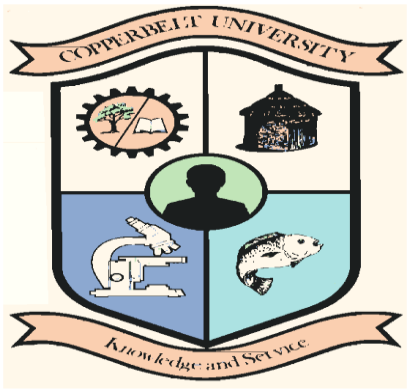
Global Scientific JOURNALS

GSJ: Volume 7, Issue 9, September 2019, Online: ISSN 2320-9186
www.globalscientificjournal.com



THE COPPERBELT UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DOES ETHNO-BIOLOGY IMPROVE PUPIL'S UNDERSTANDING IN ECOLOGY? A CASE OF LUBUTO SECONDARY SCHOOL IN NDOLA DISTRICT.

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A Dissertation Submitted to The School of Mathematics and Natural Sciences in Partial Fulfillment of the Requirements for the Award of the Degree: Master of Science in Biology Education.

DECLARATION

I Emelda Mukuka do hereby declare that this is my own work and has not been done or submitted for any degree or examination to any other university.

Sign: _____

Date: _____

Supervisor's declaration

Supervisor: Dr._____

Sign: _____

Date: _____

External Examiner: Prof/ DR /Mr./Mrs._____

Sign: _____

Date: _____

DEDICATION

I dedicate this work to my mother, Justina Mukuka, my husband Edgar Sichinga and my children, and friends who made it possible for me to accomplish this work through their financial, physical, and mental support to mention but a few. I further dedicate this work to my late sister Winnie Mukuka and brother Eddie Mukuka, who showed me the importance of education.

ACKNOWLEDGEMENT

I first of all thank the Almighty Jehovah God for giving me good health, strength and courage to undertake this study. Thanks are due also to my supervisor: Dr. D. Chungu for his support and immense knowledge during the course of this study. I acknowledge the contributions of my lovely family, especially my dear husband, Edgar Sichinga for his support, love, patience and encouragement, without which this study wouldn't have been possible. I would also like to express my deep appreciation to Mr. Mbilitu, the headteacher at Lubuto secondary school and Ms Soneka J.N.C the H.O.D of natural sciences for their support, advice and encouragement. I also acknowledge Mr. Siachoono and Professor Shumba Overson for the immense knowledge they built in me during lesson sessions.

Lastly, I sincerely thank Mr. Chanda, Mr. Hamwibu and my friends: Namangolwa, Sitali, Chibwe, Suzen and everyone who provided assistance in terms of advice, encouragement and time.

Contents

ABSTRACT

The main purpose of the study was to investigate whether ethno-biology improves pupils' achievement in ecology and attitude towards ecology at Lubuto secondary school in Ndola district. The research design of the study was pre-test post-test control group quasi-experimental. The school was drawn through a purposive sampling, and two grade twelve intact classes were assigned as control and experimental groups by self-selection. The total sample size comprised of 100 pupils. To ascertain whether ethno-biology improves pupils' achievement in ecology, an ecology achievement and ecology attitude questionnaire were used. ANOVA and Independent Samples t-Test at 5% level of significance was conducted to analyse the results. There was a statistically significant difference in the achievement scores for group discussion without ethno-biology (M=37.19, SD=12.24) and group discussion with ethno-biology (M=52.52, SD=18.57) with t80.342= 4.831, P<0.001. Students taught ecology using group discussion with ethno-biology exhibited a positive Attitude towards ecology than those taught using group discussion without ethno-biology. There was a statistically significant difference in achievement across gender, male students performed better than female students. Therefore, group discussion integrating ethno-biology was found to have a positive effect on enhancing pupil's achievement and attitude towards ecology. Based on the results, recommendations on further studies and practice in education were made.

Key words: Achievement, Attitude, Ethno-biology, Group discussion and Understanding.

1.0 CHAPTER ONE

1.1 INTRODUCTION

1.2 CHAPTER OVERVIEW

This chapter gives an overview of the study by looking at the background of the study, problem statement, purpose of the study, research questions, research objectives, research hypotheses, significance of the study, theoretical and conceptual frameworks, limitations of the study and the operational definitions of terms as used in this study.

1.3 BACKGROUND OF THE STUDY

According to Mandela (1918), education is the most powerful weapon which we can use to change the world. Education has been recognized as the fundamental basis on which any nation and the world at large could function effectively. The country's political and economic development depends exclusively on the quality of education offered to its citizens. Education has been described as the individual's right as well as a means for enhancing the wellbeing and quality of life for the entire society (MOE, 1996).

To achieve quality education, therefore the teacher as a facilitator has a huge responsibility of making learning interesting and joyous so as to make learners willing to learn if meaningful learning is to occur (Bruner, 1960). Therefore, this study was sought to ascertain whether ethno biology improves pupil's achievement in ecology (biology). There have been on-going endeavours to explore and implement several possible interventions to improve students' achievement in Biology. One of such interventions is to teach the subject beginning from what the student already knows (Piaget, 1952). The inclusion of knowledge related to ethno-biology can instil a sense of ownership concepts and improve the academic achievement of students in Biology. This is so because it helps to widen the gap between the learner's background and the western biology. Ethno-biology refers to various biological related cultural and community practices. It describes the biological practices of identifiable cultural groups and may be regarded as the study of ideals found in any culture. For instance when defining ethno-mathematics, D' Ambrosio cited by Chibuye and Singh (2016), defined the prefix ethno as a very broad term that refers to the social-cultural context and hence includes jargons, language, myths, codes of behaviour and symbols. According to Rosa and

Orey (2011) Ethno refers to members of a group within cultural traditions, codes, symbols, myths and specific ways used to infer and to reason.

However, many Zambian teachers and students experience biology as a rather strange subject, imported from overseas. Therefore, in order to overcome this psychological and cultural blockage to learning and development of biology, it is essential that the Zambian traditions and practices be integrated into biology (ecology) lessons in order to improve pupils' understanding (achievement) and attitudes towards biology. Indeed, these indigenous biologically related practices may be used to make unfamiliar biology content familiar to leaners. Contextualisation has been found to promote positive attitude towards some selected science topics such as ecology and hence improves academic achievement of learners (Rivet and krajcik, 2008). For example, fermentation of maize grains in traditional production of Katata (alcohol) can be used when teaching fermentation/ anaerobic respiration and industrial application of enzymes. This study incorporated ethno-biology knowledge relevant to selected sub-topics of ecology such as soil, biodiversity and conservation. For example, the practices such as farming conservation, chitemene system, mixed farming i.e. legume plants, and moulding (fundikile/vundikile), may be used when teaching soil fertility. When teaching biodiversity and conservation, beliefs and myths such as '' my child don't hunt from that area there are evil spirits'', ''don't cut trees in the grave yard ghosts will haunt you'', don't go in the forest there are spirits of our ancestors.'' Local names may also be used to identify plants and their importance. For instance certain plants are used for timber and honey production, medicine and food. Meaningful learning can only result if learners are able to contextualize the content from classroom to real-world situations (Rivet et al, 2008). This is because contextualisation can help learners to understand how the skills and knowledge they are acquiring relate to the real world experiences. For students to fully benefit from the content they are learning, it is important for an instructor to try and create a sense of reality and authenticity to support the learning of Biology. UNESCO (1996) in 1995, the world conference on Education for All made a declaration to reaffirm the connection between Education and personal needs: Every child, youth and adult-shall be able to benefit from Educational opportunities designed to meet their basic needs. This means that the Education system should endeavour to provide specific knowledge, skills and values that its beneficiaries can apply for their own sustainability in their communities (UNESCO, 2014).

According to Ware (2001) science should be taught not only to prepare students for an academic career in science, but also to help them become relevant informed individuals able to solve societal problems in today's fast changing society. The study conducted by Chibuye et al (2016) reveals that majority of secondary school students learn science as a foreign subject, detached from real-world experiences hence do not see its importance in their own lives. However, this study integrated ethno-biology into group discussion method to determine whether pupils' achievement can be improved.

Research studies in the field of science education reveal that ethno-biology can be integrated in teaching and learning from pre-school to the university. Ecology deals with the interaction between biotic, among abiotic and the environment (Mary, 2009). Therefore, teaching ecology through incorporating ethno-biology can be a good avenue. However, in Zambia, and the world at large, very few or no studies have been conducted to explore the integration of ethno-biology in the teaching and learning of ecology in the pursuit of enhancing ecological literacy. This study therefore, was undertaken in order to ascertain whether ethno-biology improves pupils' understanding (achievement) of ecology and attitudes towards ecology.

However, although group discussion is not an effective teaching method, it has a positive influence on learning, e.g. individuals' performance in the case of concept questions concerning ecology improves after peer discussions. Participants who are able to solve the questions before discussion must also be part of the learning process in groups. If improved results are to be observed, it may not only be a copy of the answer from a student with more knowledge in the topic or subject, but that they emerge from the discussion in itself. In a survey of thousand students, the learning outcomes from traditional courses were compared to the learning outcomes of students participating in courses that used interactive engagement methods. According to Hake (1998) Interactive engagement methods include methods that promote the interactive engagement of students by activities which give immediate feedback in discussions including peers and/or instructors. The results show significant higher outcomes with interactive engagement methods both in a conceptual test and in a test on problem solving. Interactive engagement does not necessarily include the opportunity to argue individual opinions; it could also be an opportunity to discuss interpretation on parts of the scientific content. Osborne and Collins (2010) states in a review of recent science education research that the absence of opportunities to practice argumentation in contemporary science education is a significant weakness. The study

employed group discussion as method of teaching because learners collaborate together and respect the views of others in a group thus, incorporating ethno-biology into group discussion to determine pupils' understanding of ecology.

1.4 STATEMENT OF THE PROBLEM

The study assessed whether integrating ethno-biology into group discussion improves pupils' achievement in ecology. Low performance in biology at grade twelve examinations has been an area of concern for the Ministry of education and the nation at large for quite a long time. This problem has existed even up to now, for example, the average performance in 2015 was 21.29%, 24.14% in 2016 and 28.84% in 2017 (ECZ, 2015, ECZ, 2016 and ECZ, 2017). However, many scholars are in support that ecology is perceived to be one of the major difficult topics to understand in biology. Manda (2012) and Soylu (2006) outlined that ecology questions in biology significantly contribute to low achievement in biology. According to Manda (2012) and Soylu (2006), a number of studies have been conducted to look into the causes of low achievement in biology and most of them have faulted the methods and strategies adopted in teaching biology which is predominantly lecture method. Although group discussion has been advocated by most teachers in biology lessons, the researcher feels that it has not provided adequate results to give every pupil an opportunity to learn and appreciate biology better.

However, a number of studies have been done on methods of teaching trying to improve pupils' academic achievement (understanding) in biology (Manda, 2012) but not much has been done on the impacts of integration of ethno-biology into teaching and learning of biology. Ethno-biology has not been explored in the teaching-learning of science subjects, biology in particular (Sakayombo, 2014). This has therefore led to an increase in deteriorating pupils' achievement at grade twelve results. Therefore, if this issue is not tackled with seriousness it deserves, this in the long run will make it difficult to produce responsible citizens with ecological literacy that can help to combat societal-environmental issues such as climate change that leads to global warming, and also to conserve nature for sustainable use.

This study therefore, was worthy undertaking as it aimed at exploring that ethno-biology improves pupils' understanding (achievement) of ecology in a senior secondary school in Ndola district.

1.5 PURPOSE OF THE STUDY

The purpose of the study was to ascertain whether ethno-biology improves pupils' achievement in ecology and attitude towards ecology.

1.6 OBJECTIVES OF THE STUDY.

The following objectives guided the study:

1. To measure pupils' understanding of ecology when taught using group discussion with ethno-biology and when taught using group discussion without ethno-biology.
2. To determine whether pupil's understanding varies with gender when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology.
3. To determine pupil's attitudes towards ecology when taught using group discussion with ethno-biology and when taught using group discussion without ethno-biology.

1.7 RESEARCH QUESTIONS

The following were the research questions that this study sought to find answers to:

1. Is group discussion with ethno-biology more effective than group discussion without ethno-biology?
2. Does performance vary across gender when pupils taught ecology using group discussion with ethno-biology and group discussion without ethno-biology?
3. Do attitudes of pupils towards ecology vary when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology?

1.8 SIGNIFICANCE OF THE STUDY

This study is essential for it will give an intuition into the relevant steps to be taken to enhance understanding of ecology (ecological literacy) which is an important quality necessary for sustainable development. The knowledge generated by this study may be useful for school managers' to organize activities such as Continuing Profession Development (CPD) on teaching and learning strategies to improve the quality of education. The findings of this study may enlighten the researcher and other research consumers such as biology educators on the benefits of integrating ethno-biology in teaching-learning of

ecology (biology). The knowledge of this study will also contribute to the existing literature in science education because no study has been conducted to determine whether integrating ethno-biology into group discussion improves pupils' achievement in ecology in Zambia.

1.9 RESEARCH HYPOTHESES

H_1: There is a significant difference in achievement of pupils when taught ecology using group discussion with ethno-biology and when taught using group discussion without ethno-biology.

$\boldsymbol{H_o}$: There is no significant difference in achievement of pupils when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology.

$\boldsymbol{H_1}$: There is a significant difference in attitudes of pupils' when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology.

$\boldsymbol{H_o}$: There is no significant difference in the attitudes of pupils' when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology.

$\boldsymbol{H_1}$: Achievement in ecology varies with gender when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology.

$\boldsymbol{H_0}$: Achievement in ecology does not vary significantly with gender when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology.

1.2.0 CONCEPTUAL FRAMEWORK

A conceptual framework is a joyride to scaffold research which is formulated from the literature reviewed. A conceptual framework attaches meaning to the research findings (Kombo and Tomp, 2006). Basing on this framework, it can be concluded that group discussion incorporating ethno-biology in teaching and learning of ecology (biology) enhances understanding (achievement) in ecology.

Figure 1 outlines the four variables (group discussion method, ethno-biology, attitudes and gender) whose relationship to pupils' understanding (performance) of ecology was investigated.

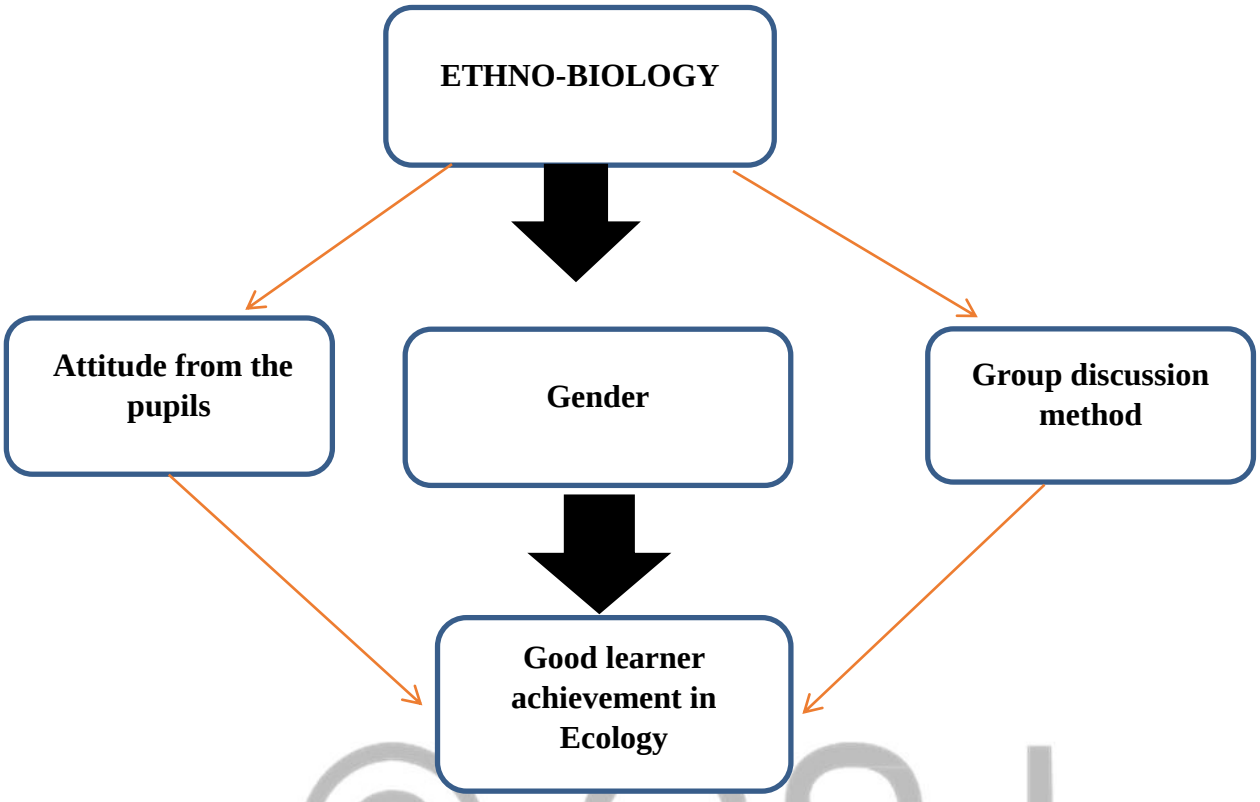

Figure 1: Conceptual framework of the study.

