and Early Education.

Moursund, D. (2007). *Introduction to Using Games in Education: A Guide for Teacher and Parents*, University of Oregon. http://uoregon.edu/moursund/dave/index.htm retrieved 21/02/20

Mubanga R. M. (2012). *School Program of In-service Training for the Term (SPRINT) program in Zambia – A Case of Collaboration towards Self-reliant Education Development;* A paper presented at the Japan Education Forum IX, 7th February.

Mudenda, V. (2008). *Zambian Grade 12 Pupils' Experiences of Biology Practical Work During School Certificate Examinations*: The Case of Kabwe High School. Unpublished Master's thesis.

Muzumara P.M. (2008). *Becoming an Effective Science Teacher*. Lusaka: Bhuta Publishers.

Mweshi, E. (2007). *Use of the Process Skills Approach by ZATEC Student teachers: The Case of Selected Basic Schools of Kitwe District in Zambia.* Unpublished Master's Thesis.

Nkoya, S. (2008). *Chemistry Teachers' Use of Learner-Centred Strategies in Large Classes: The Case of Selected Schools in Kitwe District*. Unpublished Master's Thesis.

Nsamenang A. B. and Tchombe M.S. (2011). *A Handbook of African Educational Theories: A Generative Teacher Education Curriculum*. Bamenda: Human Development Resource Centre.

Othman, M. and Zare, P. (2013). *Classroom Debate as a Systematic Teaching and Learning Approach.* World Applied Sciences Journal, 28(11), 1506 – 1513.

Oyoo, S. R. (2018). *Why language is so important in science*. Witwatersrand: World Economic Forum.

Palmer, D. (2005). *A Motivational View of Constructivist – Informed Teaching*. International Journal of Science Education, 27(15), 1853 – 1881.

Pandian, A. and Rahman, M. M. (2018). *Exploring ESL Teacher beliefs and Classroom Practices of CLT: A Case study.* International Journal of Instruction, 11(1), 295 – 310.

Philips, M. (2019). *A Place for Learning: The Physical Environment of classrooms*. United states: George Lucas Educational Foundation.

Prince, M. (2004). *Does Active Learning work? A Review of the Research.* Journal of Engineering Education, 93(3), 223 – 231.

Pritchard, A. and Woollard, J. (2010). *Psychology for the classroom: Constructivism and Social learning. London*: Routledge.

Richardson, V. (2003). *Constructivist Pedagogy.* Teachers' College Record, 105(9), 1623 – 1640.

Rodriguez-Gallego, M. R. (200). *Lesson planning in Primary and Secondary Education*. Research Gate, Technical Report No. 2.

Singh, S., and Yaduvanshi, S., (2018*). Constructivism in Science Classroom: Why and How.* International Journal of Scientific and Research Publications, 5(3), 1 – 5.

Taber, K. S. (2011). *Constructivism as Education Theory: Contingency in Learning and Optimally Guided Instruction.* New York: Nova science publishers, Inc.

Tam, M. (2000). *Constructivism, Instructional Design, and Technology: Implications for Transforming Distance Learning,* Educational Technology and Society, 3(2), 50 – 60.

Teaching Excellence in Adult Literacy Center (2011). *Just Write! Guide.* Washington DC: America Institute for Research.

Teaching Excellence in Adult Literacy Center (2010). *Effective Lesson Planning,* Center Fact Sheet No. 8.

Tichapondwa, M. S. (2013). *Preparing your Dissertation at a Distance: A Research Guide.* Vancouver: Virtual University for Small States of the Collonwealth.

Thier, D. H. (1970). *Teaching Elementary School Science, a Laboratory Approach.* Massachusetts: D. C. Heath and Company.

Ultanir, E. (2012). *An Epistemological Glance at the Constructivist Approach: Constructivist Learning in Dewey, Piaget, and Montessori*. International Journal of Instruction, 5(2).

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes.* London: Harvard University Press.

Westbrook, R. B. (1999). *John Dewey (1859-1952).* Paris: UNESCO, International Bureau of education.

Wolff, J.S. (2000). *Features of the Physical Learning Environment for Collaborative, Project-Based Learning at the Community College Level.* U.S., Research Centre for Career and Technical Education.

Xu, L. (2012). *The Role of Teachers' Beliefs in the Language Teaching-Learning process.* Theory and Practice in Language Studies, 2(7), 1397 – 1402.

