

**LEARNING DIFFICULTIES GRADE 12 PUPILS EXPERIENCE IN BIOLOGY: THE  
CASE OF SELECTED HIGH SCHOOLS IN SAMFYA DISTRICT OF ZAMBIA**

by

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# **CHAPTER ONE**

## **INTRODUCTION**

### **1.0 Introduction**

This chapter presents the background to the study, the statement of the problem, purpose of the study, objectives, research questions, significance of the study and the theoretical framework.

### **1.1 Background to the study**

Zambia is divided into nine educational regions namely Lusaka, Central, Copperbelt, Northwestern, Western, Southern, Eastern, Northern, and Luapula region (MoE, 1996). Each region is further divided into Districts. The region is headed by the Provincial Education Officer (PEO) and the district is headed by the District Education Board Secretary. The number of districts varies from region to region. Luapula region has nine districts, one of which is Samfya. There are many different types of schools in Samfya district, namely 5 Preschools, 106 Basic Schools and 4 High schools. Basic Schools offer grades one to nine, while High Schools provide high school education comprising grades ten to twelve (MoE, 1996).

Science occupies an important place at various levels of the educational system in Zambia. At lower and middle basic school level pupils are exposed to integrated science which aims at helping them develop scientific skills, knowledge and attitudes (CDC, 2003). The integrated science syllabus requires teachers to use activity based approaches that enhance pupil's creativity, analysis and problem solving in and outside the classroom (CDC, 2003, MoE, 2000). The integrated science is usually taught by teachers who have been trained to teach all the subjects at lower and middle basic school.

At upper basic school level pupils are exposed to environmental science. The specific aims are to develop the pupil's ability to think reflectively, logically, scientifically and critically. The major topics taught at lower and middle basic school levels include; the human body, health, the environment, plants and animals, materials and energy. The major topics taught at upper basic school level starting from grade 8 to 9 include; water, man, matter, gases, human reproduction, plants, communication, electricity and ecology. At upper basic school teachers are usually trained to teach environmental science (CDC, 2003).

At high school level grades 10 to 12 pupils study physics, chemistry, biology and agricultural science for three years. Out of all these sciences offered at high school, biology is the only science offered in all the high schools in Zambia, and quite a good number of pupils both boys and girls take biology (MoE, 2004). In Luapula province only four schools offer physics and chemistry namely Samfya, Mwense, St Clements and Mansa high school while biology is offered by all the 21 high schools.

The popularity of biology has also been reported by others as early as the nineteen eighties. Meyer (1988) reported that over the past two to three decades biology had become firmly established as a main stream subject.

The study of biology is essential to human beings for many reasons. School pupils study biology to obtain a certificate and to go on and train for jobs that need the knowledge and the practical skills acquired through the study of biology. The study of biology also helps us live healthier and

happier lives because it helps us to understand our bodies, other living organisms and our environment. It also reveals the importance of nutrition and hygiene. High school biology is not merely intended to increase a pupil's knowledge but also to develop and encourage scientific attitudes. High school biology also encourages pupils to be open minded in asking questions and to be objective and accurate in interpreting results (CDC, 2000).

In addition learning of biology gives the pupil the opportunity to follow instructions, perform and report on tasks and comprehend written information underlying scientific principles. It is also intended to give the pupil the opportunity to develop skills of observation, recording, classifying, seeking answers and objectively assessing information or interpreting situations (CDC, 2000).

The learner should be aware that the study and practice of biology is subject to social, economic, technological, ethical and cultural influences and limitations. The application of biology may be both beneficial and detrimental to the individual, the community and the environment. Biology transcends national boundaries and that the language of science, correctly and rigorously applied, is universal (CDC, 2000).

In Zambia, pupils study biology for three years at high school level and sit for final examinations at the end of grade 12. The biology examination prepared by the Examination Council of Zambia is comprised of 3 papers namely paper 1 which consists of multiple choice items, paper 2 which is comprised of essay type questions and structured questions and paper 3 which is the practical paper. In answering questions, learners are required to use principles and

concepts that are within the syllabus and apply them in a logical and deductive manner. Nevertheless performance of pupils in the 3 biology examination papers has been very discouraging although biology is perceived to be easier to learn than other science subjects.

Biology examination papers usually cover a wide range of topics providing for a wide coverage of syllabus content. The papers usually include questions on recall of factual knowledge as well as questions on application and synthesis (CDC, 2000).

The problem of underachievement of pupils in biology is not new, for example table one below shows countrywide biology school certificate results for 1992 and 1993.

**Table 1: Countrywide biology school certificate results for 1992 and 1993.**

Year	1 and 2 Distinction	3 and 4 Merit	5 and 6 Credit	7 and 8 Pass	9 fail	Total
1992	371	2037	3404	6420	6139 – (33%)	18370
1993	510	2048	3580	6811	6113 – (32%)	19062

Source: MOE 1994

It is clear from table one that a large percentage of candidates in the two years given just passed or failed biology. Again in 2002 the picture remained the same, 9975 pupils failed biology out of a total of 19000 registered candidates. In 2003 again 11890 pupils failed biology out of a total of 20500 registered candidates.

At provincial level, the performance pattern was similar to that given above. For example table two shows performance of pupils in school certificate biology examinations in 21 High schools of Luapula province for 2009.

**Table 2: Performance of pupils in biology school certificate examination in 2009 for Luapula province.**

No	School	1 & 2 Dist	3 & 4 Merit	5 & 6 Credit	7 & 8 Pass	9 Fail	Total sat	Pass percentage
1	St Clements Sec	11	31	51	38	13	144	91.0
2	St Marys Sec	3	19	31	24	11	88	87.5
3	Nchelenge High	6	68	168	148	31	416	92.5
4	Mwense High	2	31	41	71	22	167	86.8
5	Mabel Shaw High	3	10	52	83	25	169	85.2
6	Kabunda High	0	2	33	64	31	130	76.2
7	Kawambwa boys	2	14	51	110	129	306	57.8
8	Ponde High	0	3	15	39	35	92	62.0
9	Lukwesa High	2	3	19	47	63	134	53.0
10	Samfya High	2	9	39	88	169	307	45.0
11	Mabumba high	0	1	18	54	54	127	57.5
12	Ngoni High	0	2	11	40	46	99	53.5
13	Chembe High	0	0	5	11	30	46	34.8
14	Mansa High	2	3	19	75	140	239	41.4
15	Lubwe High	0	0	7	31	73	111	34.2
16	Chipili High	0	0	9	56	136	201	32.3
17	Kasaba High	0	0	3	20	47	70	32.9
18	Luela High	0	1	3	26	99	129	23.3
19	Chimpempe High	0	0	2	8	73	83	12.0
20	Kawambwa Tea	0	0	0	5	34	39	12.8
21	Twingi High	0	0	0	11	84	95	11.6
	<b>TOTAL</b>	<b>33</b>	<b>188</b>	<b>577</b>	<b>1049</b>	<b>1345</b>	<b>3192</b>	<b>57.9</b>

Source: PEO Mansa

As can be seen from table two out of a total of 3192 candidates who wrote the school certificate biology examinations in Luapula province in 2009, 1345 candidates failed the examinations bringing the passing percentage to 57.9%.

At Samfya High School performance of pupils in school certificate Biology for six years, from 2005 to 2010 has been shown in table three.

**Table 3: School certificate biology results for Samfya High School for the period 2005 to 2010.**

<b>Year</b>	<b>1 and 2 Distinction</b>	<b>3 and 4 Merit</b>	<b>5 and 6 Credit</b>	<b>7 and 8 Pass</b>	<b>9 Fail</b>	<b>Total Sat</b>	<b>Pass percentage</b>
2005	0	3	12	45	145	205	29.3%
2006	2	6	8	43	64	130	50.8%
2007	0	1	5	61	173	240	27.9%
2008	30	70	93	144	39	376	89.6%
2009	2	9	39	88	169	307	44.9%
2010	5	23	62	180	373	643	41.9%

Source: PEO Mansa

As can be seen from table three the pass percentage at Samfya High School in the six years went as low as 27.9% in 2007.

At Lubwe High School performance of pupils in the school certificate biology examination from 2004 to 2009 is shown in table four.

**Table 4: Biology school certificate results for Lubwe High School from 2004 to 2009.**

<b>Year</b>	<b>1 and 2 Distinction</b>	<b>3 and 4 Merit</b>	<b>5 and 6 Credit</b>	<b>7 and 8 Pass</b>	<b>9 Fail</b>	<b>Total sat</b>	<b>Pass percentage</b>
<b>2004</b>	4	3	4	26	42	80	47.5%
<b>2005</b>	2	4	7	32	42	88	52.3%
<b>2006</b>	2	4	12	17	58	103	42.7%
<b>2007</b>	3	6	9	64	43	127	63.0%
<b>2008</b>	11	15	24	34	18	102	82.4%
<b>2009</b>	0	0	7	31	73	111	34.2%

Source: PEO Mansa

As can be seen in table four the pass percentage at Lubwe went as low as 34.2% in 2009.

## **1.2 Statement of the problem**

Although the general view is that biology is the easiest science subject to learn in comparison to other science subjects offered at high school level (Haambokoma, 2007). Examination results presented above have shown that many candidates fail this subject at the end of their high school education in Zambia. This underachievement or poor performance of pupils in biology suggests that they experience difficulties in learning the subject.

However, the nature and causes of learning difficulties experienced by pupils in biology are not known. Therefore, there was need to identify the nature and causes of learning difficulties in biology. This is important because persistent lack of knowledge about the nature and causes of learning difficulties might lead to continued and prolonged underachievement of pupils in the subject.

## **1.3 Purpose of the study**

The purpose of this study was therefore to investigate the nature and causes of learning difficulties pupils experience in Biology in High Schools of Samfya District.

## **1.4 Research objectives**

The objectives of the study were

- 1 .To identify the nature of learning difficulties pupils experienced in high school Biology.
- 2 .To determine the causes of the learning difficulties pupils experienced in high school Biology.
- 3 .To establish what could be done to minimize learning difficulties experienced by pupils.



### **1.5 Research questions**

The study was guided by the following questions:

1. What learning difficulties do pupils experience in high school Biology?
2. Why do pupils experience these learning difficulties?
3. How could these learning difficulties be minimized?

### **1.6 Significance of the study**

It was anticipated that this study would generate information which could contribute to knowledge in learning biology and could be used by various stakeholders namely the Ministry of Education to influence policy on curriculum design, in service programs and even changes in the teaching methods. The teacher training colleges and universities will be able to identify areas in their training programs that might need change. Teachers of biology are likely to benefit from the findings of this study by improving their teaching methodologies. Heads of science departments will be able to monitor the teaching and learning of biology effectively by ensuring the availability of teaching and learning aids. School administrators are likely to improve the learning environments of the pupils in their schools by providing textbooks and reagents for practical activities, insert providers by organizing seminars on effective teaching methods, Education Standard Officers by providing regular advisory services to teachers who might be experiencing problems in teaching some topics in biology, Curriculum Developers by developing localized curricula and Examination Council of Zambia by preparing questions which are clear and reliable. The information generated by this study could be used by other researchers in the learning of biology.

## **1.7 Theoretical Framework**

This study was informed by a transactional model of the teaching and learning process developed by Huitt (1995). This model classified factors affecting learning into four categories namely; context, input, classroom processes and output. Context covers all the factors outside the classroom that might influence teaching and learning such as social economic status and state policies. Input covers those qualities or characteristics of teachers and students that they bring with them to the classroom experience such as previous knowledge about the subject matter. Classroom processes include teacher and student behaviors in the classroom as well as some other variables such as classroom climate and teacher and student relationships. Output covers measures of student learning taken apart from the normal instructional process.