The conceptual framework in this study is that if ethno-biology is integrated into group discussion, the attitude of pupils towards ecology was positive and their understanding in ecology was high and this resulted into excellent achievement in ecology (biology).

1.2.1 THEORETICAL FRAMEWORK

This study was informed by cognitive and constructivist learning theories of Piaget (1952) and Vygotsky (1978) and Ausubel (1963) meaningful learning theory.

According to Ausubels' theory, learning occurs meaningfully when new information or knowledge is linked or associated with already existing but relevant knowledge or concept in the learning cognitive structure. This brings about meaningful learning (Gregory & Mayer, 2002).

Piaget and Vygotsky believed that young children are curious and actively involved in their own learning and they discover and develop new understandings / schema.

Piaget (1952) postulated that children are responsible for creating their own understanding of the world and using what they know based on previous experiences in the process of linking new information to those experiences. Students use experiences and new information to construct their own meaning and understanding.

Vygotsky state that learning awakens in children a variety of internal development processes that can operate when they interact with more competent people in their environment and in cooperation with peers. When children scaffold each other, they modify a task and offer assistance to each other to help complete the task (Tharpe and Gallimore, 1988).

According to Anderson and Greeno (2006) constructivism is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas. It has influenced a number of disciplines, including psychology, sociology, education and the history of science. Constructivism examined the interaction between human experiences and their reflexes or behaviour-patterns. The study is highly considerate of the socio–cultural environment in which learners are born and bred. Many developmental scientists believe that children do not proceed through universal stages or processes of development and particularly, sociocultural theorists like Vygotsky cited by Kundu (2015: p 63) believe that children's growth is deeply guided by the values, goals, and expectations of their culture. In this perspective, children acquire skills valued by their culture-such as reading, managing crops, or using an abacus-through the guidance and support of older people. Thus, developmental abilities may differ for children in different societies, and development cannot be separated from its cultural context.

Alongside this belief are constructivists like Vygotsky and Piaget who have believed that knowledge is dynamic; it is created, acquired, examined and transformed by individual learners where the role of adults such as educators is to support learning and knowledge development through scaffolding meaning providing supportive and challenging learning situations and the environments (Calderhead and Gates, 1993). Piaget claimed that children construct new knowledge by applying their current knowledge structures to new experiences and modifying them accordingly.

Altogether, children in-corporate culture into their reasoning, social interaction, and self-understanding and in the perspective, called constructivism, there is great emphasis placed on the active role that children play in their own mental growth as inquisitive thinkers. It is underlined the ecology concepts fit into an ordered view of nature that was developed by

scientists to simplify the study of the relationships between organisms and their physical environment (Mary, 2009). The living, or biotic, parts of an ecosystem, such as the plants, animals, and bacteria found in soil would for instance be the stepping stone in creating massive knowledge and consequently improving the understanding of ecology in entirety because learners are physically in contact with this ecological community. Therefore, engaging learners in activities that allow them to contextualize, explore and interact with what is being learnt maximizes learning and leads to high knowledge retention.

1.2.2 INTERVENTION

The teaching of the sub-topics: soils, biodiversity and conservation of ecology were taught by integrating cultural knowledge and practices. Firstly, the researcher explained that ethno-biology refers to local knowledge, practices, materials, ideas, beliefs, and myth and language that are used or done in our community or homes. Pupils were put in groups of six (4 males and 2 females) per group.

Pupils were provided with questions to discuss in groups and 'incorporating' what actually is done, belief or say in the community regarding the question. For instance, the question, '' Discuss the methods that retain soil fertility''. Methods such as chitemene system, fundikile, mixed farming (planting together with leguminous plants e.g. beans) to mention a few were brought out by pupils in groups. Pupils had a field trip to the forest where they observed indigenous plants and discussed their importance and local names with the help of the local man. For example, when looked at biodiversity, pupils were taken to Dola-hill forest. They had an opportunity to observe different indigenous plants and the local man helped them to identify plants using local names and explained their uses such as medicinal, food, honey production and timber. Pupils also had an opportunity to ask the local man questions regarding on what was being learnt. Through such social interactions, learners were able to relate the cultural knowledge to biological concepts in ecology, thus led to meaningful learning. Pupils had an opportunity to ask questions during the lessons. To monitor the learning progress class exercises, homework and assignments were given individually and marked. Pupils were assigned in groups and given questions to discuss and learnt most of the concepts by discussing the indigenous knowledge such as beliefs, myths and practices done by people long ago and now. For example, pupils were provided with clay pots when looked at the properties and uses of soil.

During the fieldtrip activity, pupils worked together in groups in gathering information and wrote notes on what they observed and discussed.

Guidelines were given in the form of questions so as to direct the pupils to do the activity required. Precautions and safety measures were also taken for effective learning outcome. Pupils were expected to make detailed notes on soils, effects and biodiversity and conservation. Then, the researcher administered a post-test to the pupils and marked the test, and recorded.

1.2.3 ASSUMPTIONS OF THE STUDY

1. The treatment and the control groups were conceptually equal in the understanding of ecology after putting them in groups and this was confirmed through a pre-test.
2. The conceptual activities that were used in this research were familiar to all the learners and this helped them make informed connections to the concepts presented to them.

1.2.4 SCOPE OF THE STUDY

1.2.5 LIMITATIONS OF THE STUDY

In this research, purposive sampling procedure was used to sample the schools due to time and resources as the researcher had to do the teaching herself at the two schools were the study was conducted. The results of the study may be less representative and less generalised due to the sampling procedure. Another limitation resulted from the fact that the enrolment of pupils in senior classes significantly varied. The study was carried out only in one school in one district of the Copper belt province and was restricted to soils, biodiversity and conservation as sub-topics of ecology taught and learnt at grade twelve levels. Another limitation is that, the researcher had a challenge of finding aged people in the city to provide with more indigenous biologically practices. The results of the study could have been more generalizable if more schools, more districts and more provinces were included in the study.

1.2.6 DELIMITATIONS OF THE STUDY

The study was carried out using Grade twelve biology pupils at Lubuto Secondary School in Ndola district, Zambia. The school was chosen because it was easily accessible by the researcher and would be able to ensure an effective monitoring and supervision of the study.

The investigation was restricted only to soil, biodiversity and conservation as sub-topics in ecology as the study of interactions of living things with each other and their environment, as found in the section of the senior secondary school Biology curriculum.

1.2.7 OPERATIONAL DEFINITIONS OF TERMS AS USED IN THIS STUDY.

Achievement: Test scores of pupils in ecology expressed in percentage.

Ethno-biology: Various biological related cultural and community practices.

Group discussion Method: The teacher had to put pupils in groups of 6 and provided them with questions and biological concepts to discuss.

Understanding: Refers to the intellectual process of applying and evaluating of Ecological concepts and will be measured through performance.

Gender: The persons' physical sex (female or male).

Attitude: Pupils' interest, dislike and appreciation towards ecology.

Conservation: Deals with environmental protection and pollution control: deals with prohibition of pollution of air, land and water and protection of the environment.

Child – centred: When learning is focused on learner needs and potential.

Teacher-centred approaches: When teaching is often focused, on what the teacher knows.

2.0 CHAPTER TWO

2.1 LITERATURE REVIEW AND ANALYSIS

2.2 CHAPTER OVERVIEW

This chapter analyses different studies that are related to this research in order to provide a framework for the efficacy of this study as well as a benchmark for comparing the outcomes of the study when undertaken with other related studies. To be specific, this chapter will look at relevant literature on concepts of ethno-biology, ecology attitude, gender and disadvantages of group discussion method, and advantages of integrating ethno-biology into group discussion method and related studies regarding the effects of ethno-biology which are the factors whose relationships to ecology understanding (performance) are being looked into in this study as well as the importance of the topic.

2.3 CURRICULUM AND TEACHING STRATEGIES

Delpit (2015) stresses that 'If the curriculums we use to teach our children do not connect in positive ways to the culture young people bring to school, it is doomed to failure'. Hence, any assumption that a Zambian child could easily adjust to western knowledge dramatically without creating a suitable link is bound to fail. For the child to accept and adapt to a new field of knowledge, the gap between him, his culture and the new field of knowledge has to be bridged.

In the light of the curriculum, education is holistic in that it pursues to extract the best out of man and; it further suggests that all knowledge is inherent in children (Kuppuswamy, 2012). The belief is underpinned on the methods and which should be found in order to tap out this knowledge so that it flows. Kochhar (2015:73) looks at activity based curriculum as subject matter being translated in terms of activities and all the requisite knowledge, skills and attitudes are imparted through the activities. In other words learning is a matter of sense impression. The senses are supposed to be active in absorbing impressions of the world round about the learner. The mind is occupied with mirroring the universe of knowledge and value. When we talk of activity curriculum, we do not conceive of an activity in the narrow sense only. All activities connected with craft work; activities leading to the better knowledge of the physical and social environments; linking the school with home and community; activities leading to citizenship and social living. So it is absolutely essential

that all types of activities, informative, productive, organisational, social, community and practical are assigned in a proper place.

The precept set by Dewey cited in Ballantine (2009) emphasizes the aspect of fitting the curriculum to the children instead of children being fitted into the curriculum. The process of thinking about education is said to be a means of planning action, of removing the obstacles between what is given and what is wanted. Child – centred curriculum is a curriculum based on the philosophy of experimentalism and contextualisation. The principal propagator of this thinking, Flaum cited in Sidhu (2012:2) is of the opinion that the experience is not static like atmosphere of some man, hence in curriculum interests and needs of the student should be made central, not the previous determined curriculum base. It is suggested that the child is an individual growing of his own activity, living in his own environment and preparing himself for adult's life, not imitating the adults, but living as fully as possible in the environment of childhood. It is therefore important that the curriculum be based on the present needs and circumstances of the child. It should provide rich experiences to children for proper development.

What then should be the shape of teaching and learning is a matter of eclecticism; not taking a single lane and a one sized fit all approach; here, teachers do not employ a single teaching method but use different types of methods that shift the role of the instructors from givers of information to facilitators of student learning (Bergin, 1990). Mitchell (1997) in Mangal (2009) noted that teaching strategies that promote student involvement and which students find meaningful will hold students' interest. "There is a switch over from the subject matter to be learned to the human being who is learning it (Kochhar, 2015:12)." Teachers should not just be specialists in the subject matter alone but also helping pupils to relate what they are learning to the science practiced at home/ in the community in order for them to solve societal problems. The methodology of teaching in classrooms are hanged on the process of communication where the teacher and the taught need to know each other well because the teacher has an understanding of the pupils, the abilities, their limitations and involves motivation and learners' aspirations so that there is effective learning in that class.

The child is the focus of the limelight today. Gone are the days when much of the classroom time was devoted to sing-song, verbatim recital of text-book material and unmotivated drills that were largely meaningless to the child. From this perspective, the curriculum is to be thought of in terms of activity and experience rather than of knowledge to be acquired and facts to be stored and memorised for exams. Child centred is pinned on children constructing

their own knowledge and this light, Sichalwe (2011) recognizes the constructivist approach as being preoccupied with the primary and fundamental responsibility of education to be in the context of providing learning that make available new learning experiences to enable learners identify opportunities, initiate improvement in life, become entrepreneurs, innovators and inventors thereby offering new life avenues that will enhance joy and happiness in society. This fact underlines the teacher as a facilitator and clarifier but the child very active and responsible of his or her learning.

The teaching strategies employed in teaching are very crucial in bringing about meaningful learning. According to Ganyaupfu (2013) poor academic performance by majority students is fundamentally linked to employing of ineffective teaching methods. In the same manner, Adunola (2011) argued that, bringing about the desirable kind of learning demands that methods adopted in the teaching and learning process are in line with the material being learnt. That is to say that the teacher must possess pedagogical content knowledge-PCK (Shulman, 1987; p9). The teacher must have sufficient knowledge on the subject matter, pedagogical and content in order to teach effectively. The teacher to understand the material to be taught as well as the skills, attitudes, and values among other competences to be developed in order to select the appropriate method of teaching.

Chang (2002) postulated that teaching methods should cater for the learners' needs since each student construct meaning in their own unique way. Learners construct and build knowledge more effectively when they are actively engaged. This is consistent with the proponents of the cognitive theories of learning who argue that, learners are active participants in their own way of learning and that learners thought of patterns which are influenced by their pre-requisite knowledge which is different for each learner determines how to teach (Henson, 2003). To this effect, the constructivists approaches (pupil-centered) have proved to be more effective than teacher centered approaches such as lecture method and group discussion method. According to Anderson et al., (2006), meaningful learning is achieved when learners encounter something new; they have to reconcile it with their previous knowledge (ideas) and experience causing them to change what they believe. Learners become engaged by applying existing knowledge and real-world experiences. The group discussion method on the other hand allows learners to remember concepts for a short period of time and does not allow learners to contextualize what is being learnt to real life experiences, and so does not enhance meaningful learning as much as the integration of

ethno-biology into group discussion method. In other words, incorporating ethno-biology in teaching-learning allows learners to relate their learning to real-life problems and situations.

Ausubel however, did not focus on classroom activities but on internal mental processes within the individual learner (cognitive processes). According to Ausubel, the method of teaching matters less because creating connection between new knowledge and pre-existing knowledge is done mentally and individually (Ausubel, 1968).

Novak (1987) on the other hand realized that classroom activities play a role in arousing and stimulating mental processes and so the choice of the method of teaching is very cardinal. The latter argument is consistent with Dale (1969), who in his cone of experiences stressed that, the more the number of senses engaged in the learning process, the more learning and the higher the retention of the material being learnt. The implication of this assertion is that, if learners are engaged in activities that allow them not only to think but also to interact with what they are learning in a physical manner maximizes learning retention of knowledge will be high.

This study is therefore premised on the fact that, meaningful learning involves the amalgamation of the cognitive and constructivist views of learning because when learners are engaged, cognitive processes become stimulated provoking learners to begin to think and look for relationships between what they are learning and what they already know. This is true for example through integrating ethno-biology into group discussion method.

2.4 STUDIES LINKING MAN TO THE ENVIRONMENT

The basis of education is entrenched on availing the knowledge of things in the manner concepts get understood; to assemble raw facts into meaningful patterns known as understanding which leads to that desired unity or package of things (Borusso, 2007:). Conventionally, it is obtained that we human beings live in the physical, social and chemical world where there are objects and forces, the chemical elements and the social forces surrounding us to determine, affecting and controlling our lives and activities. Eventually, humans are becoming more and more sophisticated over time, to become one of the foremost forces affecting ecosystem structure and function in the process of attaining development.

Education negotiates, creates awareness and provokes thinking. Envisioning this kind of learning is active; indeed it is interactive, with the teacher responsible for ensuring the direction that this learning takes but with the learner consistently being challenged to shape

it to his or her needs. Education of this kind has increasingly become a feature of effective schools and school systems worldwide. Bate (2010) exclaims that in the advent of skills, development is initiated yet keeping it in mind that there must be this continued interaction between people and the environment where the riches of the environment are to be used so that people can live well and natural resources to be exploited but at the same time conserving it for future generations.