Yero, J. L. (2010). *Teaching in Mind: How Teacher Thinking Shapes Education*. U.S.A.: Mind Flight Publishing.

## APPENDICES

APPENDIX I

QUESTIONNAIRE FOR TEACHERS

INFORMATION FOR THE RESPONDENT: The purpose of this study is to investigate the nature of learning and teaching activities in biology classrooms. The information that will be gathered in the study is purely for academic purposes only. Confidentiality will be highly observed and your participation will remain anonymous. You are therefore NOT required to indicate your name on the questionnaire. Kindly fill in the questionnaire as truthfully as possible.

DATE DISTRIBUTED: …… DATE COLLECTED: ……DISTRICT: ……...

TOTAL TEACHING LOAD PER WEEK: ……...……

PERSONAL INFORMATION OF RESPONDENT: Place a tick ( ) in the appropriate box.

1. Gender: male ☐ female ☐
2. Years of teaching experience:
   a. 1 to 5 years ☐
   b. 6 to 10 years ☐
   c. 11 to 15 years ☐
   d. 16 to 20 years ☐
   e. Over 21 years ☐
3. Highest professional qualifications:
   a. Diploma ☐
   b. Adv./Diploma ☐
   c. Degree ☐
   d. Masters ☐
   e. Others (specify) …….

4. Age:
   a. 18 to 20 years ☐
   b. 21 to 30 years ☐

c. 31 to 40 years ☐

d. 41 to 50 years ☐

e. Over 51 years ☐

5. Teaching subject/s: ……

**SECTION A**

**RESEARCH QUESTION 1: How do teachers of biology in the selected schools prepare for their biology lessons?** (For the researcher)

SECTION A1

**INSTRUCTIONS FOR THE RESPONDENT:** Answer the questions below by making a tick (√) in the box of your choice.

To what extent do you agree or disagree with each of the following statements?

**KEY:** SA = strongly agree; A = agree; UD = undecided; SD = strongly disagree; D = disagree

| S/NO. | STATEMENT | RESPONSE<br>SA A UD SD D |
|---|---|---|
| 1 | For each of my Biology lessons there is an adequately prepared lesson plan. | ☐ ☐ ☐ ☐ ☐ |
| 2 | For each biology classroom I prepare a different lesson plan even if the grade and topic are the same. | ☐ ☐ ☐ ☐ ☐ |
| 3 | For a particular biology classroom I only prepare one lesson plan per week | ☐ ☐ ☐ ☐ ☐ |
| 4 | Teaching resources/materials are adequately available in the department. | ☐ ☐ ☐ ☐ ☐ |
| 5 | I adequately and consistently make use of the teaching and | ☐ ☐ ☐ ☐ ☐ |

| | | |
|---|---|---|
| | learning resources in the Department. | |
| 6 | The Science Department is poorly equipped with teaching/learning resources. | ☐ ☐ ☐ ☐ ☐ |
| 7 | I make my own teaching/learning aids from available local resources. | ☐ ☐ ☐ ☐ ☐ |
| 8 | Most of my lessons for my biology classrooms lack teaching/learning materials. | ☐ ☐ ☐ ☐ ☐ |
| 9 | Adequate reference books are available in the department for teachers. | ☐ ☐ ☐ ☐ ☐ |
| 10 | I effectively use the reference books available in the department for my lesson preparations | ☐ ☐ ☐ ☐ ☐ |
| 11 | The Department has inadequate reference books for teachers which negatively affects lesson preparation. | ☐ ☐ ☐ ☐ ☐ |
| 12 | Pupils' text books are adequately available in the Department | ☐ ☐ ☐ ☐ ☐ |
| 13 | Pupils have access to the biology text books in the department | ☐ ☐ ☐ ☐ ☐ |
| 14 | The department has insufficient text books for pupils and this has a negative effect on teaching/learning. | ☐ ☐ ☐ ☐ ☐ |

| | | |
|---|---|---|
| | | |

SECTION A2

**INSTRUCTIONS:** Write your responses in the spaces provided for each question.

1. When preparing lesson plans do you make reference to the schemes of work? Give a reason for your response.

   ……

   ……

2. When preparing lesson plans do you make reference to the records of work? Give a reason for your response.

   ……

   ……

3. What challenges affect your preparation of lesson plans?

   ……

   ……

**SECTION B**

**RESEARCH QUESTION 2: What methodologies do teachers of biology in the selected schools apply in their biology classrooms?** (For the researcher**)**