The role of the teacher in terms of facilitation of learning by specifying the lesson objectives, selecting groups of pupils and their roles in groups and in monitoring the effectiveness of the groups, was the focus of the open ended questionnaires and interview schedules. The use of learner's own responses also guided the analysis and interpretation of the findings.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter is about review of the related literature and will cover the following areas: Learning, topics learners find difficult in biology and the nature of errors pupils make in biology examinations, causes of learning difficulties pupils experience and the proposals advanced to facilitate learning.

#### **2.1 Learning**

Teaching pre-supposes an environment where learning can take place. It means the creation of a situation which facilitates learning or leads to learning. Teaching and learning are interrelated processes, where teaching involves various activities, learning the benefit derived from them. Teaching is the process which results in learning. It includes instruction, principles, teaching materials, methods, models and innovative devices (Das, 2007).

The theories of learning aim at explaining the nature of the process of learning, whereas the theories of teaching are concerned with effective teaching leading to the development of the learner. Learning theories are concerned with the psychological characteristics of the learners and analysis of the nature of learning, whereas teaching theories operate in social and cultural settings. Learning theories explain the interaction among the variables in the learning situations and the teaching theories devise methods and models to achieve effective learning in such situations (Das, 2007).

## **2.2. Topics learners find difficult in Biology and the nature of errors pupils make in biology examinations**

A total number of forty eight Heads of Departments who participated in the baseline study which was done by Haambokoma and others (2002) indicated the following as topics in biology where teachers needed more help to be more effective than was the case before: inheritance, ecology, coordination and response, use and abuse of drugs, diversity of organisms, nutrient cycles, chemical control of plants, skeleton and locomotion including homeostasis. They also indicated that teachers needed help in practical work.

In the same study some teachers revealed that they experienced difficulties teaching some topics like: Inheritance and genetics, diversity of organisms, functions of the brain and the nerves, chemical control of plants, the use and abuse of drugs, energy flow, food chains and food webs, homeostasis, nutrient and water cycles, support and locomotion. Haambokoma and others (2002) discovered that genetics was difficult to learn because of calculations involved in it and too many similar terms. Not surprisingly, the topics which teachers found difficult to teach were in most cases the same ones pupils found difficult to learn (Haambokoma et al, 2002).

Some of the topics listed above have also been identified as difficult topics for teachers by other studies. Rugumayo (1978) found that teachers of biology needed help in ecology and genetics. Haambokoma and Mwale (1998) found that in two technical high schools, teachers had difficulties teaching genetics, coordination, use and abuse of drugs, ecology and diversity of living organisms, homeostasis, support and movement.

Abimbola (1998) revealed that Darwinian theories of evolution may conflict with the teacher's beliefs thereby putting them in a difficult situation to teach the theories. Abimbola (1998) also discovered that physiology content areas are mostly abstract and microscopic and contain many fine processes that require proper explanations to enable pupils understand them.

According to Haambokoma (2007) on the nature and causes of learning difficulties in genetics at high school level in Zambia, certain topics in biology are perceived to be too difficult to be taught and learnt by teachers and pupils respectively. This is a clear indication that some learners come to school already defeated in mind. The manner of presenting information tends to be monotonous by teachers. For example genetics is perceived negatively by some students thus pupils find it difficult to understand what teachers are teaching.

ECZ (2009) revealed that a lot of candidates had performed poorly on a question on genetics. It appeared as if many candidates had not covered this topic in the course. Many candidates did not give a correct genetic diagram indicating the stages of parents, gametes and off springs. They did not use the correct symbols like  $1^A$ ,  $1^B$ , and  $1^O$ . They did not identify genotype and phenotype correctly. The chief examiner also went on to say that the use of genetic diagrams had been asked almost in all past papers but teachers had not guided candidates well in this area. A good genetic diagram without labeling the parents, parental genotype, gametes and off springs could not score any marks.

Most candidates seemed not to have learnt the term meiosis and as a result failed to answer the question. Even those who attempted failed to bring out the actual events during meiosis which could cause each ovum to be genetically different from one another (ECZ, 2008).

This scenario has been aggravated by the lack of experiments in genetics. Usually all the experiments conducted by Mendel are just described since they are slow to yield results. One of the difficulties in teaching evolution in high schools is that we can neither illustrate nor concretize the evolutionary process in the laboratory. (Lederman and Sandra: <http://books.google.com/books>).

According to the chief examiners report of 2002 on a question which required naming the parts of a wind pollinated flower, characteristics of these parts and their functions, most candidates failed to label the parts on a diagram correctly and failed to describe the characteristics of the various parts of the flower. They also lost marks on wrong spellings and functions.

Many candidates could not distinguish between plant and animal hormones. Some candidates could not identify the hormones in the table or failed to state their action. Some of the wrong answers included: progesterone instead of estrogen. Most candidates failed to state what happens to hormones after completing their action in target organs (ECZ, 2009).

Most candidates failed to show the difference between excretion and homeostasis and therefore mixed up the role of the kidney in excretion and the role of the kidney in homeostasis (ECZ, 2009).

According to the chief examiners report of the 2008, despite the definition of homeostasis being asked almost yearly, candidates still failed to give the correct definition. Most candidates knew the component of the definition but were just mixing them up. This clearly shows lack of understanding on the part of the candidates.

Many candidates could not define homeostasis in terms of regulation of a constant internal environment. Many candidates could not relate functions of the liver related to homeostasis (ECZ, 2009).

It was clear that candidates just learn ecology without the aspect of biodiversity. Most candidates showed very little understanding of the term biodiversity. Some candidates referred it to food web (ECZ, 2008).

According to the examiner's report of the 2006 Biology practical exam, generally most of the candidates failed to apply mathematical skills in trying to answer a question on graphs. The majority of candidates failed to draw the graph. Many candidates performed poorly on a question involving reading points on the graph and interpretation of data on homeostasis.

In addition the 2009 Biology paper two covered a wide range of topics in the syllabus, but the general performance by candidates was very poor compared to the last few years. Most pupils could not identify cells, interpret graphs, or even grasp what each question was asking for.

Nearly one quarter of the candidates got zero or below 10 out of the maximum possible mark of 80 (ECZ, 2009).

Apart from failure to draw the graph, a large number of candidates also failed to explain what they had seen in the experiments on the leaf. The explanation given showed either some memorized work or total ignorance of what they were supposed to do (ECZ, 2009).

Further analysis of the biology results shows that in most cases, pupil's performance was worse in the practical test than in the theory examination papers. In other words, the performance in the practical test is a major contributor to candidates overall poor performance in biology. This means that pupils are rarely engaged in meaningful practical activities and therefore they find the biology practical examination new (Haambokoma, 2007, Mudenda, 2008).

With regard to practical work, pupils' poor performance in school certificate examination in the last 10 or so years suggest that teachers needed further professional development in this area. Examiner's report of 2009 points to the fact that drawing specimens, measuring, calculating, magnification and food tests were a problem to pupils. This suggests that pupils were not adequately prepared in those areas (Haambokoma et al, 2002).

ECZ (2009) reported that most drawings were of poor quality. Once more, the issue of failure to calculate magnification was prevalent among candidates in most schools. Candidates still had problems with the formula for calculating magnification. The other major difficulty was in the



application of scientific facts to real life situations. Most pupils found it difficult to explain why there is spacing of seeds when planting.

In the same practical exam of 2008, the chief examiner said that the drawing skills were still very poor. Among the expectations in the questions were that the drawings should be realistic (close to the specimen), clean and neat. In most cases the drawings were dirty with a lot of rubbing, in some cases shading (ECZ, 2009).

According to the chief examiners report of the 2008 joint examination for school certificate and general certificate of education ordinary level biology, most candidates did not answer the questions correctly and it was also evident from the pupil's responses that most teachers do not cover the whole syllabus. Hence topics like genetics and ecology suffered a lot. In addition the chief examiner reported on the biology practical examination that most pupils showed lack of proper biological understanding of the concepts despite some questions been routine. Moreover, the problem of magnification was still rampant (ECZ, 2008).

The section above has outlined the topics pupils find difficult to learn and the nature of errors candidates make when answering biology examination questions. However, the next section will concentrate on the causes of learning difficulties pupils experience.

### **2.3. Causes of learning difficulties pupils experience**

Comber and Keeves (1973) who were looking at science education in nineteen countries reported that in primary and elementary schools, where students spend most of their school day under the supervision of a general classroom teacher, some science has been taught traditionally under, the name of nature study in most countries. The work has usually been restricted in scope almost entirely descriptive in character, and often without the observation basis which is an essential feature of scientific study. These deficiencies can be related to the lack of specialized knowledge and adequate training on the part of the teachers and, to a lesser extent, to the absence of suitable physical facilities.

Comber and Keeves (1973) reported that in most countries, pupils either have no laboratory experience in their science learning or are taught in large groups through teacher demonstrations, and this fact is related to the low provision of laboratory assistance in these cases. However, those countries which emphasize individual practical experience make attempts both to reduce laboratory group sizes and to provide the necessary ancillary help.

In most school settings, typical instructions emphasize the memorization of classification schemas and established theories. In middle school, classification may take the form of learning the names of the bones of the body, the names and shapes of different plant leaves or the phyla in the animal kingdom. In high school and early undergraduate studies, the content broadens to include unseen phenomena such as parts of the cell or types of protozoa, but the processes of memorizing classifications remains essentially the same (Wilensky and Reisman, <http://ccl.sesp.northwestern.edu/papers/bio/short> ).

Haambokoma (2007) established that most of the heads of science department have never attended any kind of workshop or course pertaining to managing a department. This suggests that they lack management skills as a result they do not monitor learning of pupils in the subjects they have been mandated to supervise. Haambokoma (2007) goes on to say that the majority of heads of science department have expressed willingness to be educated on the monitoring of teaching and learning and on the management of practical examinations. It would appear from their submissions that these areas have been giving heads of science departments' problems to handle.

Ezewu (1990) believed that a child's mental capabilities and emotional behavior which are the necessary ingredients for school education are greatly influenced by the type of family an individual comes from. Psychologists have always been keen to discover just what proportion of our makeup is due to heredity and what to environment. However, this desperate attempt to find the truth has revealed that heredity dominates the life and behavior of some individuals while others are influenced by the environment. The stronger and more dominant the forces of either heredity or environment are, the greater are their effects on the individual. Therefore teachers must be aware of pupil's backgrounds whenever they are teaching so as to make informed decisions on the type of methodology to apply in the classroom.

Mashambe (1973) explains that environment controls the learning activities of the child. It is the culture in which teaching and learning takes place. The home, the community, the physical environment the school and the classroom are aspects of the environment which control learning. These different aspects of environment may not be always working in harmony. It is left to the management to try and synchronize them. It seems that there is a very strong evidence to suggest

that the individual differences in learning ability stem in part from inheritance, very considerably modified by a wide range of personal circumstances, some of which can be changed by parents and teachers.

In addition Argule (1967) argued that while there is probably a genetic factor which sets the possible limits for abilities like speaking and proper reasoning, educational and other environmental experiences are important in deciding how far each person's ability is developed for use.

The views raised by the researchers above are also supported by Chibesakunda (1983) who believed that some pupils might have been brought up in a culture in which magic, witchcraft and other supernatural play a great part. From the stand point of science education such beliefs, attitudes and schemes of reasoning create barriers to learning.