The children of today and tomorrow should be able to grow up healthy, enjoy clean air and water, build proper homes, eat good food, be free from preventable diseases as well as be able to suggest their world is wonderful! Over the past decades, the economy has experienced tremendous growth significantly resulting in great improvements in education, health and the quality of life for many people. This development has not only improved peoples' lives but it has also led to massive destruction of the environment (UNESCO, 2012). The negative effects of economic growth include; destruction of natural ecosystems and habitats at a very high rate resulting in apparent loss in biodiversity, increases in soil/land, air and water pollution, accumulation of huge amounts of waste in the environment that cannot be assimilated by the biosphere or managed by humans effectively, world climate changes resulting in global warming, and extensive land destruction (Miller and Tyler, 1994). ''Biodiversity is being lost at massive extinction rate,'' states The Global Risks Report 2018, and ''pollution of air and sea has become an increasingly pressing threat to human health.'' Indeed, impacts of economic growth have also brought about disturbances in natural cycles such as the nitrogen, carbon and water cycles and increased food contamination by toxic elements, gases and pathogens which are detrimental to peoples' healthy.

2.5 CONCEPT OF ETHNOBIOLOGY

Primarily, Ethno-biology is the biological study of the way living things are treated or used by different human cultures. It studies the dynamic relationships between people, biota, and environment, from the distance past to the immediate present (Harrington, 2007). It also refers to the study of materials, ideas, and beliefs from students' environment and technology (Abony, 1999). Ethno-biology enables students to interact with their environment and construct reality by linking culture to advanced biological knowledge and ideas found in any culture (Atrin, 2007). Culture helps human societies survive in changing

natural environments where for instance man from time in memorial has domesticated both plants and animals.

In another dimension, Kelly (2009) delineates ethno-biology as a total-person (holistic) learning in that it helps students to make sense of what they are learning, both in the context of culture and in the context of school biology. Ethno-biology enables learners to draw specific connections between content knowledge taught to an authentic environment in which the content can be applied. It also provides students with opportunities to participate actively in the teaching-learning process. It gives the students greater opportunity to be responsible for their own learning, equipping them with skills and competencies required for living and making meaningful contribution to the society's development and to function adequately in the world of science (Onuoha, 2007). In ethno-biology education, students become engaged in many of the cultural activities and thinking processes that biologists use to produce new knowledge. Biology educators encourage biology teachers to replace traditional teacher- centred instructional practices, such as emphasis on textbooks, lectures, and scientific facts, with learner-centred methods like the integration of ethno-biology in teaching-learning of biology that (a) engage students' interest in biology (b) provide opportunities for students to contextualize cultural activities to real world experiences, (c) require students to relate the biology in the industry to that they learn in classroom situation and solve problems using logic and evidence (Kelly, 2009).

Man through culture has developed new technologies and has learnt how to subsist on new plant and animal species; people have for example settled into villages of permanent, durable houses and farms because of this interaction. Borusso (2007: p231) contests that education should achieve beyond knowledge to cultivate understanding alleging that, "raw facts don't constitute knowledge until assembled into meaningful patterns." Culture is referred to as everything about man; cultural adaptation has made humans to be one of the most successful species on the planet whereby along the thread of history, major developments in technology, medicine, and nutrition have allowed people to reproduce and survive in ever-increasing numbers. The topic as a study is like a revival. This stimulation reflects increasing concern about the disappearance of the rain forests and the tribal cultures inhabiting them; facing new diseases for which there is no known cure and ancient diseases that have grown resistant to drugs as learners meet these stories in the corridors of life.

2.6 ADVANTAGES OF INTEGRATING ETHNO-BIOLOGY INTO TEACHING OF BIOLOGY (ECOLOGY).

Students see biology as a non-native subject, and this presents one of the principal challenges to biology educators. Thus, integrating ethno-biology in lessons may bring a sense of ownership of the subject. The application of ethno-biology practices in teaching and learning may help learners to attune to the western biology which is to some extent strange and conflicting with the pupil's initial knowledge (Adesoji & Akpan, 2009). It offers pupils with an opportunity to learn biology from their cultural perspective and to appreciate biology better. It also promotes self-efficacy in pupils because they will become critical thinkers and is able to construct new knowledge and ideas which will enable them to make informed decisions; it enables learners to draw specific connections between content knowledge taught to an authentic environment in which the content can be applied. It also provides students with opportunities to participate actively in the teaching-learning process. It gives the students greater opportunity to be responsible for their own learning, equipping them with skills and competencies required for living and making meaningful contribution to the society's development and to function adequately in the world of science (Onuoha, 2007). It provides a more objective and experimental way which permits understanding of biology and its practical basis (Goulet, 1998). With integration of ethno biology practices into group discussion, students have the responsibility of learning on their own, with the teacher acting as a guide. Furthermore, integrating ethno-biology into group discussion provides learners with experiential and discovery learning, which increase learner's intellectual potency, learner shifts from extrinsic to intrinsic motivation and promotes self-confidence in students (self-efficacy) (Bruner, 1960).

Integrating ethno-biology into group discussion-based classroom offers a base for construction of reality (Tindimubona, 1993). This is because it deals with the knowledge indigenous to a culture and serves as a base for the construction of reality by linking culture to advanced biological knowledge. Moreover, indigenous biological related practices may be used to make the unfamiliar biology content familiar to students. It bridges the gap between the learners and the world of reality therefore, the Zambian biology traditions and practices should be 'incorporated' into the biology lessons in order to improve pupils' understanding (performance) in biology.

2.7 DISADVANTAGES OF GROUP DISCUSSION

1. Some suggest that discussion is too time consuming.
2. Others argue that while discussion might be appropriate in some courses it is inappropriate for some courses. Of course, covering content is not particularly essential if students fail to engage it in a meaningful way. Likewise, discussion can be adapted to any course if creatively applied.
3. The challenge for teachers is to determine how best to engage students with the material in a way that will facilitate reflective thinking about it.
4. Karp and Yoels (1976) first identified a couple of college classroom norms that worked against effective classroom discussion. The first they called civil attention. Because college professors would rarely call on students who didn't show some indication that they are willing to contribute, it is easy for students to merely create the appearance of paying attention in class rather than actually being engaged in classroom activities.

Secondly, Karp et al., (1976) found that regardless of class size the vast majority of contributions to classroom discussion came from a very small number of students. Students come to accept and even expect this consolidation of responsibility for classroom participation often directing their attention to those few "talkers" when a teacher asks for input from the class. Thus a teacher can leave a classroom thinking an effective discussion took place without recognizing that the discussion occurred primarily between the teachers and three to five students while the rest of the class primarily were onlookers.

2.8 CONCEPT OF ECOLOGY

According to Townsend et al., 2008, ecology is the scientific study of how organisms are distributed as well as their abundance and the relationships that exists among them and between them and their environment which influence their distribution and abundance. Ecology is a topic in the senior secondary Zambian biology syllabus taught at grade twelve in secondary schools. The concepts taught at this level include; biotic, abiotic (e.g. soils) ecosystem, energy flow, nutrient cycles as well as food chains, food webs, population ecology, biodiversity and conservation (CDC, 2013). The world as a whole is facing a challenge of social-environmental problems such as the climate change, pollution, destruction of the forest covering the earth and global warming. To overcome these problems, it is essential that citizens be aware of ecological literacy. They need to acquire

knowledge, attitudes, values and skills necessary to shape a sustainable future (UNESCO, 2012). Today, human activities such as construction, farming, mining, and energy production have led to the destruction of the environment and these clashes with conservation objectives. The reason behind all this is that, most secondary school pupils' perceive ecology to be a difficult topic to understand and lack ecological literacy (ECZ, 2016 and Manda, 2012). For instance, a study conducted by Cherif, (2011): an investigation to ascertain the barriers to ecology education in England high schools, the results of the study showed that, ecology education has produced ecologically responsible citizens who can take care of the environment. Cimer (2011) conducted a study which looked into the factors that makes biology teaching and learning difficult and effective in Turkey, on matter cycles which are a component of ecology took the first place among the topics perceived to be difficult to learn in biology. In addition, Oyovwi in Nigeria conducted a study on effects of academic achievement on the topics identified to be difficult, the results revealed that, ecology was found to be one of the topics perceived to be difficult by secondary school students' in the Delta state of Nigeria (Oyovwi, 2015). In Zambia, Manda (2012) conducted a study: an investigation into the nature and causes of poor performance in biology at grade twelve, the results showed that, ecology was found to be one of the topics that contribute significantly to poor performance.

2.9. CONCEPT OF ATTITUDE

Gagne cited by (Abony, 1999) defined attitude as a state of mental and emotional readiness on the part of an individual to respond to an educational situation in a manner that gives first place to the attitude of the society and the profession. Gagne mentioned early believed that attitude is an internal state that influences the individual's personal actions. Attitude to (ecology) biology implies reactions, impressions and feelings an individual has to ecology and ecology related tasks. According to Husen and Neville (1991) attitude is dichotomized into two kinds: the basic attitudes that is, the kind of things a person likes to do and occupational attitudes, or the degree to which an individual is similar in likes and dislikes to individuals who are happily employed in a particular occupation. Attitude is also in relation to a state of motivation (Husen et al., 1996). These two scholars viewed attitude as the state of motivation which directs activity towards certain goal and which are resultants of emotional (affective) and motivational (appetitive) processes. Attitude to biology (ecology), viewed from these perspectives are the mental and emotional disposition of individuals to engage in biology related studies and activities.

Carter cited by (Abony, 1999) noted that attitude has to do with the combination of intellectual and feeling of consciousness based on native curiosity conditioned by experience. Thus, the most appropriate ingredient in all attitudes ointments will be the one that touches on the individuals' native curiosity and experience. Viewed from this perspective, a package that integrates the individual's native curiosity and experience within his immediate environment may have worth-exploring implications in biology (ecology) attitude developments.

However, a number of studies regarding science education today have to do with the identification of factors that impede on the provision of quality science education and enrolment in science courses. Attitude towards science is one of the factors critical to pupils' understanding of science and most research studies today regarding science education aims at finding ways and means which can arouse pupils' interest in science courses and science-related careers (George, 2006). Therefore, in this research attitude is considered as interest, appreciation and dislike of students in response to events or ideas among other things. Phrases like ecology is my favourite topic in biology entail attitude (Simpson and Oliver, 1990).

According to Talton and Simpson (1985) attitude of pupils towards a subject is influenced by substantial number of factors. Some of the factors are the environment in which a child is raised and the background of parents or guardians, whether the individual is intrinsically or extrinsically motivated, performance, motivation and teachers' philosophies which render into teaching methodologies. A number of studies have reckoned on a number of factors that are assumed to influence pupils' attitude towards a subject (Osborne et al., 2003). For instance, there are studies that have looked at the perception of the science teacher and how it influences pupils' attitude, the contextualization of science, the method of teaching, motivation towards science; enjoyment of science; attitudes of peers and friends towards science; attitudes of parents towards science; the nature of the classroom environment; performance in science; and fear of failure in the course. A study conducted by Chibuye et al., (2017), on the effects of incorporating ethno-chemistry practices in chemistry lessons on pupils' attitude towards chemistry showed that, a positive attitude towards chemistry can enhance understanding. It would, therefore be very appropriate to explore the influence of integrating ethno-biology into group discussion method as an instructional package on students' attitude towards ecology.

Pupils tend to make an effort to learn and understand the meaning of the concepts being taught to them if and only if they are interested in learning. Cracker (2006) stated that

students' motivation is an important factor that can lead to raising or lowering pupils' understanding. In short, learners' positive attitude towards a subject or topic is among the factors that significantly enhances understanding. If learners' have a negative attitude towards what they are learning, they will not direct their effort, energy and time in trying to learn and consequently little or no learning will take place. This implies that, the teacher has a huge responsibility of making learning interesting and joyous so as to make learners' willing to learn if meaningful learning is to occur.

2.2.0. CONCEPT OF GENDER EFFECT

Gender is defined as a range of characteristics relating to and differentiating between masculinity and feminity (Male and Female). Gender equality is among the sustainable development goals (SDGs) which succeeded the millennium development goals (MDGs). According to Fatokun and Odagboyi (2011) it is noted that in most societies this goal is far from being achieved because even in this century (21st century), the role of women is still reduced to the ground preventing them from participating in and benefiting from the efforts of development. They added that some challenging subjects such as mathematics and sciences are considered as masculine, whilst home economics, secretarial studies are perceived not difficult, hence for females.

There is a world view that females are inferior to males and thus, the power relations attached to their ideas, and beliefs, give males more power and more opportunities over and above females in the society (Gin, 2011). It is intriguing to note that these views penetrate the education system and consequently translates in academic achievement. In other words, pupils' understanding or rather achievement in biology is influenced by gender among other factors. The study conducted by Tekkya and Ozkan (2001), showed that there were more girls than boys who perceived that biological concepts are difficult to learn. This implies that, learning varies across gender. The classroom experiences and socialization are among the causes of more girls perceiving biological concepts to be difficult than boys. For instance, according to Shamai (1996) and, Tinklin, Croxford and Duckin (2001) boys are perceived to be more competitive, more efficacy, and more willing to have a go at something as opposed to the low esteem and passive dependent behaviour among girls.

In the study conducted by Mavrikaki and Koumparou (2012), it is shown that gender does not seem to affect pupils' overall views about difficult topics in biology. This implies that we are far from making a conclusion as to whether or not gender determines understanding

in biology and if it really does, which sex has positive views about topics perceived to be difficult in biology. To this effect, this study incorporated gender in order to find out if it determines understanding even with the use of teaching methods such group discussion integrating ethno-biology in the teaching of ecology.

2.2.1. RELATED STUDIES

Sakayombo (2014) used purposeful sampling and qualitative research method to explore the integration of indigenous knowledge in the teaching of agricultural science in secondary schools in Zambia. She stressed on the need to integrate indigenous knowledge in agricultural science education in Zambia as a way to reflect the local cultural settings. The researcher used the grounded theory to analyse the data. The study revealed that integrating indigenous knowledge into agricultural science teaching is, therefore, meant to bridge the gap between the school and the learner's home environment, and make learning more relevant. The study also revealed that most of the respondents had a general understanding of indigenous knowledge. The research showed that indigenous knowledge to a large extent has not been integrated in the teaching of agricultural science in the secondary schools in Zambia. The researcher wished to strongly that further research to be conducted in other science subjects. Nonetheless, the present study employed a quantitative research and the data was analysed using Statistical Package for Social Science (SPSS version 23).

Another study of interest to this research was done by Abonyi (1999) in Nigeria. He studied the effect of ethno-science based instructional model on students' conception of scientific phenomena and interest in integrated science. The study illustrated how ethno-science-based model may influence the utilization of indigenous understanding of the scientific concept theories and paradigms. The researcher used a non- equivalent control group quasi-experimental design. The researcher also used mixed methods (quantitative and qualitative methods) to analyse the data. The researcher used ethno-science based model to teach the experimental group and conventional model to teach control group. The study revealed that ethno-science-based model is superior to the conventional in fostering interest in science. The study did not investigate the effect of ethno-science in terms of pupils' understanding (achievement) and the study was conducted in the junior secondary school integrated science. For all that, this study therefore was determined to find out whether ethno-biology improves pupils' understanding (achievement) in ecology in senior secondary school Biology.

Elaine (2008) in the United States of America conducted a study on integrating ethno - biology with k-12 Science Education. The study employed survey method and revealed significant statistical difference between the two age cohorts who submitted the surveys. The results were to help teachers in the US by providing the most efficient means of rapidly assessing local ethno -biological knowledge for use in classroom instruction, a technique that many researchers cite will increase the relevancy of science in student's lives. The research showed that environmental exposure increases environmental awareness (Lindemman-Matthies 2006; wallczec & Zajicek (1999). Despite the positive results, the researcher conducted the study on teachers. The researcher employed only one method (survey) to collect data. However, this study employed triangulation to collect data in order to enhance the validity and reliability of the study. Triangulation is when many techniques, researchers, sources of data, methods, and possible explanations are used (Davison, 1998).