**SECTION B1**

**Instructions for the respondent:** Indicate the frequency by which you use the teaching/learning activities indicated below in your biology lessons. Indicate by ticking in the appropriate column.

| TEACHING/LEARNING ACTIVITY | FREQUENCY | | | | |
|---|---|---|---|---|---|
| | always | often | sometimes | rarely | never |
| 1. Teacher asks questions, pupils answer | | | | | |
| 2. Teacher talks, pupils listen | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3. Pupils working out solutions individually in class | | | | | |
| 4. Teacher conducts lesson outside the classroom so that real objects in the natural environment are used for teaching and learning | | | | | |
| 5. Teacher taking pupils out for an educational tour | | | | | |
| 6. Pupils searching for solutions to written questions over a given period of time | | | | | |
| 7. Teacher conducting experiment, pupils watching | | | | | |
| 8. Teacher conducting experiment, pupils participating | | | | | |
| 9. Pupils debating on a topic in class | | | | | |
| 10. Pupils engaging in quiz over a topic in class | | | | | |
| 11. Teacher asks question, allows several answers from the class. All the responses are written on the board. Finally all the answers are discussed and the most correct answer is agreed upon. | | | | | |
| 12. Teacher writes notes on the board, pupils copy the notes | | | | | |
| TEACHING/LEARNING ACTIVITY | FREQUENCY | | | | |
| | always | often | sometimes | rarely | never |
| 13. Pupils discussing work in pairs | | | | | |
| 14. Pupils discuss work in small groups | | | | | |
| 15. Teacher asks pupils to research on a topic and make a presentation to the whole class during a biology lesson | | | | | |
| 16. Teacher discussing work with pupils in class | | | | | |
| 17. Pupils carrying out experiments in the classroom | | | | | |
| 18. Pupils carrying out experiments in the laboratory | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 19. Pupils acting roles | | | | | |
| 20. Teacher conducting lessons from the laboratory | | | | | |
| 21. Teacher marking pupils' work | | | | | |
| 22. Slow learners engaging in extra classroom activities | | | | | |
| 23. Teacher using models/ charts/ pictures/ or real objects during biology lessons | | | | | |
| 24. Pupils engaging in practical work to discover knowledge on their own | | | | | |

SECTION B2

1. For the teaching methods that you use regularly explain why you do so.

   ……

   ……

**SECTION C**

**RESEARCH QUESTION 3: To what extent is the classroom physical environment organised for the teaching and learning of biology? (**For the researcher**)**

**INSTRUCTIONS:** Place a tick (√) in the appropriate column (Yes/No). Comment on your answer in the last column.

1. Are the following teaching/learning resources and facilities found in your biology classrooms?

| **Teaching/learning materials** | **Yes** | **No** | **Effect on teaching/learning due to lack or presence of facility** |
|---|---|---|---|
| Posters/charts | | | |
| Black boards | | | |

| | | | |
|---|---|---|---|
| Notice boards | | | |
| White boards | | | |
| Models | | | |
| Computer/internet | | | |
| Display of pupils' work | | | |
| Adequate furniture | | | |

APPENDIX II

QUESTIONNAIRE FOR PUPILS

INFORMATION FOR THE RESPONDENT: The purpose of this study is to investigate the nature of learning and teaching activities in biology classrooms. The information that will be gathered in the study is purely for academic purposes only. Confidentiality will be highly observed and your participation will remain anonymous. You are therefore NOT required to indicate your name on the questionnaire. Kindly fill in the questionnaire as truthfully as possible.