Case (1968) believed that we communicate with our pupils mainly by a combination of speech and writing. It is probably fair to generalize by saying that in lessons the emphasis is on speech. One thing remains certain, ideas pass from the teacher to pupils very largely by means of speech, where as our pupils interpretation of those ideas is more often returned to us in some form of written work. Therefore there is need for teachers to use appropriate speech to enable pupils understand easily.

The lack of competence in English language by both teachers and learners affects the teaching and learning of science and the immediate consequences of this, is students' poor performance in school subjects including science (Case, 1968).

A number of studies have shown that learning in the second language can pose challenges for learners. The language used for learning and teaching in most schools in Zambia is English, an additional language to the majority of pupils. According to Orton (1992), the language that supports the thinking process is likely to be the home language. Even when learners pronounce their thinking of English words their home language has an influence, because it is the one used for thinking. Therefore they find it difficult to follow what the teacher is saying

The issue of language contributing to learning difficulties has also been reported in Namibia. Pupils are unable to communicate fluently in English and find it difficult to take part in class discussions, a feature of learner-centered teaching. In addition, low performing students usually give up once faced with a challenging task to which the response cannot easily be obtained. In this case a teacher faced with reluctant learners, unable to take part in learning process actively ends up resorting to teacher-centered methods to avoid the oppressive silence in the classroom (NASTA, 1994).

Case (1968) explained that as far as science is concerned, English is a language full of great precision in vocabulary. African languages, while very rich in describing and naming some aspects of life are deficient in scientifically precise words. Therefore, Zambian languages also have greatly contributed to pupil's underachievement in biology.

Chibesakunda (1983) revealed that when a learner of science is a native speaker of a language not yet adapted to the purposes of science; his learning through English entails very special

additional difficulties of cognition and understanding. He cannot appeal to translation into his mother tongue for the resolution of doubt or the dissipation of ignorance. .

This is an indication that science students experience difficulties with the language of science all over the world. Students using a second or foreign language as a medium of instruction experiences the additional difficulties related to such use. The overall combination of the language related problems is probably the major cause of the difficulties students encounter in their approach to scientific subjects (Mammino, 1998).

Reece and Walker (1997) argued that when lessons are presented in a very fast manner pupils fail to follow the lesson therefore learning cannot take place. Usually many teachers of biology would like to present lessons very fast so that they can cover the wide biology syllabus.

Orzechowska (1975) believed that it must be obvious to teachers that students differ in the time required to learn any particular topic. But to any one observing a typical class room situation it would mean these differences are largely ignored. In the majority of our classrooms the work is covered at the apparent speed of the average learner. Whatever the teaching method used, lecturing and note giving, demonstration experiments or student experiments, the faster pupils monopolize the lessons. They shoot up their hands to ask questions or give answers and they quickly become bored, never realizing that school work has any potential for being interesting and challenging. The slower learners sit in silent frustration, unable to follow what is going on in the class room. More often both teachers and students accept the labeling of the faster learners as bright and the slower learners as lazy or dull, this has also impacted negatively on the learning of science.

High-ability pupils are usually rewarded with the highest grades, marks and publicity while the efforts of less-able pupils are seldom acknowledged, and their attainments do not inspire effort. Hence, low ability pupils and those who are disadvantaged-pupils who must work hardest have the least incentive to do so (Monk and Osborne, 2000).

Romeo (1968) argued that although much more material is covered in a lecture approach, a relatively small amount is retained. On the other hand, when the students are constantly involved in experimentation and have derived many of the basic generalizations for themselves, the amount of regression or forgetting is significantly less. Although more may be covered by lectures, it is not only possible, but even likely that at the end of a year or so more total information is retained from the laboratory approach than from a lecture approach. Therefore it is wise to keep lectures reasonably short. Hour long lectures are likely to be taxing on high school pupils, college students and even on professionals. Pupils find long lectures boring therefore for learning to be effective learning should be made interesting by using a variety of teaching methods.

Biology, mathematics and physical science teachers tend to ask oral questions to the whole class rather than to individual learners or groups. The questions asked are mostly closed and dominated by a need for learners to recall information. Questions requiring analysis or evaluation are rarely asked (Malinki, 1972). Therefore there is need for teachers to practice how to ask questions which could provoke the thinking of pupils. Petty (1993) also emphasized the need for

pupils to ask questions because this is a very important part of learning and contributes positively to the learning process.

Malinki (1972) believed that the only activity teachers make their children do is answering questions, usually after much teacher talk. These are direct questions requiring factual knowledge. Teachers rarely ask questions which can stimulate children's thoughts. Children are told to take notes of whatever the teacher says is correct without deep understanding of the subject. This has also impacted negatively on the learning of pupils.

Very few text books of biology have presented alternative forms of practical work on genetics for the pupils. This view is also held by Haambokoma (2007) who recommended that text book writers should ensure that Biology text books meant for high schools should cover genetics adequately in a way students can understand and that teachers should give adequate explanations to students using visual aids, practical activities and relating genetics to real life situations.

Many Biology text books discuss classical experiments and accepted results on genetics but they do not suggest in any detail experiments or observations which might be performed by pupils and many experiments on genetics are incapable of leading to simple results.

Schmid and Teraro (1990) put the blame on the highly conceptual nature of Biology which seems to be difficult for most pupils. Schmid and Teraro (1990) believed that the techniques used in the classroom have not sufficiently eased the learning process and they feel that little has been done regarding the learning processes that underlie biology instruction.



One of the limitations to biology investigations in the laboratory is that either many life processes are far too lengthy, such as the effect of parents, dominant and recessive genes on subsequent generations of offspring, or far too complex such as the effects of nutrition on blood sugar levels in the school laboratory (Schmid and Teraro, 1990). Therefore it is not easy for teachers to illustrate some biological facts using experiments.

However, Schmid and Teraro (1990) reported that biology is so difficult to teach and learn because it consists of a myriad of unfamiliar concepts involving complex relations. They identified rote learning as the school's favored approach to teaching unfamiliar material. However, rote learning fails in the face of complex interactions involved in Biology.

In Zambia, there is a serious shortage of qualified science teachers and the teachers are poorly paid forcing them to engage in other part time jobs thus neglecting their pupils. This situation was reported as early as the nineteen sixties by Richardson et al (1968) who attributed the causes of learning difficulties on the suffering of the science program in our schools due to the shortage of adequately prepared teachers hampered by a lack of adequate physical resources and an unimaginative educational program. The salaries of our teachers have suffered to the extent that many have been unable to continue in their work and have chosen other occupations. Many have taken a second position, or part-time work, thereby diluting their time and energy. Usually teachers do not prepare much for the pupils due to fatigue.

This fatigue of teachers results in teachers having unfriendly attitudes towards students when teaching and pupils are not even allowed to seek clarification on issues they do not understand (Haambokoma 2007).

The shortage of university graduate teachers in Zambia has been experienced mostly in mathematics and science subjects at high school level (MoE, 1996). This situation has forced the Ministry of Education and private schools to employ untrained graduates to teach science in schools provided they have a science background. Because of lack of training in teaching, their lesson presentation is not effective in most cases and this has also contributed to underachievement of pupils in science subjects in schools where they have been deployed (Haambokoma and Chabalengula, 2003).

Some of the issues which came through from the review presented above include: absence of suitable physical facilities such as well-equipped laboratories, lack of management skills by heads of departments, genetic and environmental factors, lack of competence in English language by both teachers and pupils, speed of lesson presentation, labeling of pupils as bright and dull, lack of questioning skills by teachers, lack of well-illustrated textbooks and shortage of graduate teachers.

The section above has outlined the causes of learning difficulties pupils experience in biology. However the next section will concentrate on the proposals advanced to facilitate learning.

## **2.4 Proposals advanced to facilitate learning**

There are two requirements for effective learning. The pupil has to be able to learn, that is possess the necessary processing capability and prior knowledge, and the pupil has to be willing to learn, that is possess the necessary motivation to engage in the task and to Persevere (Adey, 2001).

Teacher's attitude is very important in facilitating learning as reported by Safuli and Mtunda (1986) who said that most educational thinkers agree that besides knowledge about the learner, teachers' attitudes play an important role in the teaching and learning process. This promotes confidence trust and respect for one another and eventually promotes pupils' learning.

An important prerequisite in science learning is motivation (Das, 2007). Without interest and incentive, learning does not become meaningful. Motivation may therefore be said to be the heart of the learning process. The teacher should introduce the topic of science in an interesting way and make the content presented meaningful so that the learners find their work interesting and do all the activities willingly. It is the responsibility of the science teacher to evolve new patterns in his teaching to motivate the pupils to learn with zeal and eagerness.

ECZ (2007) recommended that candidates should be encouraged to draw neat and clear diagrams which are well labeled. At least the diagrams should occupy three quarters of the space provided and must also be realistic.

Different types of tests should be given to pupils to help them revise difficult topics as shown by Das (2007) who believed that assessment is a key in assisting pupils to revise perceived difficult topics.

Examinations remain a critical factor in influencing the learning of biology. Teachers tend to focus on those aspects which gain examination grades rather than on important outcomes such as practical skills, in depth understanding of the discipline and socially relevant attitudes and values. The role of teachers in determining examination policy and in contributing to question banks is also an important issue, especially if examinations are to be intellectually stimulating and challenging instead of being channeled into modes of presentation which are mechanically and intellectually similar from year to year and from test to test (Meyer, 1988).

The teachers should make use of incentives such as providing scope to display pupils work. Giving responsibility and leadership in scientific activities, keeping the pupils informed of their progress in science, providing opportunity for pupils demonstration, arranging for pupils co-operative enterprise in science, organizing field trips or visits and also science clubs and science fairs, creating a sense of healthy competition among the pupils. The learners should be actively involved in the learning experience (Das, 2007).

Haambokoma, (2007) and Hashweh, (1987) also discovered that the extent of mastery of the topic by the teacher has a major influence on the quality of explanation a teacher can give to students.

As early as the nineteen seventies Mashambe (1973) advised that in order that different factors work in harmony to bring about maximum learning, there must be a good organization of staff, pupils, finances and curriculum. The purpose of organization is to promote efficiency and economical operation in order to obtain maximum results. Principles of Biology should be taught in terms of developing the objectives of general education. Questions should be encouraged from students that would stimulate their thinking about the implications and applications of Biology to everyday living.

The art of formulating questions is a major task of the teacher. However, it should not be assumed that principles of Biology can be taught best by merely stating them and supplying the necessary facts to prove them. Some Biology teachers who teach Biology in terms of everyday problems are able to develop an understanding of the principles of Biology more effectively as one of the outcomes of solving Biological problems or of organizing the course around daily problems (Dreyer, 1994).

At the heart of good teaching lies good planning and good management. Individual lessons need to be well planned and structured. Individual lessons must also relate to previous lessons, previous knowledge and previous understanding and connect to future lessons and future learning. This is why individual lessons need to be planned and sequenced into a scheme of work (Wellington, 2004).

In this regard, the teacher training curriculum is geared towards producing an effective and competent teacher to meet the expectations of society. Cooper (1982) comments that for a

teacher to be effective, he/she must have a command of theoretical knowledge about learning and human behavior. He/she should know how humans develop and learn and also understand that children have differences. This would assist him/her plan his/her lessons appropriately and vary his/her teaching strategies. Qualities such as well trained teachers, highly qualified teachers and having teachers who perform their duties responsibly have a bearing on the effectiveness of teaching and creation of a good learning culture.