In Zambia, a related study was conducted by Chibuye and Signh (2014). Their focus was to investigate the effect of culturally contextualised Chemistry instruction (ethno-chemistry) on learner's attitude. The findings of this study reveal that pupils taught using Ethno-chemistry exhibited a positive attitude towards chemistry than those taught using conventional method. There was a statistically significant difference in attitude towards chemistry between the two groups. A quasi-experimental non-equivalent control group design was used. The data was collected using questionnaire. The quantitative data was analysed using statistical package for social sciences (SPSS). The mean, standard deviation and Independent samples t-test were used to compare the significant difference in attitude between the two groups, control (M= 67.52, SD=9.409) and experimental (M=67.69, SD=11.020) groups; t (111) =-0.090, p=.928.

The current study triangulated the methods of collecting the data in that the researcher used Ecology Achievement Test and Ecology Attitude Questionnaire to increase the potency, reliability and validity of the study. The later researcher used the means to compare the significant difference in two groups.

3.0 CHAPTER THREE

3.1 METHODOLOGY

3.2 CHAPTER OVERVIEW

This chapter explains the techniques and approaches used in conducting this study in terms of the research design, target population, sample size and sampling procedures, research instruments, data collection procedures, validity and reliability, data analysis and ethical issues that were taken into consideration.

3.3 RESEARCH DESIGN

A research design is the overall plan that combines the various components of the research into a complete and logic structure (De Vau, 2001). According to Cresswell (2008), a research design refers to a plan of what kind of data is to be collected and what methods are to be used to collect and analyze the data in order to effectively provide answers to the study's research questions. The study employed a quasi-experimental design (pre-test post-test control group design). In other words, the study made use of a two group pre-test post-test quasi experimental design which usually involves collecting data by subjecting two groups to the same researcher prepared tests. To one group, ecology was taught using the group discussion with ethno-biology while to the other group the same topic was taught using group discussion without ethno-biology. This method undertook the quantitative nature of the research. A pre-test was administered to both groups before the instruction. According to Sherin (2009: p323) a pre-test assesses whether or not the groups are of the same capability on the dependent variable before the treatment. Thus, the pre-test was done in order to determine if there were any differences in the two groups on the dependent variable before the treatment.

O1 **X** **O2**

O1 **O2**

Figure 2 Pre-test Post-test quasi-experimental designs.

Where;

O1: Were the observations made during the pre-test measures. Both the experimental and control groups were given an Ecology achievement Test and attitude Questionnaire as pre-test measures.

X: was the treatment that was employed so as to assess its effects on pupils' understanding (achievement) and attitude towards ecology. The experimental group was taught soil, biodiversity and conservation through incorporating relevant ethno biology knowledge and practices in ecology lessons. The treatment combined indigenous knowledge and practices with formal school ecology content, while the control group was taught using conventional approach.

O2: Were the observations made during the post-test. Both the control and the experimental groups were given Ecology Achievement Test and Attitudes Questionnaire as post-test measure. The comparisons were made between pre-test and post-test Ecology achievement Test, and Attitudes between the groups.

3.4 TARGET POPULATION

The population of this study comprised all grade twelve pupils (n=350) at Lubuto secondary school in Ndola district. The study targeted grade twelve pupils because the topic ecology, the area of interest for this study is usually taught in grade twelve in the Zambian secondary schools.

3.5 SAMPLE SIZE AND SAMPLING TECHNIQUES

Purposive sampling was used to select Lubuto secondary school in Ndola district. Purposive sampling was used to select a school due to limited time and other resources as the researcher had to teach the two classes without significantly altering the school time table. According to Ghosh (2006) purposive sampling can be employed when there are limitations that make it difficult for the researcher to select samples randomly. This sampling technique was ideal for the selection of a school due to time and resources. Two intact classes were purposively selected and were self-selected to treatment group and the other one was a control group. The classes were used as intact groups because the study was undertaken during a normal learning term. The topic under the study was not on the term schemes of work. Hence, the researcher had to teach the lessons during 'prep' time that is between 14:00hours to 15:30hours.

3.6 RESEARCH INSTRUMENTS

The study employed a five Likert-type attitude questionnaire and an ecology achievement test as instruments used in collecting data. An ecology achievement test was used to gather quantitative data on pupils' understanding of ecology while a questionnaire captured also quantitative data on pupils' attitude towards ecology. Attitudes of pupils towards ecology were measured through an eleven item questionnaire. Of the eleven items in the questionnaire, all were closed ended questionnaire items. The questionnaire was constructed after brainstorming a total of 30 grade twelve pupils who were not part of the research sample regarding their attitudes towards ecology. The pupils brainstormed were selected on the basis of having either low liking or high liking of ecology in order to come up with items that span the whole range of ecology attitudes intended to be measured (Field, 2003: p4). In order to avoid response biasness, the statements of pupils' regarding their attitudes were reverse phrased. Some responses from the brainstormed pupils were repetitions while others were sensitive and so a total of four items were discarded leaving an eleven item questionnaire. An ecology achievement test was also constructed by analysing ecology questions from the grade twelve past examination papers with the help of grade twelve examiners.

3.7 VALIDATION

The Ecology achievement Test was face validated by experts in research and Biology Education. During face validation the terms of relevance, general test format, suitability and clarity were considered. After the face validation the instrument was completely overtook to reflect the expert contributions of the validations. The attitude Ecology Scale was also face validated by experts in biology education and research experts.

3.8 RESPONSE RATE

The results were based on the questionnaire survey data collected from 100 pupils from one selected secondary school in Ndola district. Following validity and reliability analyses of quantitative measures, the overall attitude for each respondent was computed by using the statistical package for social sciences (SPSS) version twenty three. The specific breakout of the composition of the net delivery and net response are broken out as shown in Table 1.

Table 1shows the number of questionnaires which were distributed and those that were used in the analysis.

Table 1**:** Composition of Net Delivery

Item	***No. of respondents***	***Percentage***
Questionnaires Issued	100	100%
Questionnaires not returned	0%	0%
Net Delivery	100	100%

Table 1 above shows 100 (100%) distributed questionnaires and that 100 (100%) were collected and used in the analysis.

3.9 PILOT TESTING

A pilot testing refers to the pre-testing of the instruments before the actual study is conducted in order to determine the weaknesses and strengths. It is important to piloting a questionnaire if quality data is to be gathered as it plays vital roles in enhancing validity, reliability, and practicability of the questionnaire. Piloting a questionnaire acquaints the researcher with the necessary information regarding the validity and consistency of the questionnaire items (Morris and Cohen, 2008). Piloting the questionnaire therefore helps the researcher to know how long it will take for respondents to handle the instrument, if items are clear or abstract, checks whether the targeted respondents are well able to respond to questionnaire items and whether the questionnaire is too short or too long. Consequently, 40 copies of the questionnaire were printed and pilot tested on 30 pupils' who were not part of the sample. The data from the pilot study was entered in SPSS and reliability test ascertained by conducting the Cronbach's alpha test which gave the coefficient value of 0.724. The alpha coefficient of 0.70 can be considered to be good and so this questionnaire had good reliability (Devellis, 2012).

Table 2 is an extract from the Cronbach's reliability test output showing the overall reliability of the questionnaire.

Table 2: Cronbach's Alpha Reliability Test Results.

Cronbach's Alpha	Number of items
0.724	11

The results in table 2 above give a coefficient of 0.724 on the 11 closed ended questionnaire items which entails a good reliability.

3.2.0 DATA COLLECTION PROCEDURE

The study was conducted over the period of nine weeks. Each of the respondents in the two groups were pre-tested to find out if they were approximately at the same level on the dependent variables achievement and attitude. The respondents wrote an ecology achievement test and responded to questionnaire items before instruction. Then two groups were put to control and experimental groups. Thenceforth, the control group was taught ecology (soils, biodiversity and conservation) using group discussion without ethno-biology while the experiment group was taught ecology using discussion with ethno biology for a period of nine weeks. At the end of the instruction, both groups were given post-test using an ecology achievement test. Questionnaires were also given to the pupils in both groups to be completed for an hour of which after, the researcher collected the questionnaires. From the information given by the head of the science department (HOD) from the school, none of the classes had already covered the topic, ecology. The study was conducted in the first term of learning.

3.2.1 DATA ANALYSIS

The study actually captured quantitative data and thus the data was analysed using descriptive statistics such as the mean and standard deviation to summarize the data. The t-test was used to test for any significant difference in achievement of pupils and attitude towards ecology in the two groups before and after the instruction. All this was done by using of statistical package for social sciences software (SPSS) version 23. Cohen and Morris (2008) recommend the use of SPSS because quantitative data analysis can be easily performed using software packages such as SPSS, Excel or Minitab. These software packages have inbuilt statistical formulae and hence conduct necessary calculations just at a click of few buttons. The independent samples T-test is a parametric statistical test that

compares two samples means to determine whether the population means are significantly different (Sherin, 2009). It is used to test the statistical differences between the means of two groups, statistical differences between the means of two interventions and statistical differences between the means of two change scores. The results of this statistical test entails whether the two groups are from the same population if their means are so similar and vice versa. The statistical tests employed in this study included; an independent samples T-test for academic achievement to determine whether there was the homogeneity variance between group discussion with ethno-biology and group discussion without ethno-biology, analysis of variance for achievement across gender and attitude as well as the spearman's rho correlation to determine the strengths in relationship between two dependent variables; achievement and attitude (Interest, dislike and appreciation). All the assumptions of ANOVA were met. The results were based on the ecology achievement test data from 100 pupils and a five Likert-type attitude questionnaire data from 100 pupils at Lubuto secondary school in Ndola District.

The Attitudes of pupils were measured through eleven item questionnaire which was rated on the scale as shown below;

1*= strongly disagree,* ***2****= Disagree,* ***3****=Doubt,* ***4****=Agree,* ***5****= strongly agree*

Responses of attitudes (interest, dislike and appreciation) of pupils towards ecology were collected from the two groups; experimental group (group discussion with ethno-biology) and control group (group discussion without ethno-biology). Then, the average was calculated and then analyzed by Analysis of variance. The tables were used to display the responses.

3.2.2 ETHICAL ISSUES

The research ethics were taken into account in this study. Foremost, consent from the school authorities was sought; the school administrators were briefed on the research procedures and enlightened on the value of the research to be conducted. Confidentiality of respondents was also highly respected such that respondents were told not to put their names on the test papers and questionnaires except only for identification numbers so as to determine which group the respondent belonged to (Control group or Experimental group). The lessons were conducted by the researcher during 'prep' time so as to avoid as much as possible disturbing the school normal running of programs thereby according the research site respect. Participation was voluntary. Permission was sought from parents regarding the field trip.

4.0 CHAPTER FOUR

4.1 CHAPTER OVERVIEW

This chapter is going to analyse and present results of quantitative testing of the conceptual model as presented in the first chapter of this research. The purpose of this study was to ascertain whether ethno biology improves pupils' understanding (achievement) of ecology. The study also determined whether the teaching method influences the attitude of students towards a topic (subject) as well as whether or not academic achievement in ecology varies with sex. Descriptive statistics related to student's academic achievement in ecology before and after the treatment measured using an ecology achievement test, students' attitude towards ecology after treatment was obtained by a five Likert-type attitude questionnaire and inferential statistics results of testing the three null hypotheses are presented in this chapter.

4.2.0 DESCRIPTIVE STATISTICS OF ECOLOGY PRE-TEST PERFORMANCE.

An ecology achievement test was used to measure pupils' understanding of ecology concepts when taught using group discussion with ethno-biology and group discussion without ethno-biology. This instrument was constructed by using grade twelve past examination papers as a guide to come up with almost completely new questions. This instrument was validated by biology educators and research experts within Ndola district.

Table 3a: Pre-test Achievement of pupils between teaching methods (n=100).

Teaching method	N	Minimum	Maximum	Mean score	Std. Deviation
Ethno-biology	48	0%	23%	8.35	4.138
Group discussion	52	0%	20%	8.31	5.792

The table above shows 48 respondents in experimental group and 52 respondents in control group. The minimum score in both groups was 0% and the maximum scores were; 23% for the experimental group and 20% for the control group.

The figure below compares the performance of pupils before the intervention to determine whether there was a difference.

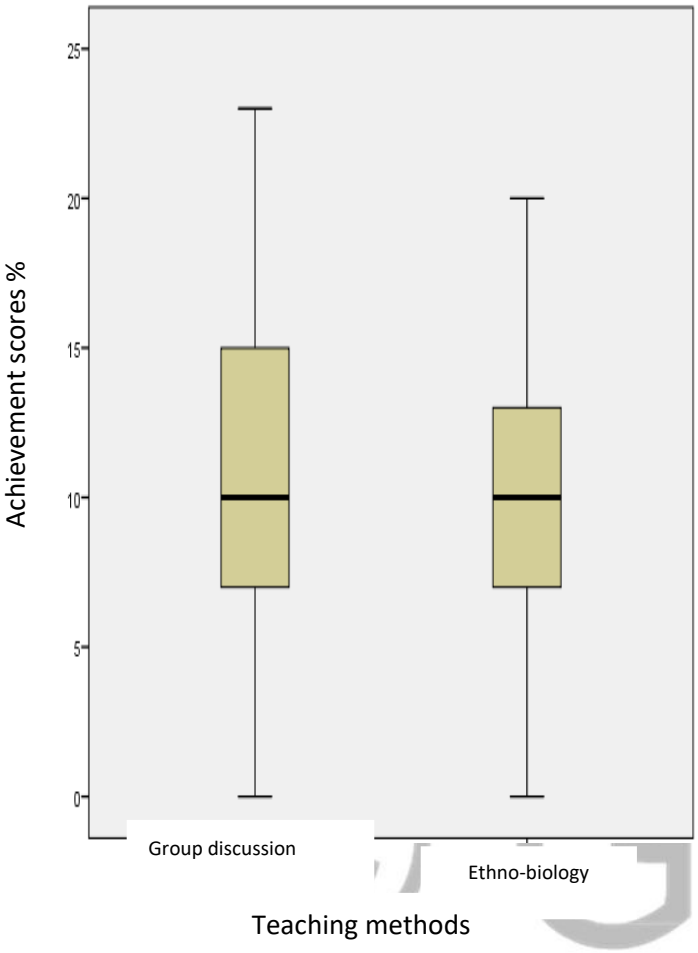

Figure 2: Boxplot of Pre-test achievement of pupils' in ecology.

Figure 2 above shows that before the intervention, pupils in both groups were at the same level in the sense that, the minimum score in both groups was 0.0% and the median (50th percentile) was 10.0%. The 25th percentile was 6.5% for both groups, while the 75th percentiles were 15% for group discussion without ethno-biology and13% for group discussion with ethno-biology. The maximum score for group discussion without ethno-biology was 23% and for group discussion with ethno-biology was 20%. Although, there was a difference in the maximum score in favour of the group discussion without ethno-biology, it was negligible. However, there was no significant difference in achievement between the two groups before the intervention.

The figure below shows the normal distribution of the data before the T-test was employed.

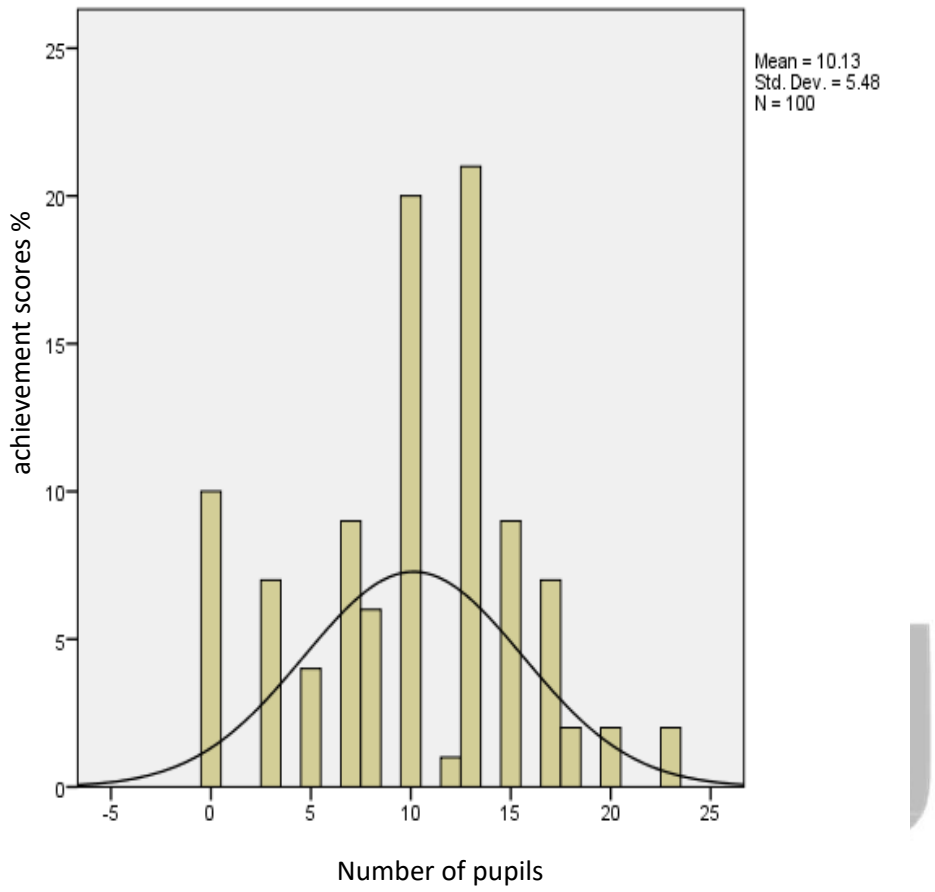

Figure 3: Normal Distribution Curve of Pre-test achievement.