Date distributed: …… Date collected: ……. district: ……..... Gender of pupil …… Age of pupil: ……. Grade: ……School: ……

**PART A**

**RESEARCH QUESTION 2:** What methodologies do teachers of biology in the selected schools apply in their biology classrooms? (For the researcher)

**Instructions for the respondent:** Indicate the frequency by which the activity indicated below is used by your teacher of biology in your biology lessons. Indicate by placing a tick ( ) in the appropriate column.

| Teaching/learning activity | Frequency | | | | |
|---|---|---|---|---|---|
| | Always | often | sometimes | rarely | never |
| 25. Teacher asks questions, pupils answer | | | | | |
| 26. Teacher talks, pupils listen | | | | | |
| 27. Pupils working out solutions individually in class | | | | | |
| 28. Teacher conducts lesson outside the classroom so that real objects in the natural environment are used for teaching and learning | | | | | |
| 29. Teacher taking pupils out for an educational tour | | | | | |
| 30. Pupils searching for solutions to written questions over a given period of time | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 31. Teacher conducting experiment, pupils watching | | | | | |
| 32. Teacher conducting experiment, pupils participating | | | | | |
| 33. Pupils debating on a topic in class | | | | | |
| 34. Pupils engaging in quiz over a topic in class | | | | | |
| 35. Teacher asks question, allows several responses/answers from the class. All the responses are written on the board. Finally all the answers are discussed and the most correct answer is agreed upon. | | | | | |
| 36. Teacher writes notes on the board, pupils copy the notes | | | | | |
| 37. Pupils discussing work in pairs | | | | | |
| 38. Pupils discuss work in small groups | | | | | |
| 39. Teacher asks pupils to research on a topic and make a presentation to the whole class during a biology lesson | | | | | |
| 40. Teacher discussing work with pupils in class | | | | | |
| 41. Pupils carrying out experiments in the classroom | | | | | |
| 42. Pupils carrying out experiments in the laboratory | | | | | |
| 43. Pupils acting roles | | | | | |
| 44. Teacher conducting lessons from the laboratory | | | | | |
| 45. Teacher marking pupils' work | | | | | |
| 46. Slow learners engaging in extra classroom activities | | | | | |
| 47. Teacher using models/ charts/ pictures/ or real objects during biology lessons | | | | | |
| 48. Pupils engaging in practical work to discover knowledge on their own | | | | | |

**PART B**

**INSTRUCTIONS FOR THE RESPONDENT:** Write your answers in the spaces provided.

1. Which of the above stated activities would you like your teachers of biology to use often in your biology lessons and why?

   ……
   ……..……
   ……
   ……

**RESEARCH QUESTION 3:** To what extent is the classroom physical environment organised for the teaching and learning of biology? (For the researcher)

**INSTRUCTIONS:** Place a tick ( ) in the appropriate column.

Are the following teaching/learning materials/facilities found in your biology classrooms?

| **Teaching/learning materials** | **yes** | **No** |
|---|---|---|
| Posters/charts | | |
| Black boards | | |
| Notice boards | | |
| White boards | | |
| Models | | |
| Computer/internet | | |
| Display of pupils' work | | |
| Adequate furniture | | |

THANK YOU FOR YOUR TIME. GOD BLESS YOU!

APPENDIX III

QUESTIONNAIRE FOR HEAD OF DEPARTMENT

INFORMATION FOR THE RESPONDENT: The purpose of this study is to investigate the nature of learning and teaching activities in biology classrooms. The information that will be gathered in the study is purely for academic purposes only. Confidentiality will be highly observed and your participation will remain anonymous. You are therefore NOT required to indicate your name on the questionnaire. Kindly fill in the questionnaire as truthfully as possible.

DATE DISTRIBUTED: …… DATE OF COLLECTION: …… DISTRICT: …….

PERSONAL INFORMATION OF RESPONDENT: Place a tick (√) in the appropriate box.

6. Gender: male ☐ female ☐
7. Years of teaching experience:
   f. 1 to 5 years ☐
   g. 6 to 10 years ☐
   h. 11 to 15 years ☐
   i. 16 to 20 years ☐
   j. Over 21 years ☐
8. Highest professional qualifications:
   f. Diploma ☐
   g. Adv. /Diploma ☐
   h. Degree ☐
   i. Masters ☐
   j. Others (specify) …….

9. Age:

1 30 to 35 years ☐
2 36 to 40 years ☐
3 41 to 45 years ☐
4 46 to 50 years ☐
5 Over 51 years ☐

10. Teaching subject: …….....

**RESEARCH QUESTION 1:** How skillful are teachers of biology in their lesson preparation? **(**For the researcher**)**

1. How often is the science department funded to procure books?

   ……

   ……

   ……..

2. How well stocked is the department with text books for biology?

   ……

   ……

3. How often is the science department funded to procure chemicals and apparatus?

   ……

   ……..