A teacher should also have command knowledge of the subject matter to be taught. With this, he can teach confidently and effectively. He should also have control of technical skills of teaching that facilitate learning. The teacher, in this case, is perceived as a person who needs to be conversant with various skills so that when he comes in contact with the children who have varied social backgrounds and learning abilities, he/she should find it easy to switch from one teaching strategy to another (Safuli and Mtunda, 1986).

Promotion of CPD for teachers of biology should be emphasized as MoE (1996) explained that training and professional development underpin what a teacher can accomplish in a school. The essential competences required in every teacher are mastery of the material that is to be taught, and skill in communicating that material to pupils. These deceptively simple formulations cover a great array of knowledge, Understanding and skills that must become integral to every teacher. The initial preparation, provided at training colleges and the university does no more than lay the foundation for a life time of teaching. There is need for regular ongoing development in a

process that is never complete. This is because a teacher's professional life revolves around two areas of never ending growth and progression.

The need for CPD for science teachers is an issue which has been advanced as early as 1960 for example MoE (1960) a pamphlet produced in London on science in secondary schools also agrees with MoE (1996) produced in Zambia on the need for teachers to embark on continuous professional development by advising that it is of advantage for any teacher, at whatever stage he proposes to teach science to have reached the standard of a university degree. It must be emphasized however that, even for the specialist teacher of advanced work, this is not all, and the possession of a university degree, desirable as it may be, is not by itself sufficient. All the ablest teachers of science would testify to the necessity for continued development after graduation. The attainment of a degree involves little more than the passive absorption of the ideas of others. Beyond this all good teachers of science possess a measure of originality. They are able to recognize problems which are within the powers of their pupils to solve and guide the investigation of them (MoE, 1960).

Washton (1981) stated that to teach Biology for the development of basic laboratory skills and an understanding of biological principles, it is necessary that minimum apparatus and supplies become available. Moreover, Biological principles can be taught effectively through the use of living as well as preserved specimens.

Practical work is one of the hall marks of science and many educators argue that a science education without practical work fails to reflect the true nature of scientific activity. This has led

to a widespread acceptance in many countries of a strong emphasis on pupils doing practical work. There is now a need to examine carefully the purpose of different kinds of practical activity in order to select appropriate strategies for achieving different aims.

Theory and practice are interrelated. Practical work needs essentially to be about thinking; that is about trying to understand the relations between evidence and theory and to stimulate and challenge pupils (Monk and Osborne, 2000).

ECZ (2007) reported that there is need to encourage all schools in the country to have laboratories which are well equipped and that students should be encouraged to carry out experiments so that they do not face difficulties during the final examinations.

The natural environment of any region is another aspect that can work for or against the spread of effective biological education. Therefore, the curriculum should be based on an analysis of the local environment and which focus on a study of local animals and plants because this will have immediate relevance. Great care must be taken, therefore not to import unsuitable resources and curricula, without at least undertaking extensive adaptations to match local circumstances (Meyer, 1988)

In biology, the interactions between predators and prey form one of the most important features of an ecosystem, and there are now many computer programs which enable pupils to experiment with a simulated predator-prey system. Pupils can study complex interactions using one prey and one predator species. Given the limitations of time for studying such a system, and lack of access



to species in their natural habitat, pupils have no other way of investigating these interactions. Either in the laboratory or through field work (Monk and Osborne, 2000).

For cooperative learning to be successful, Johnson et al (1994) indicated that there are five requirements, namely:

1. Positive interdependence

The success of one person depends on the others. Students must both (i) learn the material and (ii) ensure all group members learn it. No free loaders are allowed; everyone must contribute.

2. Face to face interaction

Students facilitate each other's success

3. Individual accountability and personal responsibility to achieve group's goals

Students learn together but perform alone. The group holds each person responsible for contributing their fair share to the group's success. Each person's contribution should be assessed. Feedback should be given to individuals and the group.

4. Interpersonal and small group skills

Students must get to know and trust each other, communicate accurately accept and support one another and resolve conflicts constructively. Students need to be taught group skills and motivated to use them.

5. Group processing

The effectiveness of group work is influenced by whether groups reflect on how well they function.

Time needs to be allocated for group processing.

Because teachers are confronted with big classes, cooperative learning has the potential. If shown to be effective to be a valuable teaching approach. It could improve the quality of learning. One teacher is confronted with many learners and this could be of value (Johnson et al, 1994).

The preceding arguments suggest that a lesson presentation that is consistence with active learning is characterized by activities in which pupils fully engage their higher order – thinking mental capacities like analyzing, synthesizing, comparing, evaluating the concepts, principles and procedures, predicting and justifying with each other (Das, 2007).

Teachers should use open-ended questions and allow waiting time for responses, use appropriate levels of challenges, those which learners could perceive as offering them a realistic but not a certain chance of meeting. Teachers should cultivate work environments in which they are able to watch pupils at work and listen to them explaining learning strategies that could be used in the presentation. Create opportunities to use problem solving, games, puzzles, and small group work (Johnson et al, 1994).

The instructions should be organized to involve students to actively construct their own knowledge with understanding and that instructions should stress relationships among concepts, skills and problem solving.

The learning activities that students employ determine to a large extent the quality of the learning outcomes they achieve. Therefore, teachers should be directed at encouraging students to use high quality learning activities (Vermunt, 1996).

The teacher does not take center stage in the classroom but should be a facilitator and listener. The teacher should design activities that focus on allowing pupils support, refine or repute their theories about a particular phenomenon or event (Kristensen, 2000).

ECZ (2002) advised that teachers should introduce pupils to examination words such as explain, state, list, illustrate and many more as outlined at the end of the syllabus. Usually pupils do not know how to use these words which examiners use when asking questions.

Promotion of lessons outside the classroom in biology is also one of the best ways of teaching biology. Biological field trips constitute an important part of learning Biological principles and relationships. A trip, with basic equipment and the instructor, to local marshes, woodlands, forests, parks, ponds, lakes, or rural areas can be a most satisfying Learning experience (Washton, 1981).

Interest in the teaching profession may not be enough for one to be effective. There are different skills of teaching which, when used correctly, would promote good teaching. In this regard, it may be necessary to point out that variation in the use of those skills help to facilitate learning. That is why it would be necessary to emphasize that any teacher training program should try to

include a training component that focuses on the acquisition of teaching skills (Safuli, and Mtunda 1986).

The use of teachers who understand content and learners makes learning easy. Mashambe (1973) described the teacher as a critical learning resource in and outside the classroom, and the teacher sets limits to the effective use of every other resource like the syllabus, textbooks and teaching Aids.

Mashambe (1973) revealed that the teacher must have adequate knowledge not only of his subject but also of all the pupils he teaches. He must possess the right type of personality and have an altitude conducive to establishing a learning situation and must always be up to date.

Teachers should teach in line with what learners already know. Many people think that when a teacher talks to a group of children, learning occurs. Learning does not occur automatically as a result of any kind of unconsidered teaching. For learning to take place, there are a number of prerequisites a good teacher must take into consideration. In the first place what the teacher intends to teach must be in line with the children's experiences (Obioha, 1972).

When preparing and when teaching consider varying learning styles among learners because different people have different learning styles. Some are holists looking for overviews and connections amongst different parts. Some are serialists preferring to take an element at a time (Pask, 1975).

Pask (1975) argued that people learn most effectively if they are taught in a style that matches their preferred mode of learning. This is not an easy task for the teacher when actually teaching, but the difference should be borne in mind when arranging learning activities.

Malinki (1972) advised the teacher to realize that his class consists of individuals and not a mere unit, and as such, general instructions would not meet their needs and that one of the best ways to ensure full participation of individuals in class is by arranging pupils in small groups. Moreover, the teacher must start if possible from the pupil's background of experience. He must make scientific knowledge appear immediately useful, practical and valuable, and not present it as abstract academic knowledge divorced from everyday life.

Teachers should provide opportunities for learners to participate in the learning process because learners remember things they do themselves and not things they hear or read about. Participation by children in lessons is therefore of immense importance. Nothing is learned unless the learner is active in it. This is true learning as opposed to parrot learning, which fades rapidly from the learners mind (Obioha, 1972).

Modern biology education also emphasizes outcomes such as community values and improvements in the quality of life. If such outcomes have to be achieved, teaching methodologies must be creative, responsive and innovative (CDC, 2000).

Teachers should use a variety of teaching aids as advised by Wellington (2004) that instructions should be given using a variety of visual or aural support materials including: Drawings, diagrams and pictures as support for the spoken words. For some practical activities preferred

pictures with words of different stages in an experiment can be given and pupils asked to sequence them correctly and perhaps label them. Obviously the sequence will need to be checked before starting.

ECZ (2007) advised that calculation of magnification should be emphasized once more as it is a serious setback for most candidates. The formula is:

$$\text{Magnification} = \frac{\text{Size of image}}{\text{Size of object}}$$

It is believed that for teachers to effectively encourage good learning by students, they should possess such qualities as good manners, modesty, responsibility, friendliness, and appropriate speech (Mtunda and Safuli, 1986).

By its nature biology touches on beliefs and more especially on religion and morality. An effective program, therefore, must take cognizance of cultural differences in the development of curricular. Language, of course, is an obvious attribute of culture and problems associated with mother tongue in contrast with a foreign language, must be considered (Meyer, 1988)

Qualities such as well trained teachers, highly qualified teachers and having teachers who perform their duties responsibly have a bearing on the effectiveness of teaching and creation of a good learning culture (Das, 2007)..

Discovery learning must be encouraged (Yandila, 1994). Discovery methods of learning are in the forefront of the instructional techniques to which educators are currently giving attention.

Large scale curricula projects in science and mathematics as well as numerous research studies, feature independent discovery, self-directed study or heuristic methods. The teacher or the experimenter using these approaches directs the learner's attention to some data or problems and encourages him to search more or less independently for solutions, rules, or effective strategies. The teacher may provide various forms and degrees of guidance, but not the answers, the learner is expected to find, derive, infer or discover them. This popularity may suggest that discovery methods have been shown to be generally superior to other methods (Monk and Osborne, 2000).

## **2.5. Summary of literature review**

In this chapter, I have presented a review of literature related to this study. The major issues coming through the reviewed literature are that pupils find certain topics in biology difficult to learn like genetics, ecology, coordination, homeostasis and the skeleton. Also during practical examinations pupils fail to draw proper biological diagrams and find it difficult to calculate magnification. Causes of learning difficulties emerging from the review of the literature include: Lack of seriousness by teachers, lack of practical work, lack of explanation from teachers, inadequate teaching and learning materials and the language of instruction. Literature review has also shown that the most frequent reasons given for learning difficulties in biology are the complexity of the content areas, abstractness and sophistication of certain biology topics.

Physiology content areas are mostly abstract and microscopic and they contain many fine processes that require proper explanations to enable pupils understand them (Abimbola, 1998).

Ways of improving the learning of biology coming out from the literature include: Strengthening of CPD in schools, which will help broaden the teachers teaching skills. Use appropriately qualified personnel to teach, promote practical work and encourage cooperative learning, teaching in line with what the pupils already know, considering varying learning styles among learners and the use of teaching aids.

Bennett (2001) observed that learning through discovery helps to retain knowledge much longer than we could make it through our tradition way of teaching. The learner should be made aware that it is not only his teacher that has all the information he wants to know but that there are other sources. Self-reliance is also required in learning and this increases pupil's interest and their desire to continue with the study of science subjects.

It has also been discovered that learning difficulties can only be minimized when pupils experience, observe, hypothesize, predict, manipulate objects, pose questions, research answers, imagine and invent in order for new constructions to be developed (Fosnot,1989).