Figure 3 above shows that the data was normally distributed.

4.2.1 Test of Normality of Pre-test Ecology Performance.

The table below shows a test of normality of Shapiro-wilk. The null hypothesis of this test is that the population is normally distributed. This test was conducted before the independent Samples t-test was carried out to ensure that the data was normally distributed to qualify the test.

Table 3b: Shapiro-Wilk Test of Normality of Pre-test Achievement (N=100).

Teaching method	Statistic	df	P-value
Ethno-biology	0.965	48	0.127
Group discussion	0.962	52	0.125

From the table above, it is seen that the statistic difference between the two groups was negligible and the p-values in both groups are greater than the alpha value (α=0.05).

P > α, hence we fail to reject the null hypothesis and conclude that the data was normally distributed before the intervention.

4.2.2 INDEPENDENT SAMPLES T-TEST FOR PRE-TEST ECOLOGY PERFORMANCE.

Table 3c below presents the results of the Levene's test for homogeneity of error variances. These results are based on the pre-test of the ecology performance test to test whether the assumption of equality of error variances was achieved. The table below summarises the results of the performance Independent Samples t-test to determine whether the two groups had the same performance in ecology before instruction.

Table 3c: Independent samples T-test testing the effects of teaching methods on pre-test Average achievement (n=100).

Teaching method	**N**	**Mean**	**Std. Deviation**	**t-value**	**df**	**p-value**	**Mean difference**
Ethno-biology	48	8.35	5.138	0.042	98	0.966	0.46
Group discussion	52	8.31	5.792				

The table above shows that before the intervention, the mean scores for experimental group was M=8.35; SD=5.138 and the control group was M=8.31; SD=5.792 with the mean difference of 0.46. Table 3c above shows that there was no significant difference in the mean performance between the two groups (Control and Experimental) before the intervention (t98=0.042, p<0 .966). Since p< 0.966 is greater than 0.05 our chosen significant level, hence we fail to reject the null hypothesis and conclude that there was no statistically significant difference in two groups before the instruction.

4.3.0 DESCRIPTIVE STATISTICS OF POST-TEST PERFORMANCE FOR PUPILS IN GROUPS.

The table below summarises the results of post-test academic achievement for pupils.

Table 4a: Post-test achievement of pupils between teaching methods (n=100).

Teaching method	N	minimum score	maximum score	mean score	Std. Deviation
Ethno-biology	48	13%	87%	52.52	18.57
Group discussion	52	15%	57%	37.19	12.240

Table 4a above shows that there were 48 respondents in group discussion with ethno-biology and 52 respondents in group discussion without ethno-biology making a total of 100 respondents. The minimum scores were; 13% for group discussion with ethno-biology and 15% for group discussion without ethno-biology. The maximum scores were; 87% for the experimental group and 57% for the control group. The mean score for the experimental was 52.52 with the standard deviation of 18.571 and the mean score for the control group was 37.19 with standard deviation of 12.240. There was a difference of 15.33 in mean score between the group discussion with ethno-biology and group discussion without ethno-biology. Pupils taught ecology using group discussion with ethno-biology performed better than those taught ecology using group discussion without ethno-biology.

The figure below compares the academic achievement of post-test between the group discussion with ethno-biology and group discussion without ethno-biology.

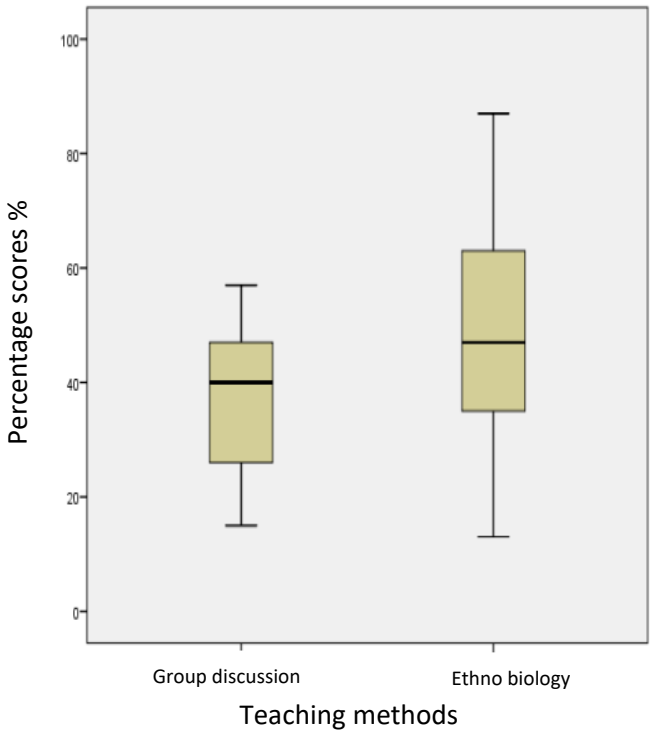

Figure 4: Boxplot of Post-test performance in groups.

Figure 4 above shows that the minimum score in group discussion without ethno-biology was 15%, then 25th percentile was 25%, 50th percentile (median) was 40%, 75th percentile was 48% and the maximum score was 57%. While for group discussion with ethno-biology, the minimum score was 13%, the 25th percentile was 32%, the 50th percentile (median) was 47%, the 75th percentile was 62% and the maximum score was 87%. The interquartile range for control group was 22% while for the experimental group was 29%. The median for group discussion with ethno-biology was greater than that of the group discussion without ethno-biology. Hence, ethno-biology enhanced understanding of ecology.

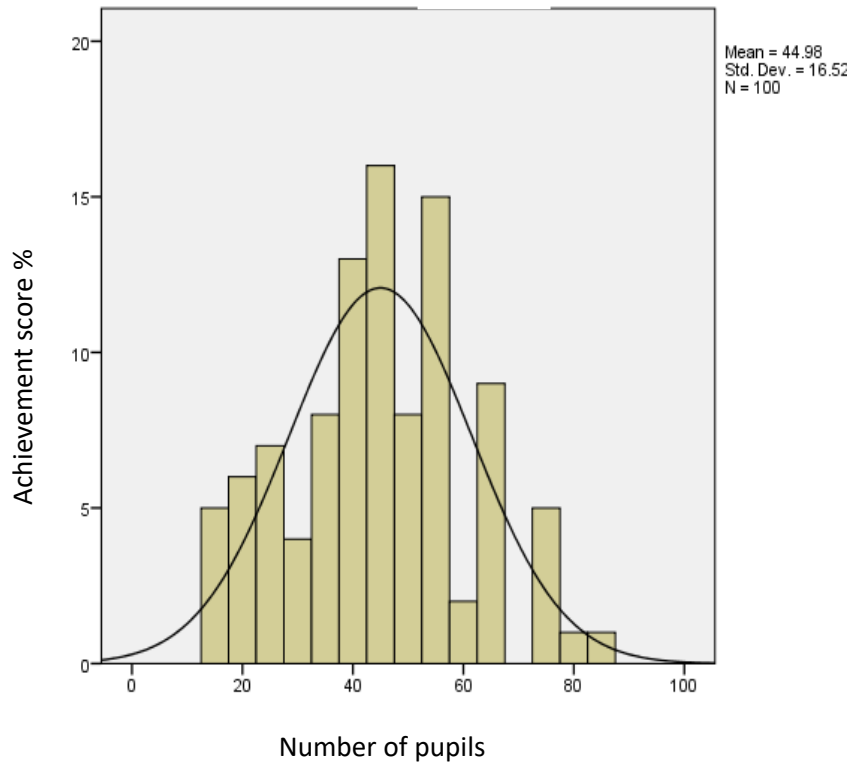

Figure 5: Normal Distribution curve of post-test performance.

The figure above shows that the data was normally distributed.

4.3.1 TEST OF NORMALITY OF POST-TEST PERFORMANCE.

Table 4b: Shapiro-Wilk Test of Normality for post-test performance in groups (n=100).

Teaching method	statistic	df	p-value
Ethnobiology	0.974	48	0.361
Group discussion	0.954	52	0.043

In the table above, the p-value for experimental group ($p < 0.361$) is greater than the α-value (0.05) thus, we fail to reject the null hypothesis and conclude that the data was normally distributed after the intervention in experimental group. While in control group the p-value ($p < 0.043$) is smaller than the alpha value ($\alpha = 0.05$).

4.3.2 INDEPENDENT SAMPLES T-TEST OF POST-TEST PERFORMANCE SCORES.

The table below summarise the results of the performance Independent Samples t-test to determine whether the two groups had the same performance after the intervention.

Table 4c: Independent samples t-test of post-test performance by group (n = 100).

Teaching method	N	mean	std. Deviation	t-value	df	p-value	mean difference
Ethno-biology	48	52.52	18.571	4.831	80.342	**0.001**	15.33
Group discussion	52	37.19	12.230				

From the table above, it is shown that the mean scores for experimental group was 52.52 with standard deviation of 18.571 and for control group was 37.19 with the standard deviation of 12.240, with 15.33 mean score difference. This entails that there was a great difference in performance between the two groups after intervention.

Table 4c above also shows a non-significant result for the Levene's test for equality of variances with t80.342 = 4.831, P < 0.001. Since P (0.001) is less than our chosen alpha value (0.05), we reject the null hypothesis and conclude that the mean performance for control and experimental was significantly different after the instruction. From the Table, Levene's Test for equality of variances gives t80.342 = 4.831, p < 0.001.

4.4.0 ANALYSIS OF TEACHING METHODS ACROSS GENDER.

Table 5a: ANOVA Testing the effect of Gender and Teaching methods on achievement (n = 100).

Source of variance	DF	SS	MS	F-value	P-value
Gender	1	15.27	15.2698	10.2582	**0.002**
Teaching method	1	13.83	13.8303	9.2911	**0.003**
Residuals	97	144.39	1.4886		

Table 5a above reveals the ANOVA on the teaching methods and gender. It is observed that gender and teaching methods are statistically different with F (1, 98) = 10.26, P < 0.002 and F (1, 98) = 9.29, P < 0.003 respectively. The results show that gender has got significant effect on achievement as well as teaching methods. There was a significant difference in academic achievement between teaching methods across gender, but do not show where exactly the difference lies.

The figure below shows the significant difference in academic performance between the teaching methods across gender.

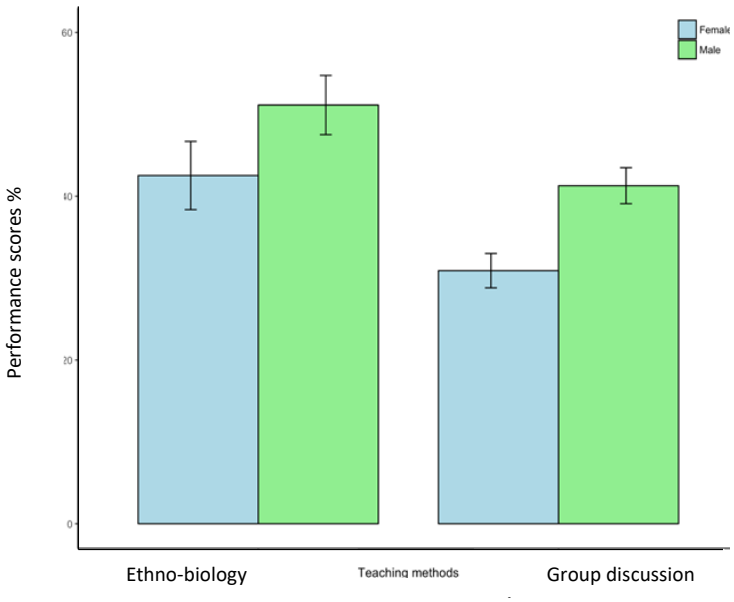

Figure 6: Academic achievement of students between teaching methods across gender.

Figure 6 shows that students taught ecology using ethno-biology performed better than those taught ecology using group discussion without ethno-biology. Therefore, group discussion incorporating ethno-biology enhanced academic achievement compared to group discussion without ethno-biology. Overall male students performed better than female students.

4.5.0 PUPILS' ATTITUDES TOWARDS ECOLOGY.

Attitude was considered as interest, dislike and appreciation of students in learning ecology.

4.5.1 ANALYSIS OF ATTITUDE ACROSS GENDER BETWEEN TEACHING METHODS.

The table below summarizes the results of Analysis of variance on interest across gender.

Table 6a: ANOVA Testing the effect of teaching methods on Interest across gender (n = 100).

Source of variation	DF	SS	MS	F-value	P-value
Gender	1	0.40	0.4004	0.863	0.355
Teaching methods	1	27.23	27.2301	58.6958	**0.001**
Residuals	97	45.00	0.4639		

Table 6a reveals the ANOVA on the interest of students in ecology between teaching methods across gender. It shows that there is no significant difference in students' interest

across gender with F (1, 98) = 0.863, P < 0.355 while there is a significant difference between teaching methods with F (1, 98) = 58.696, P < 0.001.

Table 6b: Significant difference between teaching methods across gender on the interest of students in learning ecology (n = 100).

Teaching method/Gender	Mean	Std. Deviation	P-value
Ethno-biology	3.770	0.826	**0.001**
Group discussion	2.721	0.507	
Gender: Male	3.276	0.900	0.355
Female	3.147	0.792	

The P-value in bold in 6b above shows that there was a significant difference between teaching methods on the interest of students' in ecology, for group discussion with ethno-biology (M = 3.770, SD = 0.826) and the group discussion without ethno-biology (M = 2.721, SD = 0.507). The mean difference was 1.048 which seems to be significant. This shows that students taught ecology using group discussion with ethno-biology were more interested in learning ecology than those taught using group discussion without ethno-biology. This means that teaching method influence students' interest in learning of ecology. It is also observed that there was no significant difference across gender, for male (M = 3.276, SD = 0.900) and female (M = 3.147, SD = 0.792). The mean difference was 0.129 which seems not to significant. This entails that given a teaching method, interest is the same regardless of gender. Hence gender does not affect the interest of students' in learning of ecology.

Table 6c: ANOVA Testing the effect of teaching methods on Dislike across gender (n=100).

Source of variation	DF	SS	MS	F-value	P-value
Gender	1	1.414	1.414	3.69	0.057
Teaching methods	1	41.159	41.159	107.39	**0.001**
Residuals	97	37.177	0.383		

Table 6c reveals the ANOVA on the dislike of students in ecology between teaching methods across gender. The P-value 0.057 is greater than the significance level 0.05. This indicates that we fail to reject the null hypothesis and conclude that there was no significant

difference across gender in the dislike of students in learning of ecology. The P-value in bold is less than the significance level (0.05), hence we reject the null hypothesis and conclude that there was a significant difference in the dislike of students in ecology.

Table 6d below shows where the difference lies between the teaching methods across gender on the dislike of students in ecology.

Table 6d: Significant difference between teaching methods across gender on the dislike of students in ecology (n = 100).