4. How well stocked is the department with chemicals and apparatus?

   ……

   ……

**Research question 2:** What methodologies do teachers of biology in the selected schools apply in their biology classrooms? (For the researcher)

5. Do you monitor teaching and learning of biology in your department?

   ……

6. Who else monitors teaching and learning of biology in your department?

   ……

   ……

7. How is the teaching and learning of biology in your department monitored?

   ……

   ……

8. Do you get monitoring reports from external monitors when they monitor teaching and learning in your department?

……

9. Do you and the teachers in the department engage in school based continuing professional development (SBCPD) activities?

   ……

   …….....

10. What continuing professional development (SBCPD) activities do you engage in?

    ……

    ……

11. Do you and the teachers in the department engage in continuing professional activities outside school?

    ……..

12. What type of continuing professional activities do you engage in outside school?

    ……

    ……

    ……

    ……

13. What do you think are the reasons for the low pupil achievement in biology at your school?

    ……

    ……

    ……

    ……

    ……

    ……..

14. What challenges are faced by teachers in the teaching of biology at your school?

    ……

    ……

    ……

    ……..

15. What measures has the school undertaken to make your biology lessons more effective?

……

……

……

……

……

END

THANK YOU!

APPENDIX IV

FOCUS GROUP DISCUSSION GUIDE FOR TEACHERS

DATE: …… DISTRICT: …… SCHOOL: …….

RESEARCH QUESTIONS

(iv) How skillful are teachers of biology in their lesson preparation?

(v) What methodologies do teachers of biology apply in their biology classrooms?

(vi) To what extent is the classroom physical environment organized for the teaching and learning of biology?

---

**RESEARCH QUESTION 1:** How skillful are teachers of biology in their lesson preparation?

(a) How often do you prepare schemes of work and what challenges affect your preparation of schemes of work?

(b)How often do you prepare lesson plans?

(a) What challenges affect your preparation of lesson plans?

**RESEARCH QUESTION 2:** What methodologies do teachers of biology in the selected schools apply in their biology classrooms?

(a) Why do you use these teaching methods (as observed) in your biology classrooms?

(b) Isn't there any other methods you could use for this topic (topic for lesson observed) which may enhance teaching and learning?

(c)Are practicals done simultaneously with theory or a separate time is set for practical work?

(d)Do you think pupils are adequately prepared for biology examinations in both theory and practical work by the time they sit for examinations?

(e) How often do your pupils have their biology lessons in the laboratory?

(f) What challenges do you face in organising for laboratory work?

(g) How can you resolve these challenges?

(h) How do you use the records of work?

(i) How effective have CPD activities been in improving teaching and learning in biology?

(That is, both certification and non-certification CPD)

(j) It was observed that very few learners participated in answering questions in your biology lessons. Why is this so? Is there anything you can do to encourage more learners to participate in answering questions and also taking part in classroom activities?

**RESEARCH QUESTION 3:** To what extent are classrooms of the selected schools organized for the teaching and learning of biology?

1 (a) It was observed that biology classrooms and laboratories do not display resources to support teaching and learning such as charts models, posters, apparatus, real specimens and learners' work.

(b) What has contributed to this situation?

(c) Is there anything you can do about the situation?

2. Modern teaching methodologies support the use of information, communication and technologies (ICT) to enhance teaching and learning. Why are you not using these facilities to enhance teaching/learning in your biology lessons?
3. (i) Does the sitting arrangement stream pupils according to ability?
   (ii) Does the sitting arrangement stream pupils according to gender?
4. What measures have you undertaken to make your biology lessons more effective?

END

APPENDIX V

FOCUS GROUP DISCUSSION FOR PUPILS

**DISTRICT: …… SCHOOL: ……. DATE: ……..**

**Research question 2: What methodologies do teachers of biology apply in their biology classrooms?**

1. (a) What teaching activities do your teachers of biology mostly use in biology lessons?

   (b) How often do you have biology lessons outside the classroom?

   (c) How often do you have educational tours in your biology lessons?

   (d) How often do you have biology lessons in the laboratory?

   (e) How often do you do experiments in your biology lessons?

2. (a) Does the school have sufficient biology text books for pupils and do you have access to the books?

   (b) How often do you use these text books and for how long?

   (c) How often are class exercises given and marked?

   (d) How often is homework given and marked?