However, from the reviewed literature, we cannot clearly state the nature and causes of learning difficulties in biology amongst high school pupils in Samfya District. Therefore, there was need to carry out this study.



## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.0 Introduction**

This chapter covers the research design, study population, sample, sampling techniques, research instruments, pilot study, data collection techniques, data analysis and ethical concerns.

#### **3.1 Research design**

A descriptive sample survey design was used in this study to enable the researcher collect data from a wide range of respondents. It involved collecting data from biology teachers and grade 12 pupils. A sample survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals (White, 2005). This method was used in order to solicit the desired descriptive information (Kombo and Tromp, 2006).

#### **3.2 Research sites**

The study was done at Samfya High School and Lubwe High School in Samfya District of Luapula Province.

#### **3.3 Study population**

The study population was all grade 12 pupils and biology teachers in the two high schools of Samfya District. Grade twelve pupils were chosen for the study because they had covered almost the entire biology syllabus therefore they were in a position to provide information needed to answer the research questions compared to pupils in other grades (Sidhu, 2006).

### **3.4 Study Sample**

Due to limited resources and time, only a sample out of the study population was studied (Sidhu, 2006). The sample consisted of 80 pupils drawn from two high schools namely Samfya High School and Lubwe High School. Forty pupils were drawn from each school comprising twenty boys and twenty girls. The two high schools were selected because they were easily accessible to me (Nkhata, 2003).

### **3.5 Sampling techniques**

Pupil participants were selected using simple random sampling (Kombo and Tromp, 2006). It was done as follows; numbers were written on pieces of paper and were assigned to all grade 12 pupils and put in boxes, one box for boys and one for girls. The boxes were shaken thoroughly to mix the contents. Numbers of pupils who were to participate in the study were picked from the boxes by hand (White, 2005). Ten biology teachers were selected five from each school on the basis of availability and willingness to participate in the study. Nine male teachers and only one female teacher (White, 2005).

### **3.6 Research instruments**

The research instruments used for data collection included interview guides and self-completion questionnaires. The contents of the interview guides and questionnaires were derived from the research questions. The interview guide and questionnaire were meant to collect data on learning difficulties grade 12 pupils experience when learning biology, their causes and how they could be minimized.

### **3.7 Pilot study**

Data collection was preceded by a pilot study at Twingi High School in Samfya District of Luapula Province between December 2009 and January 2010. Thirty pupils and five teachers participated in the study. The purpose of this pilot study was to examine the open-ended questions in the interview schedule and questionnaire for bias, sequence, clarity and face validity (Marshall and Rossman; Denzin and Lincoln, 2000). The pilot study was intended to determine the usefulness and reliability of the design of the study, research instruments and procedures for data collection and data analysis (White, 2005). It was discovered from the pilot that pupils were unable to describe the difficulties they experience in learning biology on the questionnaires therefore personal interviews were also included in the main study.

### **3.8 Data collection Procedure**

Entrance into schools was permitted by the two head teachers of the schools. A letter of introduction was provided by the office of the DEBS. The two head teachers were approached and given the introductory letter from the office of the DEBS. Permission was granted to carry out research in the two schools and with the assistance from the head of departments, pupils and teachers were mobilized to participate in the study. Questionnaires were administered by the researcher with the assistance of the heads of departments to the pupils and teachers. Individual interviews were conducted with some pupils and teachers. Data from the interviews was recorded on plain papers in note form by the researcher.

Interview schedules and questionnaires were used to gather data from biology teachers. However, in order to allow for the collection of as much relevant information as possible the

interviews were not tightly structured. Therefore, relevant issues which were not included in the interview schedule but arose during the process of conducting personal interviews were explored and noted down in impromptu supplementary questions. Follow-up probing questions were also asked for elaboration or clarification (White, 2005). Some grade 12 pupils were interviewed while others were given questionnaires to complete depending on their wish. This also applied to teachers; those who were willing to complete the questionnaires were allowed to do so while others opted to be interviewed. Other teachers and pupils wanted both the interviews as well as the questionnaires. The reason for using two methods for collecting data was to combine the strength of both methods so that validity and reliability were established in the research findings (White, 2005; Borg and Gall, 1989; Kumar, 1999; Kombo and Tromp, 2006).

### **3.9 Data Analysis**

The data collected were analyzed using the content analysis approach (Kombo and Tromp, 2006). This involved identifying, categorizing and listing responses according to themes. These responses were coded and grouped by establishing the emerging themes.

### **3.10 Ethical concerns**

All the participants were assured that the information which they gave would be treated with confidentiality. Names of participants were omitted and they were only identified by number. Efforts were made to ensure that the study was undertaken in a morally acceptable manner. In this regard the following were done:

1. Permission was sort from school management to conduct the study in the schools.
2. Heads of departments were asked for assistance in the distribution of questionnaires and in organizing interview sessions with teachers and pupils.

3. Permission was sort from the pupils who participated in the study.

## **CHAPTER FOUR**

### **FINDINGS**

#### **4.0 Introduction**

In this chapter, findings of the study are presented according to the research questions. The first part of this chapter gives the findings from the pupils and teachers on the nature of learning difficulties. The second part gives the findings from the pupils and biology teachers on causes of learning difficulties obtained through questionnaires and interviews and the last part presents what pupils and teachers thought should be done to improve the learning of biology.

#### **4.1 Topics pupils found difficult to learn in biology**

The majority of teachers and pupils revealed that learners usually find the following subtopics under genetics difficult to learn; mitosis and meiosis, chromosomes and genes, DNA replication, monohybrid crosses, mutation and evolution. Other subtopics found difficult to learn included flow of energy in food chains, motor neurons and sensory neurons, water balance and osmoregulation, reproduction and the skeleton and locomotion.

#### **4.2 Learning difficulties experienced by pupils**

##### **4.2.1 Biological terms**

Pupils were asked to state the difficulties they experienced when learning biology. The majority of pupils who completed the questionnaires indicated that they did not understand the biological terms, such as mitosis, meiosis, heterozygous and homozygous. Most of the terms used were difficult to remember. One teacher observed that pupils had difficulties in understanding biological terms like mitosis, meiosis, heterozygous and homozygous, biceps and triceps,

protandry and protogyny and that their spellings were poor due poor English background and that they failed to define biological terms. Moreover, another teacher wrote that pupils fail to express themselves clearly and this made them fail to participate fully during learning.

On pronouncing biological terms pupils feel that some teachers do not pronounce the terms very well. One pupil wrote that:

*Our teacher does not pronounce the biological terms correctly and it seems as if use of English is very difficult for her and that she used vernacular when teaching.*

#### **4.2.2. Genetics**

Genetics is in most cases found difficult to understand by pupils. One pupil said that he found Genetics difficult to understand. His exact words were as follows:

*I do not understand Genetics, I usually find so many similar words and they are so confusing and monotonous.*

This was also observed by one teacher who said that:

*Genetics has similar terms and confusing processes under mitosis and meiosis. Even diagrams representing these processes are usually confusing and not very clear to pupils.*

With respect to meiosis and mitosis another teacher wrote that:

*The five stages of mitosis which are interphase, prophase, metaphase, anaphase and telophase are similar to those under meiosis and it becomes difficult to differentiate between mitosis and meiosis. Meiosis also has no interphase in the second division and*

*stages in the second meiotic division which are called as prophase II, metaphase II, anaphase II and telophase II are similar to mitosis there by causing more confusion.*

One pupil submitted that co-dominance and incomplete dominance are usually poorly presented by his teacher and he found the two terms confusing.

Another pupil wrote that:

*“I find DNA replication difficult to understand and I usually forget the nitrogenous bases which hold the two DNA helices”.*

One teacher observed that pupils fail to draw genetic diagrams and they usually fail to label the diagrams correctly. They also fail to show ratios of off springs in F1 and F2 generations.

#### **4.2.3. Ecology**

One pupil admitted that he was not comfortable with ecology and food chains. He put it as follows:

*I usually find the terms habitat, community and ecosystem similar, therefore I fail to differentiate between them. To me a habitat is the same as a community and a community is the same as an ecosystem.*

One teacher also admitted that it was difficult to make pupils understand ecology and the ecosystem due to terms having similar meanings.



#### **4.2.4. Evolution**

Evolution is usually found to be contrary to religious beliefs as indicated by one pupil who wrote that:

*I have no interest when the teacher is explaining evolution because I see it as false due to my religious beliefs as a result I find mutation and evolution difficult.*

One teacher also agreed that pupils do not take evolution and mutation seriously as they think that evolution is false.

#### **4.2.5. Diagrams**

Diagrams are usually difficult for pupils as shown by one teacher who stated that:

*The biggest learning difficult in biology that I consider in pupils is that, they fail to draw diagrams. This learning difficult has led to pupils failing to draw proper diagrams in the biology practical examination.*

#### **4.2.6. Practical activities**

Practical activities also make many pupils uncomfortable as shown by one teacher who wrote that:

*Pupils have phobia for practical activities they face serious problems in the writing of observations and results as well as conclusions based on their practical activities.*

Five pupils indicated that teachers concentrate on teaching the theory part forgetting the practical material. On the lack of experiments one pupil had this to say:

*The difficulties that I experience when learning biology is that as a class we do not go for experiments in the laboratory as a result we fail practical tests because some of us we do not know how to use laboratory apparatus and we have never seen these apparatus before.*

#### **4.2.7. Graphs**

Graphs are usually poorly plotted by pupils. One teacher made a comment regarding graphs and had this to say:

*Pupils are unable to plot graphs and interpret them therefore they always do badly when answering questions on graphs.*

#### **4.2.8. Magnification**

On magnification one teacher said that pupils do not write the formula for magnification correctly, hence they fail to calculate magnification.

#### **4.2.9. Nervous system**

One teacher wrote that pupils have difficulties in differentiating between motor neurons and sensory neurons, he put it as follows:

*Some pupils do not know that the multi-polar neurons are neither sensory nor motor but make connections to other neurons inside the central nervous system. Other pupils also confuse themselves by stating that the sensory neurons carry impulses from the central nervous system to the sense organs instead of stating that sensory neurons carry impulses from the sense organs to the central nervous system.*

#### **4.2.10. Homeostasis**

Water balance and osmoregulation are also considered difficult by pupils. One teacher had this to say:

*Pupils find water balance and osmoregulation difficult, they fail to show that water balance is related to blood concentration, the regulation of the osmotic strength of blood is usually misunderstood by pupils.*

#### **4.2.11. Reproduction**

Reproduction is also considered difficult by pupils as shown by one pupil who said that:

*Reproduction has too many terms like oestrogen, androgens, corpus luteum, and endometrium, progesterone which are confusing and difficult to remember. Other terms like vagina, testes, and penis appear like insults therefore teachers do not like mentioning them.*

#### **4.2.12. The skeleton and locomotion**

The skeleton and locomotion was also listed among difficult topics by twelve (15%) pupils this is shown by one pupil who said that:

*The mammalian skeleton has too many bones and their names are difficult to remember, this makes their functions also difficult to remember.*

Some of the difficulties pupils experience when learning biology have been described above, However, some of the causes are listed in the section below

### **4.3 Causes of learning difficulties as perceived by pupils and teachers**

Participants cited a number of issues which they thought have brought about difficulties in learning topics in biology. These are presented below: lack of seriousness by teachers, frequent change of teachers, no practical work, bulky syllabus, scheduling of topics, lack of explanation from teachers, language of instruction, large classes, overloaded teachers and inadequate teaching and learning materials.