Teaching methods /Gender	Mean	Std. Deviation	P-value
Ethno-biology	2.190	0.683	**0.001**
Group discussion	3.484	0.560	
Gender: Male	2.766	0.858	0.057
Female	3.008	0.945	

The P-value in bold shows that there was a significant difference between teaching methods on the dislike of students in ecology, for group discussion with ethno-biology (M = 2.190, SD = 0.683) and group discussion without ethno-biology (M = 3.484, SD = 0.945). The mean difference of 1.214 seems to be significant in favour of the group discussion without ethno-biology. This shows that students taught ecology with group discussion without ethno-biology disliked ecology than those taught ecology with group discussion with ethno-biology.

The results also show that there was no significant difference in the dislike of ecology across gender, for male (M = 2.766, SD = 0.858) and female (M = 3. 008, SD = 0.945). The mean difference of 0.242 seems to be insignificant.

Table 6e: ANOVA testing the effects of teaching methods on appreciation across gender (n=100).

Source of variation	DF	SS	MS	F-value	P-value
Gender	1	0.4769	0.4769	1.799	0.183
Teaching methods	1	22.2644	22.2644	83.978	**0.001**
Residuals	96	25.4516	0.2651		

Table 6e reveals ANOVA on the appreciation of students in ecology between teaching methods across gender. The results show that there was no significant difference in students' appreciation of ecology across gender, with F (1, 98) = 1.80, P < 0.183. The results also show the significant difference between the teaching methods in the appreciation of students' in ecology with F (1, 98) = 83.98, P < 0.001.

The table below shows exactly where the difference is in students' appreciation of ecology between teaching methods.

Table 6f: Significant difference between teaching methods on appreciation of students' in ecology (n = 100).

Teaching methods/Gender	Mean	Std. Deviation	P-value
Ethno-biology	3.837	0.484	**0.001**
Group discussion	2.839	0.542	
Gender: Male	3.384	0.750	0.183
Female	3.267	0.631	

The P-value in bold shows a significant difference between teaching methods on the appreciation of students in ecology, for group discussion with ethno-biology (M = 3.837, SD = 0.484) and group discussion without ethno-biology (M = 2.839, SD = 0.542). This indicates that teaching methods affect appreciation of students' in ecology. The P-value 0.183 does indicate insignificant difference across gender in the appreciation of students' in ecology, for male (M = 3.384, SD = 0.750) and female (M = 3.267, SD = 0.631). This entails that given a teaching method, appreciation of students' in ecology is the same regardless of gender. Therefore, incorporating ethno-biology into group discussion enhances students' appreciation of learning ecology.

4.6. SIGNIFICANT RELATIONSHIP BETWEEN PERFORMANCE, INTEREST AND DISLIKE.

Table 7: Correlation Matrix

	Achievement	Interest	Dislike
Achievement	1	0.624536	-0.5999552
Interest	0.6124536	1	-0.6882306
Dislike	-0.5999552	-0.6882306	1

Table 7 shows the correlation of achievement, interest and dislike of the students towards learning of ecology. There is a high positive relationship between achievement and interest of students. The relationship is positive in that as the interest of student's increases in learning ecology, the achievement increases. The value of 0.6124536 indicates a high positive relationship between interest and achievement of the students at correlation significance at 0.05 level. The relationship between interest and achievement is statistically significant. There is a negative relationship between achievement and dislike of students. The relationship is negative in the sense that as student do not tend to like learning ecology (biology), the achievement decreases. The value of -0.5999552 entails a negative relationship between achievement and dislike. There is also a high negative relationship between interest and dislike of students. The relationship is negative in that when students do not like learning ecology, their interest will be low hence low achievement in ecology (biology). Therefore, there is a direct relationship between interest and achievement and inverse relationship between dislike and achievement, and interest. Integrating ethno-biology into group discussion aroused students' interest and engaged in learning with a self-direct motivation. Hence, group discussion with ethno-biology enabled students to develop positive interest which has a direct relationship with achievement.

5.0 CHAPTER FIVE: DISCUSSION

5.1 CHAPTER OVERVIEW

In this chapter, we discuss the findings of the study vis-à-vis the specific questions of the study. This chapter will therefore give answers to the three research questions that guided

the study. This study sought to find out whether ethno-biology improves pupils' understanding (performance) of ecology at Lubuto school pupils in Ndola district.

5.2 RESEARCH QUESTION 1

Is group discussion with ethno-biology more effective than group discussion without ethno-biology?

From the findings, it was revealed that students taught ecology using group discussion with ethno-biology performed better than those taught ecology using group discussion without ethno-biology. The results showed that there was a significant difference in the post-test performance scores between the two groups for group discussion with ethno-biology (M = 37.19, SD = 12.24) and group discussion without ethno-biology (M = 52.52, SD = 18.57) with P-value (0.001) less than the α-value (0.05). The null hypothesis which states that: ''There is no significance difference in achievement of students when taught ecology using group discussion with ethno-biology and group discussion without ethno-biology'', was tested. This hypothesis was proved false by the overall respondent's results. The credibility of the results was confirmed by the Independent Samples t-Test which had given convincing proof for rejecting the null hypothesis. For instance, the p-value was 0.001 less than the alpha value (α = 0.05). Therefore, basing on the computed figures it was observed that group discussion with ethno-biology was more effective than the group discussion without ethno-biology. These results therefore showed that ethno-biology improves pupils' understanding which can result to excellent achievement in ecology. Pupils taught ecology using group discussion with ethno-biology were able to see ecological concepts as real from their real world experiences and were also able to contextualize biology practices and knowledge done in their homes and / or community.

These results are in agreement with the findings of Elaine (2008) and Sakayombo (2014) studies which stipulate that integrating indigenous knowledge in teaching-learning enhances understanding of the concepts in a topic or subject. It is therefore, deduced that to improve pupils academic achievement in biology, teachers of biology must 'incorporate' pupils basic indigenous knowledge and practices so that learners can make connections between the biology learnt in classroom and the biology practiced at home or in a community so as to bring about meaningful learning. This however, will increase quality and relevance education.

The findings of this study was also in line with other studies such as Manda (2012) and Oyovwi (2015) that secondary school pupils find it difficult to understand ecology. This is because in most cases the methods adopted in teaching ecology are those that don't let learners' process knowledge and construct their own understanding. Hence, leave learners passive resulting in the loss of attention and eventually loss of interest in learning ecology. The findings of this study indicate that teaching methods such as group discussion with ethno-biology that actively engages students by applying their existing knowledge and real-world experiences throughout the lesson can significantly enhance pupils' understanding of ecological concepts. This is so because it engages students' interest in learning of ecology (biology) and provides opportunities for students to contextualize what they are learning to real world experiences and processing of knowledge in the manner that the brain works efficiently.

The table of descriptive statistics (Table 4c) clearly explains the meaning of method of teaching being significant. Table 4c shows that, the average achievement of students in group discussion with ethno-biology was M = 52.52; SD = 18.57 while that of the group discussion without ethno-biology was M = 37.19, SD = 12.24. There was the mean difference of 15.33 between the two groups in the average achievement after the intervention. This showed that the group discussion with ethno-biology was more effective than group discussion without ethno-biology. This means that, the integrating ethno-biology into group discussion enhances understanding of ecology group discussion method on its own. However, the Levene's Test results give p-value (0.001) less than α-value (0.05). The effectiveness of integrating ethno biology into group discussion was explicitly seen in the students' participation and brining out indigenous practices they do at home and also in a community. Pupils taught ecology using ethno-biology were able to relate what they do at home to what was being learnt. They explained why it is important to use organic fertiliser such as mature rather than inorganic fertilisers when improving soil fertility. They developed a meaningful understanding by linking the practices done at home and/ in a community to the ecological concepts learnt in classroom which helped them to answer questions well. Questions like; ''explain the importance of biodiversity?'' "Discuss the effects of not conserving nature?'' in a meaningful way compared to group discussion without ethno-biology. This is in support with the constructivism theory that compels students to ''reinvent the wheel''. That it taps into and triggers the students' innate curiosity about the world and how things work. Students did not reinvent the wheel but rather,

attempted to understand how it turns and how it functions (Anderson et al., 2006). Therefore, integrating ethno-biology into group discussion, students became engaged by applying their existing knowledge and real-world experiences to biological concepts and thus, enhances their understanding of ecology than their counterpart in group discussion without ethno-biology who actually discussed the concepts without relating to their experiences, it was more likely to forget the concepts because knowledge retention was low which in-turn led to low performance. Group discussion with ethno-biology catered for all students' capability and learners were engaged in applying existing knowledge and what was being taught to the real-world experiences. Students were all actively involved in their own process of learning. Group discussion method did not allow learners to be actively participating in learning and learners were not allowed to make connections with what they were learning to real world or life experiences.

5.3 RESEARCH QUESTION 2

Does performance vary across gender when pupils taught ecology using group discussion with ethno-biology and group discussion without ethno-biology?

From the findings, it revealed that there was a statistically significant difference between teaching methods across gender, for teaching methods with $F(1, 98) = 10.26$, $P < 0.002$ and gender with $F(1, 98) = 9.29$, $P < 0.003$. The results showed that teaching methods have got significant effect on the academic achievement as well as gender. Figure 6 show that students taught ecology using group discussion with ethno-biology performed better than those taught ecology using group discussion without ethno-biology. Figure 6 also show that male students performed better than female students in both groups. This warrants an inference that gender and teaching methods influence academic achievement in ecology. These findings were the same as those established by Osborne (2003) whose findings went on to give attributions to gender difference in terms of achievement. Osborne stated that, the teacher, curricular and cultural are among the factors that result in the difference in achievement that exists across gender. The belief that girls cannot do science is an example of a society belief that contributes to girls' low achievement in science compared to that of boys. The findings of Shamai (1996) and, Tinklin, Croxford and Duckin (2001) reveals that classroom experiences and socialization are among the causes of more girls perceiving biological concepts to be difficult than boys. Boys are perceived to be more competitive and more willing to have a go at doing something as opposed to the low esteem and passive

dependent behaviour among girls. This affects the academic achievement of girls in biology. The findings of Mavrikaki et al., (2012) contradict to the findings of this study which reveal that gender does not affect students' achievement. Another similar study conducted by Keeves and Kotte (1992) revealed that there is no statistically significant difference in the average achievement of males and females. However, other studies are in agreement with the findings of this study.

The null hypothesis which states that: Achievement in ecology does not vary significantly with gender. This hypothesis proved false by the overall respondent's results. The results showed that there was a statistically significant difference in the academic achievement between male students and female students. Although, there was the difference across gender in both groups, male and female students in group discussion with ethno-biology performed better than those without in group discussion without ethno-biology. It can be therefore, deduced that group discussion integrating ethno-biology enhanced academic achievement compared to group discussion without ethno-biology. This is so because integrating ethno-biology into group discussion method enabled learners to draw specific connections between content knowledge taught to an authentic environment in which the content can be applied. It also provided students with opportunities to participate actively in teaching-learning process and students were responsible for their own learning. Students moved from extrinsic to intrinsic motivation, and the topic was self-driven due to the fact that pupils were able to contextualize the content learnt to the knowledge and practices done in the community.

5.4 RESEARCH QUESTION 3

Do Attitudes of students towards ecology vary when taught ecology using ethno-biology integrated into group discussion method and group discussion method?

The findings revealed that students taught ecology using group discussion with ethno-biology were interested in learning of ecology than those taught ecology using group discussion without ethno-biology. The results also showed that students taught ecology with group discussion without ethno-biology disliked learning of ecology, hence had a negative attitude towards learning of ecology. According to Bevins et al (2005), the negative attitude towards ecology has for a long time been one of the reasons for low performance in biology.

However, the answer to the research question was that attitudes of pupils towards ecology varied between the two groups. The results showed that the group taught ecology using

group discussion with ethno-biology had a positive attitude towards ecology than those taught using group discussion without ethno-biology who exhibited a negative attitude towards ecology. There was no difference in attitudes between males and females.

The findings of this study are in agreement with the results of Cimer (2004) who imputes that negative attitude towards science is due to the methods adopted in teaching science, biology inclusively. From the responses, pupils in both groups agreed that understanding of ecology depends on how it is taught; this is in line with most of the studies that seem to agree with the fact that a teaching method is one of the factors that affect learner's attributions. For instance, when teachers employ teaching strategies that enable learners appreciate and feel that what they are learning is easy and actually exists; they tend to be motivated to achieve and expect success (Kochhar, 2015). This is also in line with Craker (2006) who stipulated that attitude is one of the utmost significant factors that can lead to raising or lowering pupils' understanding, thus affect students' achievement in science. This is true because pupils enjoy studying what they feel is easy to understand and develop interest in studying such materials while paying less attention to concepts that perceived to be difficult to understand. However, this entails that an inappropriate teaching method will result in a negative attitude towards a topic or subject which will eventually result in less effort directed (self-directed) towards studying and understanding of concepts leading to low achievement.

The teaching method should enable learners to make connections with what they are learning to life experiences, will they then appreciate it. Students taught ecology using group discussion with ethno-biology developed a positive attitude towards ecology than their counterpart group discussion without ethno-biology because integrating ethno-biology into group discussion provided pupils with opportunities to participate actively in teaching-learning process. Students were able to draw specific connections between ecological concepts taught to that practiced at home or in a community. For example, pupils were able to explain the importance of biodiversity that it provides food and shelter for other animals and for aesthetic. Pupils were able to explain why it is important to conserve nature. People can appreciate nature only if they understand what it is and its relevance in their lives will they then conserve it for sustainable use (Rivet et al, 2008). The result is in agreement with Tooke and Lindstorm's (1998) and Craker (2006) cited by Guido (2013) that a positive attitude influences expected achievement and that students who have a positive attitude and believes in science will succeed at a higher level.

The study conducted by Chibuye et al (2017) is also in line with the current study in that positive attitude enhances understanding which leads to excellent performance in a topic or subject.

Students' attitude towards ecology varied between the two groups in that pupils taught ecology using group discussion with ethno-biology had a positive attitude towards ecology while those taught ecology using group discussion without ethno-biology had a negative attitude towards ecology and there was no difference in attitudes across gender. Therefore, integrating ethno-biology into group discussion method enabled learners to develop a positive attitude towards ecology and their understanding of ecology was improved and resulted into high academic achievement in ecology.

5.5 SUMMARY OF CHAPTER FIVE

The chapter has provided an overview of the findings of the study. It discussed the findings regarding whether group discussion incorporating ethno-biology improves pupils achievement in ecology on the grade twelve pupils of Lubuto secondary school of Ndola district.

The next and final chapter (chapter six) of this thesis gives a synoptic view of the study. It highlights the major findings of this study and gives recommendations based on the findings of the study.

6.0 CHAPTER SIX

6.1 CONCLUSION AND RECOMMENDATIONS

Conclusively, it is the researchers general assertion that many studies have agreed that most pupils find ecological concepts challenging to understand and that the reasons behind this are the teaching method strategies and attitude of learners towards a topic or subject.

The findings of this study revealed that, group discussion incorporating ethno-biology significantly improves pupils' academic achievement in ecology as well as attitude towards ecology. It has also revealed that gender influence achievement but has got no effect on attitude in ecology. To enhance meaningful learning, teachers should be aware of teaching methods and other factors such as interest that influence learning as they prepare and deliver lessons and make sure that all learners are catered for despite their background.

Therefore, the study recommends that; integration of ethno-biology to be explored with other biology topics such as cell organisation, anaerobic respiration, classification just to mention a few and science subjects. School Heads to organise local seminars such as profession continuing development (C P D) to educate teachers on teaching methods that will bring quality and relevance education and teachers of Biology to take into consideration the learner's cultural knowledge when teaching.

Finally, future studies to be conducted using qualitative methodology, in a different district and a number of schools both single and core schools to be considered. Also, different grades like junior secondary level can be investigated.

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APPENDICES

APPENDIX I: ECOLOGY PERFORMANCE PRE-TEST AND POST-TEST.

NATURAL SCIENCE DEPARTMENT Tropical Test

GRADE 12 BIOLOGY – ECOLOGY 40 Minutes

Instructions

- Answer all questions in this paper.
- Present your answers in a clear and logical manner.

1	What is soil?
2	Name four weathering agents responsible for soil formation.
3	Describe the types of soil and their properties.
4	Name three inorganic components of a soil.
5	Give examples of three living organisms to be found in a fertile soil.
6	What are the properties of a fertile soil?
7	Explain methods of improving and retaining soil fertility.
8	Explain the purpose of adding lime to the soil.
9	What is Biodiversity?
10	Explain how some organisms are adapted to the environment.
11	Explain the impact of human activity on organisms.
12	Describe the economic reasons for maintaining bio-diversity.