3. What classroom activities would you like your biology teachers to use often and why?

**Research question 3: To what extent is the classroom physical environment organized for teaching and learning of biology?**

4. (a) Do your teachers of biology at any time display pupils' work in the classroom or laboratory?

   (b) Do your teachers of biology at any time display charts, models, pictures, real specimen and other teaching/learning materials in the classroom or laboratory?

5. Do your teachers of biology use internet and computers for some of your biology lessons?

APPENDIX VI

LESSON OBSERVATION SCHEDULE

RESEARCH QUESTIONS

(c) How skillful are teachers of biology in their lesson preparation?

(ci) What methodologies do teachers of biology in the selected schools apply in their biology classrooms?

(cii) To what extent is the classroom physical environment organised teaching and learning of biology?

---

| **RESEARCH QUESTION 1: How do teachers of biology in the selected schools prepare for biology lessons?** | |
|---|---|
| **ITEM** | **OBSERVATION** |
| Was the lesson plan available? | |
| What teaching and learning resources were available? (real specimen, models, pictures, diagrams) | |
| In the case of chemicals, what type was available? (actual chemicals or substitutes) | |
| Were the lesson objectives clearly stated in the lesson plan? | |

| | |
|---|---|
| Were the teaching materials appropriate? | |
| Were the teaching materials adequate? | |
| Were the teachers resourceful and innovative in the preparation of teaching and learning materials? | |
| How punctual was the teacher for biology lessons? | |
| **RESEARCH QUESTION 2: What methodologies do teachers of biology in the selected schools apply in their biology classrooms?** | |
| **2.1 TEACHING METHODS APPLIED IN THE OBSERVED LESSONS** | |
| TEACHING METHOD | APPROACH (whole class, small groups, pairs, individually) |
| | |
| | |
| | |
| | |
| | |
| **2.2 LESSON PRESENTATION** | |

| 2.2.1 How organized was the teacher in using teaching/learning materials | | | |
|---|---|---|---|
| **ITEM** | **YES** | **NO** | |
| Were the teaching/learning resources gathered to the classroom in time? | | | |
| Were the teaching/ learning resources used appropriately? | | | |
| Were teaching/learning resources used in an orderly manner? | | | |
| Were safety measures observed in the use of teaching/learning resources? | | | |
| **2.3 LESSON INTRODUCTION** | | | |
| **ITEM** | **YES** | **NO** | |
| Did the teacher take time to draw minds of the learners to the classroom? | | | |
| Did the teacher evaluate prior knowledge of learners? | | | |
| Was the lesson title written on the board? | | | |
| Were the lesson objectives written on the board and discussed with learners? | | | |
| Were the key terms noted and discussed? | | | |
| Were activities sequenced in a logical | | | |

| | | | |
|---|---|---|---|
| order? | | | |

## 2.4 LESSON DEVELOPMENT/ PROGRESS

| ITEM | OBSERVATION |
|---|---|
| Was teaching/learning linked to prior knowledge of learner? | |
| Did the teacher vary classroom activities to motivate learners and sustain their interest? | |
| Were learners given opportunity to ask questions? | |
| Were learners given time to think before answering or asking questions? | |
| What was the quality of teacher questions? | |
| What was the quality of pupil responses? | |
| How did teacher respond to learners' questions? | |
| Did teacher apply concepts and principles to real life situations? | |
| Did teacher have sufficient knowledge of subject matter? | |

| | | | |
|---|---|---|---|
| | | | |
| **ITEM** | **OBSERVATION** | | |
| What was the quality of chalk board?<br>-spellings<br>-teacher handwriting<br>-organisation of board work | | | |
| What was the quality of classroom discussions? | | | |
| How did the teacher conduct formative assessment? | | | |
| Motivation strategies-how effective was the teacher in motivating learners and sustaining learners' interest? | | | |
| Is lesson content suitable to level of the class? | | | |
| Timing of activities-where activities allocated enough time for effective teaching and learning? | | | |
| Was the teacher monitoring classroom activities? | | | |
| **2.5 LESSON CONCLUSION** | | | |
| | YES | NO | |
| Did the teacher evaluate the lesson to find | | | |