#### **4.3.1. Lack of seriousness by teachers**

One pupil wrote that in her class the biology teacher was not serious when teaching. She put it as follows

*Our teacher is not serious with his teaching, he makes a lot of jokes away from biology and he does not even write a lot of things on the board.*

#### **4.3.2. Lack of continuity**

Another pupil complained of lack of continuity in the learning process due to frequent change of teachers within the academic year. She expressed concern that since the beginning of the year, her class had a new teacher each term, and he was having problems to adjust. Others mentioned the coming in of student teachers from colleges as a disturbing factor as these new teachers usually start from where they are comfortable and not where the other teacher left.

#### **4.3.3. Bulk notes**

Two pupils cited the bulkiness of the notes such that it becomes difficult to put them into their brains.

#### **4.3.4. Labeling pupils**

One pupil revealed that teachers concentrated more on bright pupils and largely ignored those with learning difficulties and had this to say:

*Our teacher does not allow those who have not understood to ask him questions and if those he knows to be intelligent have understood he goes on to introduce another topic and tells us to ask those who are intelligent to explain to us and he says that he does not like wasting time on simple things.*

#### **4.3.5. Lack of remedial work**

Another pupil wrote that teachers were not available for help when needed outside normal classes. As a result most of their difficulties in biology remained uncorrected and the slow learners always lagged behind. He stated that:

*It is difficult to seek help from our biology teacher because he is also involved in sporting activities making him very busy.*

#### **4.3.6. Pupil's inability to ask questions**

One pupil wrote that some teachers are too harsh such that we failed to ask questions and also that some teachers were hiding information for instance when teaching reproduction.

#### **4.3.7. Inadequate explanations from teachers**

Another pupil revealed that some teachers did not explain fully and that they made a lot of jokes away from biology and that they were telling a lot of stories, she put it as follows:

*Mainly we are given teachers who are not good at biology. Teachers have specific subjects to teach, now at this school it has been observed that any teacher who is found in the natural sciences department can teach biology. Biology is a difficult subject which requires specific biology trained teachers. Many female biology teachers take biology as a subject that can be taught as Bemba. They usually spend most of their biology periods telling stories, giving guidelines to pupils instead of teaching. Lastly but not the least our background has contributed to increasing these problems that we face in biology.*

#### **4.3.8. Lack of experimental work**

One pupil cited lack of experiments when learning biology. His exact words were as follows;

*Biology topics need experiments to understand them, when we are taught without experimenting or putting in practice. It is very difficult to understand or if understood it is very easy to forget.*

Three pupils revealed that lack of experiments made some topics difficult to learn. This factor was also supported by one teacher who said that practical activities were not often conducted due

to the fact that some chemicals were scarce and were only reserved for mock and final examinations. She put it as follows:

*The notable cause of leaning difficulties among others are that practical activities are not conducted often due to the fact that some chemicals are scarce and are only reserved for mock and final examinations.*

#### **4.3.9. Wide biology syllabus**

Another pupil wrote that biology is very wide therefore it was difficult to finish all the topics. Fifteen pupils observed that some teachers were very slow and that the syllabus was long so teachers failed to complete it in 3 years.

Ten pupils said that the periods allocated to biology in a week were not enough as a result teachers failed to complete the syllabus.

#### **4.3.10. Skipping of topics**

One pupil cited skipping of the topics and too much mixing of languages like Bemba, Nyanja and English and she had this to say

*Our teacher skips difficult topics and teaches using different languages like Bemba and Nyanja.*

#### **4.3.11. Lack of challenging topics at junior level**

One teacher said that challenging topics like genetics were not covered at junior level hence learners found them to be new at senior level. Another teacher revealed that classes are overcrowded with pupils thereby making practical lessons impossible.

One pupil cited digestion as been difficult because the teacher was reluctant in teaching the topic and that the pupils were asked to research on their own. On topics like reproduction one pupil said that some teachers were shy in explaining therefore pupils were asked to read on their own.

#### **4.3.12. lack of motivation and language skills**

Pupils were reported to be lacking motivation to read on their own, and described by some teachers as having language problems, and also they failed to follow lessons. One teacher put it as follows:

*The most serious thing which I see is the English, because some of them (students) when we (teachers) speak they don't understand.*

Twenty pupils revealed that the English language made them feel uncomfortable and that they failed to express themselves in the language clearly and could not participate fully in class. This factor was also supported by one teacher who stated that:

*Some pupils have poor English background in that they are coming from basic schools where vernacular is usually tolerated.*

He further stated that pupils do not have the culture of reading on their own as they are always thinking of examination leakages.



#### **4.3.13. Lack of teaching and learning aids**

Lack of textbooks and other learning materials was a common complaint among the pupils who were interviewed. Most of them indicated that they could not afford to buy necessary books because they were expensive. They therefore looked to the school to provide them with the text books. Unfortunately, the schools were failing to do so due to big student numbers. One pupil expressed concern that in their class, one text book was shared among seven pupils. They therefore could not do enough practice in biology on their own. They mostly depended on the exercises and assignments given by the teacher.

One pupil wrote that difficulties in learning biology were due to the lack of proper learning materials in school. These included the lack of textbooks and laboratory apparatus for experimental purposes. He went on to say that his school had very few teachers of biology to meet the needs of all the pupils. Very few periods were allocated to biology considering the fact that the biology syllabus was very wide.

Another pupil wrote that pupils had negative attitude towards biology and that some teachers failed to pronounce some biological terms correctly. He added that pupils failed to understand questions because they were not well prepared as a result pupils found them difficult to answer. He went on to say that some teachers told pupils that biology was difficult hence pupils came to biology lessons already defeated.

One pupil complained of teacher's lack of interest in pupils, he had this to say:

*I had a very bad teacher who had no real interest in me as a learner. He called me dull and my questions in class were considered silly.*

Eight pupils blamed their teachers for being non-accommodative to them as slow learners, unapproachable and threatening. Others thought that the attitudes of their teachers towards them made them prefer subjects other than biology. For instance, some pupils praised teachers of other subjects for being enthusiastic and interested in all their learners, and blamed the biology teachers for favoring the high achievers.

Twelve pupils said that it was difficult to see their teachers after classes because they either went home immediately after classes or were just reluctant to teach overtime. This blends with the findings from teachers who said that heavy teaching loads and overcrowded classes prevented them (teachers) from giving extra lessons or individual help to those in need.

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Two teachers said that, it was very common for pupils to copy solutions for assignments from each other. Some pupils did not even write the assignments. Some chose to be absent from biology classes and also ran away from quizzes and tests.

Three teachers said that allowing pupils who had failed environmental science to proceed to grade ten and force them to take biology also made such pupils develop negative attitudes towards the subject and did not put enough effort to improve on their grades in grade 12.

#### **4.3.14. Pupil's inability to plot graphs**

Two pupils also regarded graphs to be difficult one of them stated that:

*Our teacher does not teach us how to interpret graphs he just gives us graph papers and asks us to plot curves on them without explaining.*

#### **4.3.15. Lack of mathematical skills**

One pupil expressed experiencing problems with calculations on magnification and he had this to say:

*Our teacher does not teach us how to go about calculating problems on magnification as a result we all failed to calculate magnification during the mock practical examination.*

One pupil cited lack of understanding on how to tackle questions such as those having terms like explain, describe, define and distinguish.

#### **4.3.16. Heavy teaching loads**

Another teacher cited heavy teaching loads as a contributing factor to learning difficulties by pupils. He wrote that:

*Heavy teaching loads are tiresome and prevents us from working harder like organizing special lessons for slow learners and offering individual help to those in need and in big and overcrowded classes, supervision during lessons and tests becomes very difficult.*

Pupils' negative attitudes was an hindrance to effective teaching, other hindrances mentioned by teachers included heavy teaching loads, big and overcrowded classes, lack of textbooks and other learning materials and poor grasp of English language by the pupils.

The section above has described the causes of leaning difficulties pupils experience in biology. However the next section will concentrate on ways of minimizing the learning difficulties.

#### **4.4 What pupils and teachers thought could be done to improve the learning of biology**

Participants cited a number of measures which they thought could help improve pupils learning of biology such as the following: Learning materials must be provided including qualified teachers, chemicals must be bought in adequate amounts and that experiments must be conducted, the syllabus must be made available to pupils and it must be made short, tests must be given to pupils, pupils must learn how to draw diagrams, inspectors must be inspecting biology teachers in schools, teachers must use clear English language to explain biological terms, biology teachers must avoid extracurricular activities, more time should be allocated to perceived difficult topics, funding must be provided for effective planning, management must control enrollment in classes.

##### **4.4.1. Provision of teaching and learning aids**

One pupil indicated that books and graduate biology teachers must be made available in schools, he put it as follows:

*We must be provided with adequate books because biology is a very wide subject that requires us to use our time studying something that we haven't covered with our*

*teachers. We must be given biology graduates or biology trained teachers. The teacher must introduce extra lessons for biology in each class at least in the evenings. The teacher must also start giving us examination questions so that we get used to them. Pupils must also be serious with biology lessons.*

One pupil called for the government to provide more learning materials and increase the number of biology teachers, he put it as follows:

*The school together with the government must provide more learning materials especially books. The number of biology teachers in the school must also be increased to cater for all the pupils in school and also improve the interaction between teachers and pupils. The number of periods allocated to biology each week should also be increased as it is very difficult to finish the syllabus at our school.*

Pupils are also interested in qualified teachers and apparatus for practical examinations as put by one pupil who wrote that:

*They should bring qualified teachers from the university and buy apparatus and teach us how to use them because in the practical examinations pupils shiver.*

One teacher advised that chemicals should be bought in amounts that will be adequate in order to enable pupils carry out practical work. This can also promote confidence in pupils during practical examinations. He put it as follows:

*The chemicals for various practical activities to be brought in amounts that will be adequate so that many practical activities can be carried out in order to make pupils*

*conversant with these practical activities. This can also promote confidence in pupils during practical sessions.*

Teachers emphasized the need for practical work and chemicals and one teacher had this to say:

*Demonstrations and practical work to be carried out so as to reduce the phobia in pupils for practical work. Chemicals to be procured by schools so that practical work in biology to be done than just teaching theoretically, pupils should see. Emphasis to be put on observation and conclusion, for example on food tests, color changes to be emphasized as well as their interpretations in respective practical work.*

The syllabus should be made available to pupils as mentioned by one pupil who wrote that:

*We need to see the syllabus given to every pupil, apparatus in our laboratories, books which are in the syllabus and exam type questions in our tests.*

#### **4.4.2. Provision of experimental work**

Another pupil observed that learning of biology could be improved by showing pupils how to carry out experiments because they usually appear in paper three during the final examination and that teachers should find time to go through some biological terms so that they understand them better before teaching the pupils. Another pupil observed that pupils should also be serious and they should love the subject as well as the teachers.