Total marks [50 marks].

APPENDIX II: ECOLOGY ACHIEVEMENT PRE-TEST AND POST-TEST ANSWER SHEET.

1. Soil is a weathered top layer of the earth's crust
2. Mineral particles; soil air; soil water; dead and living organic matter.
3. Clay soil- particles are small, good capillarity, poor aeration, and water drains slowly, is Alkaline.

   Sandy soil- has large particles; water drains fast water retention poor, poor capillarity, good aeration, is acidic.

   Loam soil- good aeration, good drainage, water moves fairly, has high humus, well.

   Crumb structure, has neutral P^H.
4. Air; water; mineral salts; rock particles.
5. Bacteria; fungi; moth; ants; rodents; earth worms.
6. Humus; rock particles; aeration; drainage; neutral P^H; temperature.
7. P^H control; manure; crop rotation; weeding; application of fertiliser.
8. To neutralize the acidic soil.
9. Biodiversity is the variety of organisms in an ecosystem.
10. Adaptive characteristics of fish, insects, mammals and plants.
11. Hunting, fishing and charcoal production.
12. The economic reasons for maintaining a rich biodiversity are:

    - It attracts tourists thereby earning foreign exchange.
    - Several plants and animals can be used as sources of medicines e.g. quinine which is used to treat malaria comes from the Cinchona plant.

      Used as food.

APPENDIX III: LESSON PLANS

LESSON PLAN FOR EXPERIMENTAL GROUP

Class: 12 S

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils: 48

Subtopic: The Soil Composition

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Define soil;

2. Demonstrate soil composition.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 2 minutes	-Soil is the weathered top layer of the earth's crust. -Soil supplies nutrients to plants in order to manufacture food on which animals depend. Provides anchorage to plants, Serves as shelter to animals such as snakes, mice earthworms etc. To construct buildings, roads and source of minerals, water and for farming.	Tr. Asks the pupils; what is soil? Explain the importance of soil.	Pupils to answer the ques tions.
DEVELOPMENT	-Soil comprises of organic and inorganic materials. -Mineral particles, water, air, dead and living organic matter.	Tr. to put pupils in groups, six per group two females and four males. Tr. to write questions on the board for pupils to discuss in groups. To guide and monitor as	Pupils to be in groups And discuss the question s given by the teacher.

33 minutes		pupils discuss ensuring that everyone participates in the discussion. Questions: 1. What does soil comprises of. 2. Mention four weathering agents for soil formation. Tr. to explain and emphasize on key points	
EVALUATION 5 minutes	Give examples of organic and inorganic materials.	Tr. to write key points as notes and write the class exercise -Mark the class exercise.	Pupils to copy notes and Write the class exercise a nd take for marking

SELF EVALUATION: 75% of the class answered the questions correctly.

Lesson plan for Control Group

Class: 12 B

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils: 52

Subtopic: The Soil Composition

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Define soil;

2. Demonstrate soil composition.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 2 minutes	-Soil is the weathered top layer of the earth's crust. -Soil supplies nutrients to plants in order to manufacture food on which animals depend. Provides anchorage to plants, Serves as shelter to animals such as snakes, mice earthworms etc. To construct buildings, roads and source of minerals, water and for farming.	Tr. Asks the pupils; what is soil? Explain the importance of soil.	Pupils to answer the ques tions.
DEVELOPMENT 33 minutes	-Soil comprises of organic and inorganic materials. -Mineral particles, water, air, dead and living organic matter.	Tr. to put pupils in groups, six per group two females and four males. Tr. to write questions on the board for pupils to discuss in groups. To guide and monitor as pupils discuss ensuring that	Pupils to be in groups And discuss the question s given by the teacher.

		everyone participates in the discussion. Questions: 1. What does soil comprises of. 2. Mention four weathering agents for soil formation. Tr. to explain and emphasize on key points	
EVALUATION 5 mintes	Give examples of organic and inorganic materials.	Tr. to write key points as notes and write the class exercise -Mark the class exercise.	Pupils to copy notes and Write the class exercise a nd take for marking

SELF EVALUATION: 45% of the class answered the questions correctly.

LESSON PLAN FOR EXPERIMENTAL GROUP

Class: 12 S

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils: 48

Subtopic: The Soil Composition and Fertility

Teaching Aids: Chalkboard, soils (Loam, clay and sand) and Clay pots.

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Describe types of soil and their properties;

2. Describe factors that make soil fertile.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 2 minutes	-Water, air, mineral particles, dead and living organic matter.	Tr. recapitulates on the previous lesson. Tr. asks: Mention four weathering agents responsible for soil formation.	Pupils to answer the question correctly.
DEVELOPMENT 33minutes	Types soils: sand, clay and loam soils. Properties of soil 1. Clay soil- has particles are small, good capillarity, poor aeration, elasticity and water drains slowly. P^H alkaline. Used in making clay pots and statutes. 2. Sand soil-has large particles, water drains faster, poor water retention, poor capillarity and good aeration. P^H acidic. Used in	Tr. to tell pupils to be in groups and provide them with materials (three long glass tubes, cotton wool, dry sand, loam and clay soils, water trough, three measuring cylinders, 3 funnels, 3 filter papers) to do an activity. Activity 1: To show capillarity in clay, sand and loam soils. Activity 2: To compare drainage in clay, loam and sand	Pupils to be in groups. Following the instructions on the mark sheet, pupils to perform the Practical. Pupils to draw conclusion. Pupils to discuss the Traditional uses of soils relating to properties. Pupils to incorporate

	building and village huts. 3. Loam soil-good aeration, good drainage, water moves fairly, well crumb structure, has high humus. P^H neutral. Used for agriculture. Soil fertility P^H control, adding mature, conservation farming, mixed farming, furrow farming, weeding, application of fertilizer.	soils. Tr. asks the pupils: 1. Discuss the traditional uses of three soils as related to properties and provide them with clay pots to explain the properties for its make and use. 2. Describe factors that make soil fertile (pupils to discuss what traditionally/ locally is done to make soil fertile). Tr. to emphasize on key points.	Pupils to discuss what they do to make soil fertile when gardening (adding ashes to soil, adding black soil/ humus chicken/ animal wastes e.g. cows also growing beans/ groundnuts in the field.
EVALUATION 5minutes	1. Describe the properties three soils and the uses. 2. Explain the factors that make soil fertile.	Notes Class exercise Mark the class exercise	To copy notes Answer the questions and take books for marking

SELF EVALUATION: 75% of the class answered the questions correctly.

LESSON PLAN FOR CONTROL GROUP

Class: 12 B

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils: 52

Subtopic: The Soil Composition and Fertility

Teaching Aids: Chalkboard, soils (Loam, clay and sand).

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Describe types of soil and their properties;

2. Describe factors that make soil fertile.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 2 minutes	-Water, air, mineral particles, dead and living organic matter.	Tr. recapitulates on the previous lesson. Tr. asks: Mention four weathering agents responsible for soil formation.	Pupils to answer the question correctly.
DEVELOPMENT 33minutes	Types soils: sand, clay and loam soils. Properties of soil 1. Clay soil- has particles are small, good capillarity, poor aeration, elasticity and water drains slowly. P^H alkaline. Used in making statutes. 2. Sand soil-has large particles, water drains faster, poor water retention, poor capillarity and good aeration. P^H acidic. Used in	Tr. to tell pupils to be in groups and provide them with materials (three long glass tubes, cotton wool, dry sand, loam and clay soils, water trough, three measuring cylinders, 3 funnels, 3 filter papers) to do an activity. Activity 1: To show capillarity in clay, sand and loam soils. Activity 2: To compare drainage in clay, loam and sand	Pupils to be in groups. Following the instructions on the mark sheet, pupils to perform the Practical. Pupils to draw conclusion. Pupils to discuss the uses of soils.

	building. 3. Loam soil-good aeration, good drainage, water moves fairly, well crumb structure, has high humus. P^H neutral. Used for agriculture. Soil fertility P^H control, adding mature, weeding, application of fertilizer.	soils. Tr. asks the pupils: 1. Discuss the traditional uses of three soils as related to properties and use. 2. Describe factors that make soil fertile. Tr. to emphasize on key points.	
EVALUATION 5minutes	1. Describe the properties three soils and the uses. 2. Explain the factors that make soil fertile.	Notes Class exercise Mark the class exercise	To copy notes Answer the questions and take books for marking

SELF EVALUATION: 50% of the class got the answers correctly.

LESSON PLAN FOR EXPERIMENTAL GROUP

Class: 12 S

Sex: Mixed

Subject: Biology

Duration: 80 Minutes

Topic: Ecology

No. of pupils: 48

Subtopic: Biodiversity

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Investigate the importance of diversity of organisms in a given locality;

2. Explain how some organisms are adapted to the environment.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 5 minutes	Biodiversity is the variety of living organisms in an ecosystem.	Tr. to take pupils to school playground and tell them to pick any living thing. Tr. asks the pupils: What is bio-diversity?	Pupils to go outside And pick any Living thing.
DEVELOPMENT 77 minutes	Local names and uses of plants Mupundu , masuku, musafwa, munsonkasoka, mutobo, mutondo tree, mufungo tree, musamba tree, mubanga tree. Used as food, for honey production and as source of medicine e.g. quinine which is used to treat malaria comes from the Cinchona plant (Munsonkasoka). Adaptive characteristics e.g. Fish have gills for breathing in water, bears have fur	Tr. to take pupils to Dola hill forestry. Tr. to ask the local man to explain certain plants in local names and their uses. Tr. asks pupils; 1. Explain how some organisms (fish, bears, insects, mammals and plants) are adapted to the environment.	Pupils to collect 10 Different plants; write Down their local names, and uses. Pupils in groups to Discuss the questions. Pupils to write down Points.

	to live in ice land, and mammals have well developed organs and systems to live on land. -Equilibrium of organisms in the ecosystem.	2. Explain the importance of diversity of organisms in a given locality.	
EVALUATION 2 minutes	1. Explain the importance of a rich biodiversity. 2. Give examples of how organisms are adapted to the environment.	Homework	To make notes homework

SELF EVALUATION: 85% of learners answered the questions correctly.

LESSON PLAN FOR CONTROL GROUP

Class: 12 B

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils: 52

Subtopic: Biodiversity

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Investigate the importance of diversity of organisms in a given locality;

2. Explain how some organisms are adapted to the environment.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 5 minutes	Biodiversity is the variety of living organisms in an ecosystem.	Tr. to take pupils to school playground and tell them to pick any living thing. Tr. asks the pupils: What is bio-diversity?	Pupils to go outside And pick any Living thing.
DEVELOPMENT 77 minutes	Adaptive characteristics e.g. Fish have gills for breathing in water, bears have fur to live in ice land, and mammals have well developed organs and systems to live on land. -Equilibrium of organisms in the ecosystem. Used as food, for honey production and as source of medicine e.g. quinine which is used to treat malaria comes from the	Tr. tell pupils to be in groups and discuss the following questions: Tr. asks pupils; 1. Explain how some organisms (fish, bears, insects, mammals and plants) are adapted to the environment. 2. Explain the importance of diversity of organisms in	Pupils in groups to Discuss the questions. Pupils to write down Points.

	Cinchona plant.	a given locality.	
EVALUATION 2 minutes	1. Explain the importance of a rich biodiversity. 2. Give examples of how organisms are adapted to the environment.	Writing notes Class exercise Marking the exercise.	To make notes Answering questions and taking books for marking.

SELF EVALUATION: 45% of learners answered the questions correctly.

LESSON PLAN FOR EXPERIMENTAL GROUP

Class: 12 S

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils: 48

Subtopic: Biodiversity

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Investigate the impact of human activity on organisms;

2. Describe the economic reasons for maintaining bio-diversity.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 2 minutes	For equilibrium of organisms in the ecosystem.	Tr. to recapitulates on the previous lesson. Tr. asks the pupils: Explain the importance of diversity of organisms in a given locality.	Pupils to answer the question correctly.
DEVELOPMENT 33 minutes	1.Human activities on organisms Hunting, over fishing and charcoal production. 2. Impact of human activity on organisms. Threatened to extinction of species e.g. African elemphant. 3. Economic reasons for maintain bio-diversity. For tourism, medicinal plants and animals, source of food.	Tr. to put pupils in groups and tell them to discuss the following questions: 1. Investigate the human activities on organisms (e.g. activities practiced by local people). 2. Explain the impact of human activities on organisms. 3. Describe the economic reasons for maintaining bio-	Pupils to be in groups and Discuss the questions given (to incorporate activities practiced by local people e.g. in villages like chitemene system, poaching of animals, using chemicals and mosquito nets to catch Fish). A group representative to explain their answers to

		diversity. Tr. to guide and monitor pupils as they discuss in groups. Tr. to go round the groups ensuring that everyone participates. Tr. to explain and emphasize the key points.	the whole class. Pupils to pay attention as The teacher consolidates The lesson.
EVALUATION 5 minutes	1. Investigate the impact of human activity on organisms 2. Describe the economic reasons for maintaining bio-diversity.	Write key points as notes Class exercise.	Writing notes Class exercise.

SELF EVALUATION: 80% of learners got the answers correct.

LESSON PLAN FOR CONTROL GROUP

Class: 12 B

Sex: Mixed

Subject: Biology

Duration: 40 Minutes

Topic: Ecology

No. of pupils:52

Subtopic: Biodiversity

Specific outcomes: By the end of the lesson the pupil should be able to:

1. Investigate the impact of human activity on organisms;

2. Describe the economic reasons for maintaining bio-diversity.

STAGE/TIME	TEACHING POINTS	TEACHER ACTIVITY	PUPIL ACTIVITY
INTRODUCTION 2 minutes	For equilibrium of organisms in the ecosystem.	Tr. to recapitulates on the previous lesson. Tr. asks the pupils: Explain the importance of diversity of organisms in a given locality.	Pupils to answer the question correctly.
DEVELOPMENT 33 minutes	1.Human activities on organisms Hunting, over fishing and charcoal production. 2. Impact of human activity on organisms. Threatened to extinction of species e.g. African elemphant. 3. Economic reasons for maintain bio-diversity. For tourism, medicinal plants and animals, source of food.	Tr. to put pupils in groups and tell them to discuss the following questions: 1. Investigate the human activities on organisms. 2. Explain the impact of human activities on organisms. 3. Describe the economic reasons for maintaining bio-diversity. Tr. to guide and monitor	Pupils to be in groups and Discuss the questions given. A group representative to explain their answers to the whole class. Pupils to pay attention as The teacher consolidates The lesson.

		pupils as they discuss in groups. Tr. to go round the groups ensuring that everyone participates. Tr. to explain and emphasize the key points.	
EVALUATION 5 minutes	1. Investigate the impact of human activity on organisms 2. Describe the economic reasons for maintaining bio-diversity.	Write key points as notes Class exercise.	Writing notes Class exercise.

SELF EVALUATION: 50% of learners got the answers correct.