| | | | |
|---|---|---|---|
| out whether objectives were achieved or not? | | | |
| Where the lesson objectives achieved? | | | |
| Did the teacher include activities to summarise the lesson to consolidate main points of lesson? | | | |
| Did teacher link classroom activities to the next lesson? | | | |
| Did teacher conduct the lesson as planned in the lesson plan? | | | |
| **2.6 CLASSROOM INTERACTIONS** | | | |
| Was there gender mix in the sitting arrangement of pupils? | | | |
| Was there ability mix in the sitting arrangement of pupils? | | | |
| Were pupils given the opportunity to learn from one another? | | | |
| Was there opportunity for the teacher to interact with the learners in small groups? | | | |
| Was there opportunity for the teacher to interact with the learners at individual level? | | | |
| Who forms the groups during group learning tasks, the teacher or the pupils? | | | |

| 2.7 GROUP TASKS | |
|---|---|
| **ITEM** | **OBSERVATION** |
| Did all the group members participate in carrying out group tasks?<br><br>(discussions/practical work) | |
| Did learners ask questions in the group to enhance learning? | |
| Were all learners on task? | |

**RESEARCH QUESTION 3: To what extent is the classroom physical environment organized for teaching and learning of biology?**

**3.1 PHYSICAL ENVIRONMENT**

| | **CLASSROOM** | | **LABORATORY** | | |
|---|---|---|---|---|---|
| ITEM | YES | NO | YES | NO | |
| Was the classroom space adequate in relation to the class size? | | | | | |
| Was furniture adequate? | | | | | |
| Was the laboratory lighting system adequate? | | | | | |
| Was ventilation adequate? | | | | | |
| Was the laboratory clean/tidy | | | | | |
| Resources: were the following | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| teaching/learning resources available? | | | | | |
| • Posters/charts | | | | | |
| • Notice-boards | | | | | |
| • Blackboards | | | | | |
| • Whiteboards | | | | | |
| • Models | | | | | |
| • Apparatus | | | | | |
| • Computers/Internet | | | | | |

APPENDIX VII

DOCUMENT ANALYSIS

**DISTRICT: ……..…. SCHOOL: ……..…**

**TEACHER GENDER: …….**

**GRADE TAUGHT: …… MONITORING DATE: ……**

| **RESEARCH QUESTION 1: How skillful are teachers of biology in their lesson preparation?** | | | |
|---|---|---|---|
| **1.1 TEACHING MATERIALS** | | | |
| ITEM | YES | NO | COMMENT |
| **1.1 SYLLABUS** | | | |
| Is the syllabus available? | | | |
| **1.2 SCHEMES OF WORK** | | | |
| Are the schemes of work available? | | | |
| Are teachers consistent with the preparation of schemes of work? | | | |
| Are topics sequenced such that related topics are linked? | | | |
| Is the quantity of work allocated for a term appropriate in relation to time available? | | | |
| **1.3 LESSON PLANS** | | | |

| | | | |
|---|---|---|---|
| Are teachers consistent with the preparation of lesson plans? | | | |
| Are the contents of lesson plans in line with the scheme/syllabus? | | | |
| Are the lesson activities logically sequenced? | | | |
| **1.4 RECORDS OF WORK** | | | |
| Are the teachers consistent with preparation of records of work? | | | |
| Are the contents of records of work adequate? | | | |
| What is the selection of teaching materials as indicated in lesson plans (real specimens, models, charts, pictures)? | | | |
| What are the common teaching methods as indicated in the lesson plans? | | | |
| How are the lessons concluded as indicated in the lesson plans (class exercises, lesson summary, homework)? | | | |
| | | | |

| **Research question 2: What methodologies do teachers of biology in the selected schools apply in their biology classrooms?** | |
|---|---|
| **2.1 ANALYSIS OF LEARNERS' EXERCISE BOOKS/NOTE BOOKS** | |
| ITEM | OBSERVATION |
| What is the quality of exercises given? Is the work challenging, thought provoking or simple recall questions? | |
| Is the quantity of homework given adequate? | |
| What is the quality of marking, does the teacher pay attention to spellings and quality of answers?<br><br>Are the teacher's comments facilitating teaching and learning? | |

| | |
|---|---|
| What is the quality of notes in pupils' books?<br><br>Are the spellings correct?<br><br>Are the contents correct?<br><br>What is the quality of pupil hand writing?<br><br>Are the notes adequate? | |
| What is the quality of diagrams in pupils note books/exercise books compared to actual objects? | |

**END**