#### 4.4.3. Improvement in assessment

One pupil advised that tests should be given at the end of each topic and that pupils should have access to the internet, he put it as follows:

*Tests should be given at the end of each topic. Pupils should have access to the internet for them to research what is difficult. The test should have practical papers at each end of the term tests, because we become ignorant on how to answer the papers during exams or even in JETS Olympiads. Pupils should at least be told the topics that they are going to cover the coming term in order for them to prepare and research adequately on those topics during the holiday.*

Another pupil observed that biology periods should be increased, teaching aids should be used regularly and they should provide biology text books. This suggestion was also provided by one teacher who said that:

*In order to overcome learning difficulties we must make sure that learners at any level are able to acquire good biological background by improving learning facilities and providing all the necessary learning materials and equipment to enhance learning moreover, there is need to train laboratory assistants and more biology teachers in order to facilitate the learning of biology in an effective way.*

One teacher wanted pupils to be motivated when learning biology, he put it as follows

*Pupils need to be encouraged and motivated when learning biology. Teachers should be demonstrating how to handle apparatus and chemicals. Also the safety rules should be explained to pupils and lists of the safety rules should be stuck in the laboratories.*

*Teachers should explain instructions on worksheets to pupils before allowing them to carry out experiments.*

*Find examples that display biology in creative ways for example when you are teaching about plant life and reproduction, give the class a lab to grow their own plants. Have each student grow a different one and compare them. You can also cut them open and look at them under a microscope to give you a reason to discuss cell structure.*

#### **4.4.4. Provision of qualified teachers**

Another pupil said that teachers should give notes which are well summarized and that all classes must be given specialized teachers unlike the situation now where only pure classes are given specialized teachers. He went on to say that some teachers take advantage of female pupils by proposing love to them there by compromising their concentration in class. He said that this must be avoided at all costs.

#### **4.4.5. Teaching drawing skills**

Another teacher was interested in teaching pupils drawing skills and he suggested the following:

*Pupils should at least be taught some basic skills in drawing and given enough work on drawing. For example giving them an assignment in drawing of organs of a certain organism.*



Another teacher suggested a similar idea on drawings, he put it as follows:

*Pupils should be given assignments involving both drawings and written tasks. This can help pupils to practice on how to draw proper and good diagrams not only that it will help pupils to study extra hard.*

#### **4.4.6. Inspection by Education Standard Officers**

One pupil wrote that Education Standard Officers should be inspecting teachers teaching and that teachers should find ways and means of winning the attention of pupils and that assignments should be given regularly.

One pupil was against the use of teachers of other subjects teaching biology, she put it as follows:

*You need to give us biology teachers not those pretending to be biology teachers while they are food and nutrition teachers. The Head of Department must also try to check if the teachers are teaching or not. Teachers must stop telling us stories instead they must start giving us examination questions.*

#### **4.4.7. Use of proper English language by teachers**

Another pupil wrote that teachers should use simple English when preparing questions so that pupils could understand clearly. He added that if possible they should be teaching us in our local languages.

One teacher on the use of English language wrote that:

*It is not only the obligation of the English language teachers to teach English to learners, the other teachers have equally the same duties to explain the meaning of the wordings in their respective subjects as words could have different meaning in each subject. Furthermore, learners' inability to do their homework may have a negative effect on their academic achievements. In order to encourage learners to do their homework and assignments, teachers should mark the homework or the assignment regularly and talk to parents to encourage their children to do their work.*

#### **4.4.8. Avoid hiding information**

Two Pupils held the same view that teachers should avoid hiding information when teaching reproduction and that they must be teaching more materials from past examination papers.

#### **4.4.9. Teaching of challenging topics**

Another pupil wanted teachers to concentrate on teaching topics perceived to be difficult, he put it as follows:

*Urge the teachers to teach on vital topics that are mainly brought in the exam. We should be given a task at every biology period to make us revise. Urge the teachers to give encouragement to the pupils concerning the subject. Urge the pupils to study the biology subject widely.*

#### **4.4.10. Avoid extra curricula activities**

One pupil suggested that biology teachers must not be involved in sports activities and that they should leave sports activities in the hands of physical education teachers.

One teacher emphasized the need to consider fast and slow learners he put it as follows:

*Pacing of lessons should take into account the different rates at which pupils learn, i.e. fast or slow. The teacher should be positive and encouraging when teaching biology. The teacher should also use appropriate teaching strategies matching with the outcome pupils intend to attain. The teacher should use teaching aids when dealing with abstract concepts. The teacher should also give examples which are familiar to pupils.*

Two teachers admitted that more time should be allocated to topics perceived to be difficult, one of them wrote that:

*The biology schemes of work should be made in such a way that difficult topics are given more time to be taught.*

#### **4.4.11. Improve funding and control enrolment**

One teacher suggested that funding must be provided for effective planning, paper for lesson plans must also be provided.

Another teacher urged management to control enrolment in classes.

## **CHAPTER FIVE**

### **DISCUSSION OF THE FINDINGS**

#### **5.0 Introduction**

This chapter discusses the findings of the study. The discussion covers the difficulties pupils experience when learning biology and their causes. It also includes what should be done to minimize the learning difficulties pupils experience in biology.

#### **5.1 Difficulties pupils experienced when learning biology and their causes**

The study set out to investigate the nature and causes of learning difficulties in biology at high school level. From the responses given by pupils and teachers it is clear that the majority of respondents regarded biology as a difficult subject to learn. The study also revealed a number of factors which pupils and teachers who participated in the study, thought made it difficult to learn biology.

One of the difficulties cited were the biological terms such as mitosis, meiosis, heterozygous, homozygous and many more. Pupils find biological terms very difficult to understand. This is due to the inability of some teachers to explain the different terms found in the biology vocabulary. This confirms findings of earlier studies (MoE, 1994, Haambokoma and Mwale, 1998, Haambokoma et.al, 2002). Areas identified as been difficult included genetic crosses, genetic terms, mitosis, meiosis, mutation and sex determination.

It was also discovered that pupils find genetic diagrams difficult. Genetic diagrams are usually poorly drawn by pupils, this is usually because teachers do not teach pupils how to draw genetic

diagrams. This is also in line with ECZ (2009) which stated that very few candidates scored marks on the genetic diagram. Most of the candidates who attempted the genetic diagram did not put a cross on the genotype of parents. The cross is a significant symbol. A few candidates wrongly put the cross on the gametes. Teachers really need to teach the correct way of presenting a genetic diagram. ECZ (2008) also revealed that the use of genetic diagrams had been asked almost in all past papers but teachers had not guided candidates well in this area. A good genetic diagram without labeling the parents, parental genotype, gametes and off springs could not score any marks.

Other areas of biology found difficult by pupils included: flow of energy in food chains, evolution, mutation, motor neurons and sensory neurons, water balance and osmoregulation, reproduction and the skeleton and locomotion. These areas are found difficult because teachers do not give pupils adequate explanations. This confirms findings from (Abimbola, 1998). Who included genetics, ecology, nervous system and reproduction as content areas perceived to be difficult by pupils.

The study also revealed that topics like ecology are very difficult because they require a field trip in an environment where pupils can see the food webs and food chains for themselves rather than just describing them. This is also supported by ECZ (2008) the chief examiner wrote that most candidates showed very little understanding of the term biodiversity some candidates referred it to a food web. It was clear from the answers that candidates only learn ecology without the aspect of biodiversity. ECZ (2009) also revealed that most candidates gave a general food chain simply stating plants eaten by herbivore and eaten by carnivore instead of a real practical

example. For example grass eaten by grasshopper eaten, by chicken, eaten by man. Some had arrows in the opposite direction. Some candidates simply drew life cycles of animals as food chains. Others drew a food web. Most candidates were simply explaining how one organism was feeding on the other without reference to transfer of energy

The study also revealed that pupils confuse meiosis with mitosis. Many pupils find the five stages of mitosis which are interphase, prophase, metaphase, anaphase and telophase similar to those under meiosis and it becomes difficult to differentiate between mitosis and meiosis. Meiosis also has no interphase in the second division and stages in the second meiotic division which are called as prophase II, metaphase II, anaphase II and telophase II are similar to mitosis there by causing more confusion. This is in line with ECZ (2008) which stated that most candidates seemed not to have learnt the term meiosis and as a result failed to answer the question. Even those who attempted failed to bring out the actual events during meiosis which can cause each ovum to be genetically different from one another.

The study also revealed that pupils fail to differentiate between motor neurons and sensory neurons and they do not understand the role of the hormones and that terms like estrogens and progesterone were confusing to them. This is also in line with ECZ (2009) which revealed that some candidates could not identify the hormones in the table or failed to state their action. Some of the wrong answers included: progesterone instead of estrogen. Most candidates failed to state what happens to hormones after completing their action in target organs.

Evolution and mutations were considered difficult by pupils due to their religious belief. Some teachers who are too religious do not even teach this topic. Many pupils also do not pay attention when teachers are teaching on evolution because they believe that it is false according to their religious belief. This is in line with Abimbola (1998) who revealed that Darwinian theories of evolution may conflict with the teacher's beliefs there by putting them in a difficult position to teach the theories. .

The study also revealed that pupils had difficulties in understanding water balance and osmoregulation under homeostasis. Pupils fail to show the relationship between water balance and blood concentration. This is an indication that teachers avoid teaching the regulation of the osmotic strength of blood. This was also reported by ECZ (2009) which stated that most candidates failed to show the difference between excretion and homeostasis and therefore mixed up the role of the kidney in excretion and the role of the kidney in homeostasis.

Another difficult which came through was the fact that pupils find drawings difficult. This is because teachers do not give drawing tasks to pupils, hence they do not practice how to draw diagrams. ECZ (2007) also supported this finding by stating that the major difficult was drawing skills for most candidates which were lacking. Most drawings were of poor quality. ECZ (2008) also supports this statement by stating that:

*The drawing skills are still very poor. Among the expectations in the questions are that the drawings should be realistic (close to the specimen), clean and neat. In most cases the drawings were dirty with a lot of rubbing, in some cases shading.*

It was discovered that the apparatus and chemicals were inadequate as most of them were reserved for the mock exam and final examinations, therefore teachers do not teach biology using experiments as a result pupils are just taught the theory part. This makes pupils find practical tasks very difficult to carry out. Practical work is important because pupils are always given practical examinations at the end of grade 12. This is in line with ECZ (2007) which advised that there is a need to encourage all schools in the country to have laboratories which are well equipped and that students should be encouraged to carry out experiments so that they do not face difficulties during the final examinations

The study also revealed that teachers experienced a number of participation and motivation related problems among learners. The teachers perceived challenges tend to exhibit a behaviorist orientation to teaching and learning, whereby learners are viewed as in need of external stimulation and motivation in order to learn, instead of viewing the teaching process as a motivational strategy itself. If pupils with limited English language competence are lectured to they will have limited understanding, forget and exhibit limited motivation to study on their own. This is also shown by Chibesakunda (1983) who observed that the English language is an hindrance to effective learning.

The study also revealed that it is difficult to teach biology using learner centered methods because the range of abilities is too wide among many learners, learners are not able to express themselves in English and they do not do their homework. The other factors influencing the learning of biology were teacher's lack of adequate knowledge of the subject matter and teachers feeling insecure when teaching in English. The result seems to suggest that most learners'



inability to express themselves in English as indicated by many respondents can have implications on the learning of biology in Zambian high schools. Chibesakunda (1983) has also indicated that when a learner of science is a native speaker of a language not yet adapted to the purposes of science, his learning through English entails very special additional difficulties of cognition and understanding.

Pupils complained that teachers usually ignore slow learners and concentrate on fast learners. This attitude of teachers usually contributes to some pupil's poor performance. This is also shown by Orzechowska (1975) who argued that students differ in the time required to learn any particular topic. He goes on to say that in the majority of our classrooms the work is usually covered at the apparent speed of the average learner.

Fast presentation of lessons was another factor revealed by the pupils. Teachers are usually fast when teaching so that they can finish the wide biology syllabus. When lessons are presented in a very fast manner pupils fail to follow the lesson therefore learning cannot take place (Reece and Walker, 1997).