APPENDIX IV: QUESTIONNAIRE RESPONSES

EXPERIMENTAL GROUP

GENDER	EFT	IPE	ILE		EDM	ECU	IRE		IESE		UET		UEG	ICE	EUP
MALE	1	3	2		4	4	4		1		1		1	3	5
MALE	4	4	4		2	3	2		3		2		4	4	4
MALE	4	4	4		2	2	2		2		4		4	4	4
MALE	4	3	1		2	5	2		2		4		5	2	3
MALE	5	4	4		1	2	2		1		4		4	4	4
MALE	4	5	4		1	2	1		1		4		4	5	3
MALE	4	2	3		3	4	2		3		5		4	2	2
MALE	4	4	5		2	1	1		2		5		4	5	5
MALE	2	2	1		2	4	2		3		4		5	1	2
MALE	4	4	2		2	3	1		3		5		4	3	4
MALE	5	4	5		2	1	1		1		4		4	5	5
MALE	4	5	5		2	2	1		1		4		4	5	4
MALE	4	4	4		2	2	2		3		4		5	3	4
MALE	5	4	4		1	1	2		3		4		4	4	4
MALE	4	4	4		1	2	1		2		4		4	4	4
MALE	4	4	3		3	3	3		3		4		4	3	3
MALE	5	5	5		2	2	2		2		5		4	4	5
MALE	4	4	4		2	2	2		1		4		4	4	4
MALE	4	5	4		2	1	2		2		4		4	4	4
MALE	4	4	4		3	2	3		3		4		5	3	3
MALE	5	4	5		2	1	1		2		5		4	5	5
MALE	4	5	5		1	1	2		1		4		5	4	4
MALE	4	5	4		2	3	2		2		4		4	3	4

MALE	5	5	2		1	2	2		1		4		4	4	5
MALE	4	4	5		2	2	2		2		4		4	4	4
MALE	4	4	2		2	3	2		2		4		5	2	4
MALE	3	3	1		2	4	2		1		5		4	2	1
MALE	4	4	4		1	4	2		2		4		5	1	1
MALE	4	5	4		1	1	2		2		5		4	4	5
MALE	4	4	5		2	1	2		1		4		4	5	5
FEMALE	5	5	5		2	2	1		1		5		5	5	4
FEMALE	4	4	4		1	2	2		2		4		2	3	3
FEMALE	4	1	2		2	4	2		4		4		4	2	1
FEMALE	4	4	2		2	3	2		4		5		5	2	1
FEMALE	4	4	1		2	3	1		4		5		4	1	1
FEMALE	4	5	3		2	2	2		3		4		4	3	3
FEMALE	4	5	4		1	2	1		2		4		4	4	4
FEMALE	4	4	4		2	2	2		1		5		4	4	4
FEMALE	5	4	4		1	2	1		2		4		4	4	4
FEMALE	4	4	4		2	2	2		2		4		4	4	4
FEMALE	3	4	2		2	3	2		4		5		4	4	2
FEMALE	3	3	2		2	4	2		4		4		4	4	3
FEMALE	4	4	2		1	3	2		3		4		4	1	4
FEMALE	5	4	4		2	2	2		2		4		4	3	4
FEMALE	5	4	5		2	1	1		1		5		4	4	5
FEMALE	5	4	4		2	2	1		1		4		4	3	4
FEMALE	4	4	4		2	2	2		2		4		4	4	4
FEMALE	4	4	4		2	2	2		1		5		4	5	5

CONTROL GROUP

GENDER	EFT	IPE	ILE	EDM	ECU	IRE	1ESE	UET	UEG	ICE	EUP
MALE	2	1	4	4	1	4	3	2	2	4	4
MALE	4	4	2	4	3	4	4	4	2	1	2
MALE	3	2	4	4	1	3	2	2	1	4	4
MALE	4	4	1	4	4	4	2	4	5	1	3
MALE	2	2	4	2	4	2	3	3	3	4	4
MALE	5	5	2	3	4	4	3	4	2	2	3
MALE	2	5	2	5	3	4	3	5	1	4	4
MALE	2	1	3	4	4	4	5	5	1	4	4
MALE	3	1	4	2	4	4	2	4	2	2	2
MALE	4	4	2	1	4	1	3	1	5	2	4
MALE	4	4	2	1	4	4	3	2	1	1	3
MALE	3	2	1	4	4	1	3	2	3	1	2
MALE	2	1	4	4	1	3	2	3	2	1	4
MALE	1	2	4	2	4	2	1	2	2	4	2
MALE	2	1	4	4	3	1	1	2	2	5	3
MALE	3	2	4	5	5	1	3	2	1	4	4
MALE	2	2	3	4	4	3	5	1	1	3	1
MALE	2	2	3	4	4	4	3	2	3	4	4
MALE	2	2	5	4	5	4	2	2	1	4	5
MALE	2	1	4	4	2	5	1	2	3	3	5
MALE	3	1	4	3	4	4	3	5	1	5	4
MALE	2	2	4	5	4	4	1	2	2	4	4
MALE	2	2	1	4	4	3	3	2	1	4	1
MALE	2	2	3	4	4	4	4	2	3	4	4
MALE	4	4	4	5	5	4	3	4	4	1	4
MALE	1	3	4	3	4	2	5	2	3	4	3

MALE	2	2	4	4	4	4	3	2	1	4	4
MALE	2	2	4	4	5	2	1	2	2	4	5
MALE	3	1	3	4	5	4	3	2	1	2	4
MALE	2	4	4	5	4	2	3	2	1	4	4
FEMALE	2	3	5	5	2	5	2	2	2	5	4
FEMALE	2	1	5	4	5	4	3	2	2	4	3
FEMALE	2	2	5	4	4	4	1	1	1	5	1
FEMALE	1	2	4	4	4	2	3	2	2	5	4
FEMALE	2	2	4	4	4	5	5	2	3	4	4
FEMALE	2	2	1	5	3	4	3	1	2	4	4
FEMALE	3	2	4	4	4	1	4	2	2	4	3
FEMALE	2	3	3	5	3	5	3	2	1	3	5
FEMALE	1	2	4	4	4	4	3	3	1	3	4
FEMALE	3	4	4	5	4	4	3	2	2	2	2
FEMALE	2	3	5	4	4	3	2	2	1	4	5
FEMALE	2	2	4	4	3	4	3	1	2	4	5
FEMALE	1	2	4	5	3	4	4	2	2	5	3
FEMALE	2	2	5	5	3	2	3	1	1	3	5
FEMALE	2	2	3	4	4	4	2	3	2	4	1
FEMALE	5	4	1	5	5	4	3	2	4	4	5
FEMALE	1	2	4	5	4	5	5	2	2	4	5
FEMALE	2	3	4	4	5	4	3	2	2	4	3
FEMALE	2	2	4	4	2	4	2	1	2	3	5
FEMALE	1	2	4	4	4	4	3	3	2	5	3
FEMALE	2	2	4	4	4	2	2	3	2	4	1
FEMALE	1	2	4	4	3	4	3	2	1	5	4

ATTITUDE RESPONSES IN PERCENTAGE

ITEM	EXPERIMENTAL GROUP (N=48)						CONTROL GROUP (N=52)					
	SD	D	N	A	SA	DECISION	SD	D	N	A	SA	DECISION
Ecology is one of my favourite topics.	03	04	05	67	21	AGREE	16	55	15	09	05	DISAGREE
I am sure I can perform better in ecology.	02	05	05	66	22	AGREE	15	56	10	15	04	DISAGREE
It is interesting to learn ecology through Ethnobiology	02	03	02	60	33	AGREE	12	17	52	10	09	N.SURE
Ecology is difficult for me.	33	58	03	04	02	DISAGREE	12	10	10	56	12	AGREE
Ecology is complicated to understand.	22	67	04	02	05	DISAGREE	04	06	05	60	25	AGREE
I can do nothing related to ecology.	23	64	01	07	05	DISAGREE	10	15	09	52	14	AGREE
I would not like to become an ecologist when I complete secondary education.	33	44	14	07	02	DISAGREE	10	12	16	42	20	AGREE
Understanding ecology depends on how it is taught.	05	05	02	64	24	AGREE	06	06	18	56	14	AGREE
Understanding of ecology makes life good.	05	02	00	67	26	AGREE	14	60	12	10	04	DISAGREE
It is not important to take care of the environment.	66	27	02	02	03	DISAGREE	12	10	11	52	15	AGREE
Ecology helps in making our universe a better place to live in.	05	03	01	70	21	AGREE	36	43	13	04	04	DISAGREE

APPENDIX V: AVERAGE RESPONSES OF ATTITUDES.

INTEREST	DISLIKE	APPRECIATION	GENDER	TEACHING METHOD
2.33	3	3	MALE	GROUP DISCUSSION
3.33	3.75	2.25	MALE	GROUP DISCUSSION
3	2.5	2.75	MALE	GROUP DISCUSSION
3	3.5	3.25	MALE	GROUP DISCUSSION
2.66	3.66	3.5	MALE	GROUP DISCUSSION
4	3.75	2.75	MALE	GROUP DISCUSSION
3	3.75	3.5	MALE	GROUP DISCUSSION
2	4.25	3.5	MALE	GROUP DISCUSSION
2.66	3	2.5	MALE	GROUP DISCUSSION
3.33	2.25	3	MALE	GROUP DISCUSSION
3.33	3	1.75	MALE	GROUP DISCUSSION
2	3	2	MALE	GROUP DISCUSSION
2.33	2.5	2.5	MALE	GROUP DISCUSSION
2.33	2.25	2.5	MALE	GROUP DISCUSSION
2.33	2.25	3	MALE	GROUP DISCUSSION
3	3.5	2.75	MALE	GROUP DISCUSSION
2.33	4	3.25	MALE	GROUP DISCUSSION
2.33	3.75	3.25	MALE	GROUP DISCUSSION
3	3.75	3	MALE	GROUP DISCUSSION
2.66	3	3.25	MALE	GROUP DISCUSSION
2.66	3.5	3.75	MALE	GROUP DISCUSSION
2.66	3.5	3.75	MALE	GROUP DISCUSSION
1.66	3.5	2	MALE	GROUP DISCUSSION
2.33	4	3.25	MALE	GROUP DISCUSSION
4	4.25	3.75	MALE	GROUP DISCUSSION

2.66	3.5	2.75	MALE	GROUP DISCUSSION
2.66	3	2.25	MALE	GROUP DISCUSSION
2.66	3	2.25	MALE	GROUP DISCUSSION
2.33	4	2.25	MALE	GROUP DISCUSSION
3.33	3.5	2.75	MALE	GROUP DISCUSSION
3.33	3.5	3.25	FEMALE	GROUP DISCUSSION
2.66	4	2.75	FEMALE	GROUP DISCUSSION
3	3.25	2	FEMALE	GROUP DISCUSSION
2.33	3.25	3.25	FEMALE	GROUP DISCUSSION
2.66	4.5	3.25	FEMALE	GROUP DISCUSSION
1.66	3.75	2.75	FEMALE	GROUP DISCUSSION
3	3.25	2.75	FEMALE	GROUP DISCUSSION
2.66	4	2.75	FEMALE	GROUP DISCUSSION
2.33	3.75	2.75	FEMALE	GROUP DISCUSSION
3.66	4	2.66	FEMALE	GROUP DISCUSSION
3.33	3.25	3	FEMALE	GROUP DISCUSSION
2.66	3.5	3	FEMALE	GROUP DISCUSSION
2.33	4	3	FEMALE	GROUP DISCUSSION
3	3.25	2.5	FEMALE	GROUP DISCUSSION
2.33	3.5	2.5	FEMALE	GROUP DISCUSSION
3.33	4.25	3.75	FEMALE	GROUP DISCUSSION
2.33	4.75	3.25	FEMALE	GROUP DISCUSSION
3	4	2.75	FEMALE	GROUP DISCUSSION
2.66	3	2.75	FEMALE	GROUP DISCUSSION
2.33	3.75	3.25	FEMALE	GROUP DISCUSSION
2.66	3	2.5	FEMALE	GROUP DISCUSSION
2.33	3.5	3	FEMALE	GROUP DISCUSSION
2	3.25	3	MALE	ETHNOBIOLOGY

4	2.5	3.5	MALE	ETHNOBIOLOGY
3	4	4	MALE	ETHNOBIOLOGY
2.66	3	3.5	MALE	ETHNOBIOLOGY
4.33	1.5	4	MALE	ETHNOBIOLOGY
4.33	1.66	4	MALE	ETHNOBIOLOGY
3	3	3.25	MALE	ETHNOBIOLOGY
4.33	1.5	4.75	MALE	ETHNOBIOLOGY
1.66	2.75	3	MALE	ETHNOBIOLOGY
3.33	2.5	4	MALE	ETHNOBIOLOGY
4.66	1.66	4.5	MALE	ETHNOBIOLOGY
4.66	1.5	4.25	MALE	ETHNOBIOLOGY
4	3	4	MALE	ETHNOBIOLOGY
4.33	1.75	4	MALE	ETHNOBIOLOGY
4	1.5	4	MALE	ETHNOBIOLOGY
2.75	3	3.5	MALE	ETHNOBIOLOGY
5	2	4.5	MALE	ETHNOBIOLOGY
4	1.75	4	MALE	ETHNOBIOLOGY
4.33	1.75	4	MALE	ETHNOBIOLOGY
4	2.75	3.75	MALE	ETHNOBIOLOGY
4.66	1.7	4.75	MALE	ETHNOBIOLOGY
4.66	1.25	4.25	MALE	ETHNOBIOLOGY
4.33	2.5	3.75	MALE	ETHNOBIOLOGY
4	1.5	4.25	MALE	ETHNOBIOLOGY
4.33	2	4	MALE	ETHNOBIOLOGY
3.33	2.5	3.75	MALE	ETHNOBIOLOGY
2.33	2.5	3	MALE	ETHNOBIOLOGY
4	2.5	2.75	MALE	ETHNOBIOLOGY
4.33	1.5	4.5	MALE	ETHNOBIOLOGY

4.33	1.5	4.5	MALE	ETHNOBIOLOGY
5	1.5	4.75	FEMALE	ETHNOBIOLOGY
4	1.75	3	FEMALE	ETHNOBIOLOGY
2.33	3	2.75	FEMALE	ETHNOBIOLOGY
3.33	2.75	3.25	FEMALE	ETHNOBIOLOGY
3	3.33	2.75	FEMALE	ETHNOBIOLOGY
4	3	3.5	FEMALE	ETHNOBIOLOGY
4.33	1.5	4	FEMALE	ETHNOBIOLOGY
4	1.75	4.25	FEMALE	ETHNOBIOLOGY
4.33	1.5	4	FEMALE	ETHNOBIOLOGY
4	2	4	FEMALE	ETHNOBIOLOGY
3	2.75	3.75	FEMALE	ETHNOBIOLOGY
2.33	3	3.75	FEMALE	ETHNOBIOLOGY
3.33	3	3.25	FEMALE	ETHNOBIOLOGY
4.33	2	3.75	FEMALE	ETHNOBIOLOGY
4.66	1.25	4.5	FEMALE	ETHNOBIOLOGY
4.33	1.5	3.75	FEMALE	ETHNOBIOLOGY
3	2	4	FEMALE	ETHNOBIOLOGY
3	1.75	4	FEMALE	ETHNOBIOLOGY

APPENDIX VI: ECOLOGY ATTITUDE QUESTIONNAIRE.

THE COPPERBELT UNIVERSITY

DEPARTMENT OF BIOLOGY EDUCATION

Questionnaire for Grade Twelve pupils.

Introduction

The purpose of this questionnaire is to determine pupil's attitude towards ecology. Attitude towards a subject is very important because it influences the understanding in that particular subject. The findings of this research may help to improve pupils' performance in ecology in secondary schools and as such, no answer is going to be treated as right or wrong, your opinion is what is important. The information that you give is **CONFIDENTIAL** and **NO INDIVIDUAL** will be identified with it.

Guide

1. Please be honest when answering the questions below.

2. You do not need to write your name on the questionnaire.

3. Please place a cross (X) on the appropriate number representing how you feel about each of the items given.

SECTION A: DEMOGRAPHIC INFORMATION

Gender: Male ☐ Female ☐

Group: .....

Key for answers in the box below- (SCALE)

1 = STRONGLY DISAGREE 2 = DISAGREE 3 = NOT SURE
4 = AGREE 5 = STRONGLY AGREE

Indicate your level of agreement from the table above to answer each of the following items in a table below (place a cross (X) on the appropriate number).

ITEMS	SCALE				
Section B: learners' interest in ecology	1	2	3	4	5
1. Ecology is one of my favorite topics.	1	2	3	4	5
2. I am sure I can perform better in ecology.	1	2	3	4	5
3. It is interesting to learn ecology through ethno-biology.	1	2	3	4	5
Section C: Fear of ecology	1	2	3	4	5
4. Ecology is difficult for me.	1	2	3	4	5
6. Ecology is complicated to understand.	1	2	3	4	5
5. I can do nothing related to ecology.	1	2	3	4	5
7. I would not like to become an ecologist when I complete secondary education.	1	2	3	4	5
Section D: Appreciation of ecology	1	2	3	4	5
8. Understanding ecology depends on how it is taught.	1	2	3	4	5
9. Understanding ecology makes life good.	1	2	3	4	5
10. It is important to take care of the environment.	1	2	3	4	5
11. Ecology helps in making our universe a better place to live in.	1	2	3	4	5

*Thank you very much for your time***.**