The study also revealed that some teachers refuse to answer questions from the pupils and that they do not encourage pupils to ask questions as a result pupils learn in fear. However, asking questions is a very important part of learning and contributes positively to the learning process. (Petty, 1993).

The biology syllabus is overloaded and this has been observed by others Haambokoma et al (2002). The biology syllabus does not give adequate time to teachers to engage pupils in practical work like conducting experiments which require enough time to give results. Hence teachers use theoretical methods which enable them to cover the vast syllabus before pupils sit for the final examination (Haambokoma et al 2002). This is also in line with ECZ (2009) which revealed that:

*It is also evident from the pupils' responses that most teachers do not cover the whole syllabus. Hence topics like genetics and ecology suffered a lot.*

Due to lack of textbooks, pupils solely depended on their teachers to give them biology problems to solve. The teachers were therefore largely taken as the only dispensers of biological knowledge, and the pupils felt they could not do without them. This spirit of dependence on the teachers reduced pupils' activity in the classroom which might have affected teachers' effectiveness. Reduced activity and participation in class was also due to failure to use English language comfortably. This finding supports pupil's complaint about lack of textbooks which they said made them depend on their teachers very much.

Lack of seriousness by teachers and frequent change of teachers were also cited as causes of learning difficulties by pupils. This is also in line with Haambokoma (2007) who cited inadequate explanations from teachers and unfriendly teachers as some of the causes of learning difficulties pupils experience in biology.

Large classes and overloaded teachers were also found to be causes of learning difficulties pupils experience when learning biology. In large classes teachers find it difficult to give work to pupils and later on mark the pupils work. Overloaded teachers also do not have adequate time to prepare and therefore they just present uncoordinated work. This is consistent with Johnson et al, (1994) who admitted that teachers are confronted with big classes.

## **5.2 What could be done to minimize the learning difficulties pupils experienced in biology?**

In order to address the above learning difficulties pupils experience in biology. Teachers of biology should discuss the various meanings and interpretations of words and phrases that occur in the biology vocabulary with learners in class. Teacher's explanations of these wordings and phrases should enable the learners to learn what the teacher wants them to learn without the language itself getting in their way. This finding is consistent with Haambokoma (2007) and Hashweh (1987) that the extent of mastery of the topic has a major influence on the quality of explanation a teacher can give to students.

Learning materials such as textbooks, audio visual aids and others should have certain qualities if teaching should be maximally effective this in line with Haambokoma (2007) who recommended that text book writers should ensure that Biology text books meant for high schools should cover genetics adequately in a way students can understand and that teachers should give adequate explanations to students using visual aids, practical activities and relating genetics to real life situations.

The study revealed that chemicals must be bought in adequate amounts so as to enable pupils conduct experiments and acquire practical skills. The availability of these chemicals should also be monitored by Standard Officers. This is in line with ECZ (2007) which revealed that there is need to encourage all schools in the country to have laboratories which are well equipped and that students should be encouraged to carry out experiments so that they do not face difficulties during the final examinations.

Pupils demanded that copies of the syllabus be availed to them and that the syllabus must be made short so as to enable their teachers to complete it. This is consistent with Haambokoma et al (2002) who observed that the overloaded biology syllabus does not give adequate time for teachers to engage pupils in practical work like conducting experiments which require enough time to give results.

Pupils observed that they should be given end of topic tests so that they can have time to revise the topics they do not understand. This is in line with Das (2007) who believes that assessment is a key in assisting pupils to revise perceived difficult topics.

Teachers recommended that pupils should be drawing proper diagrams. Usually pupil's drawings are poor and not close to the specimen. This is an indication that teachers do not teach pupils how to draw proper diagrams. This is consistent with ECZ (2007) which recommended that candidates should be encouraged to draw neat and clear diagrams which are well labeled. At least the diagrams should occupy three quarters of the space provided. They must also be realistic.

There is need for Education Standard Officers to be inspecting biology teachers in schools. This will help change the altitude of some biology teachers who do not prepare their work before teaching the pupils.

The other issue to be considered is teacher recruitment. There is need to select those with the most appropriate personality and commitment for effective teaching. Pupils have shown that some teachers are not committed to duty and that some teachers concentrate on other activities in school like sports other than teaching.

Furthermore, learner's inability to do their homework may have a negative effect on their academic achievements. In order to encourage learners to do their homework and assignments, teachers should mark the homework and assignments regularly and talk to parents to encourage their children to do their homework.

There is need to put into consideration pupils religious beliefs when teaching biology. Evolution and mutations should be explained clearly so that they do not conflict with pupil's religious belief. This in line with Meyer (1988) who believed that by its nature biology touches on beliefs and more especially on religion and morality. An effective program, therefore, must take cognizance of cultural differences in the development of curricular. Language, of course, is an obvious attribute of culture and problems associated with mother tongue in contrast with a foreign language, must be considered.

Teachers proposed that real life examples should be used when teaching biology. When teaching ecology, teachers should take pupils to ponds and rivers for them to experience aquatic habitats on their own. This is in line with Meyer (1988) who advocated that the natural environment of any region is another aspect that can work for or against the spread of effective biological education. Therefore, the curriculum should be based on an analysis of the local environment and which focus on a study of local animals and plants because this will have immediate relevance. Great care must be taken, therefore not to import unsuitable resources and curricula, without at least undertaking extensive adaptations to match local circumstances

Teaching and learning is very challenging. Teachers need support and training to use strategies that are more active and learner-centered, as well as developing learners' competencies in reading science texts and writing in English. Teachers also need training in designing questions that can engage in higher levels of thinking and scientific reasoning.

There is need for small group work blended with some individualized instruction. Changes in methodology imply changes in teacher education. This is consistent with the findings of Johnson et al (1994) who confirmed that cooperative learning has the potential to improve the quality of learning.

The study revealed that pupils wanted teachers to introduce them to terms like explain, describe, state, list, illustrate and many more. This is consistent with the recommendation from ECZ (2002) that teachers should introduce pupils to examination words such as explain, state, list and illustrate as outlined at the end of the syllabus.

Teachers should teach pupils how to answer examination questions. Pupils do not know how to answer examination questions. They do not usually understand words like: explain, describe and distinguish. This is consistent with Meyer (1988) who described examinations as a critical factor in influencing the learning of biology. The role of teachers in determining examination policy and in contributing to question banks is also an important issue, especially if examinations are to be intellectually stimulating and challenging instead of being channeled into modes of presentation which are mechanically and intellectually similar from year to year and from test to test

Organizational issues must also be considered in promoting effective biology education. In this area questions such as efficiency of administrative support, the type and influence of leadership, class size and the teacher pupil ratio and the administrative structure of the science department needs to be considered. This is in line with Haambokoma, (2007) who emphasized the need to provide management training to heads of science departments in Zambian high schools. Mashambe, (1973) also advised that in order that different factors work in harmony to bring about maximum learning, there must be a good organization of staff, pupils, finances and curriculum.

The study revealed that pupils do not know how to use the formula for magnification therefore there is an immediate need to teach them how to calculate magnification. This is in line with ECZ (2007) which says that calculation of magnification should be emphasized once more as it is a serious setback for most candidates. The formula is:

$$\text{Magnification} = \frac{\text{Size of image}}{\text{Size of object}}$$



## **CHAPTER SIX**

### **CONCLUSION AND RECOMMENDATION**

#### **6.0 Introduction**

This chapter concludes the study and also makes recommendations based on the major findings of the study.

#### **6.1 Conclusion**

Through the assessment of pupil's responses on the learning difficulties they experience in biology and the views of biology teachers on pupils learning difficulties, the following were the major findings from the survey conducted.

The study revealed that pupils find biological terms confusing, such as mitosis, meiosis, heterozygous and homozygous. Certain topics were also discovered to be difficult by pupils like genetics, ecology, homeostasis, nervous system and endocrine system, the skeleton and locomotion. Drawings are also usually difficult for pupils. This is because teachers do not teach pupils how to draw diagrams. Interpretation of graphs is also difficult to some pupils due to the inability by teachers to interpret graphs for their pupils. Inability of pupils to carry out practical tests is mainly due to the lack of chemicals and laboratory apparatus in schools. In addition some biological concepts are just too long to yield results in a short time. Pupils are unable to express themselves in the English language effectively because some teachers teach biology in vernacular and also pupils have poor English background from basic schools where the use of vernacular is usually tolerated.

The results generally indicated that biology teachers are sometimes not serious in explaining biological concepts due to inadequate biological knowledge and they are usually fast during lesson presentations so that they can finish the wide syllabus.

The study also revealed that various factors influenced the way biology teachers prepared their pupils. The factors mentioned included the lack of chemicals in schools to be used for practical lessons, as most of them were usually reserved for the mock and final examinations. Lack of textbooks and learning aids to be used by pupils is mainly due to overcrowded classrooms. Many pupils are usually forced to share one text book.

## **6.2. Recommendations**

Based on the findings some recommendations were made as follows:

1. Biology teachers should ensure that pupils are taught how to draw proper biological diagrams and that they should show pupils how to plot and interpret graphs.
2. Biology teachers should teach learners the various meanings and interpretations of words and phrases that occur in the biology vocabulary. This should enable learners to learn what the teacher wants them to learn without language itself becoming a barrier to their understanding of biological language.
3. The Ministry of Education, in conjunction with the Zambia Association for Science Education (ZASE) should continue to organize workshops and seminars for biology teachers for them to acquire more content knowledge of perceived difficult topics from the school certificate biology syllabus.

4. Regular advisory services from Education Standard Officers should be instituted to give help to teachers who might be experiencing problems in teaching some biology topics in the syllabus.
5. Teachers must give adequate explanations to students using visual aids, practical activities and relating things taught to real life situations.
6. Schools should ensure that materials required to conduct practical work are made available to teachers. In this regard, the Education Standards Officers for science should monitor the availability of these materials in schools.
7. There is need to review the biology syllabus and perhaps reduce the content so that more time is given to experimental work.
8. There is need to control enrolment so that assessment of pupils is improved.
9. Adequate time must be given to perceived difficult topics such as genetics and ecology so that teachers have enough time to explain.

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## **APPENDIX A**

### **INTERVIEW SCHEDULE FOR GRADE 12 PUPILS**

Which topics do you find difficult to learn in biology?

What difficulties do you experience when learning biology?

What do you think causes the learning difficulties you have mentioned?

What measures do you think should be employed to minimize the learning difficulties which you experience in biology?

## APPENDIX B

### QUESTIONNAIRE FOR GRADE TWELVE PUPILS

#### Dear Respondent

You have been randomly selected to provide information on the learning difficulties you experience in Biology at your School. You are reminded that this information is for academic purposes only. You are requested to provide information truthfully as this will be treated with strict confidence.

1. Which topics do you find difficult to learn in biology?-----

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2. What difficulties do you experience when learning biology?-----

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3. What do you think has caused these learning difficulties in biology?-----

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4. What do you think should be done to overcome these difficulties?

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**APPENDIX C**  
**INTERVIEW SCHEDULE FOR BIOLOGY TEACHERS**

What do you think are the difficulties your pupils experience in biology?

What difficulties do you experience when teaching biology?

What do you think causes learning difficulties which your pupils experience in biology?

What do you think should be done to minimize the learning difficulties your pupils experience in biology?

## APPENDIX D

### QUESTIONNAIRE FOR BIOLOGY TEACHERS

#### Identification Data

District: -----

School: -----

1. What do you consider to be your pupils learning difficulties in Biology ?-----

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2. What do you think causes these learning difficulties?-----

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3. What do you think should be done to overcome these learning difficulties-----

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