



## A Study on Assessment of Teaching and Learning Methods for Secondary School Biology Subject Content as an Approach to Addressing Environmental Degradation in Malawi. Case Study of Karonga District

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**ABSTRACT:** The purpose of this study was on assessing of teaching and learning methods for secondary school biology subject content as an approach to addressing environmental degradation in Malawi. Case study of Karonga district. The study was guided by the following research specific objectives: to assess how success criteria in secondary school Biology syllabi are framed to address environmental degradation in Malawi; to investigate the appropriateness of the methods of teaching and learning Biology that address environmental degradation and to examine how Biology teachers assess students' fieldwork that is required by the syllabus. A mixed method approach (qualitative and quantitative methods) was used in this study. Sixty secondary school teachers were selected from 40 secondary schools in Northern Education Division in the Ministry of Education in Malawi as research participants. Schools and participants were selected through convenience and purposive sampling techniques respectively. In this study, data was collected through interviews, questionnaire and document analysis. Data analysis was done thematically and using statistics. The research study found out that the success criteria, content and teaching and learning methods in Biology would not address environmental degradation because success criteria were not framed well and had many action verbs such as 'explain', 'describe' and 'state'. In addition, explanation was the main teaching and learning methods used by Secondary school Biology teachers which would not address environmental degradation since they did not encourage learning through practice, The findings also revealed that Biology teachers in secondary schools assessed learners with the aim of passing public examinations and not assisting learners to acquire skills to deal with issues of environmental degradation.

### GLOSSARY OF ACRONYMS/ABBREVIATIONS

ACARA	Australian Curriculum Assessment and reporting Authority
CDSS	Community Day Secondary School
ED	Education Division
EDM	Education Division Manager
ESD	Education for Sustainable Development
ICT	Information and Communication Technology
KIE	Kenya Institute of Education
LTA	Learn-Think-Act
MIE	Malawi Institute of Education
MoEST	Ministry of Education, Science and Technology
NED	Northern Education Division
UN	United Nations
UNEP	United Nations Environmental Programme
UNE5SCO	United Nations Educational, Scientific and Cultural Organization

### CHAPTER ONE

#### 1.0. Introduction

Environmental degradation is one of the aspects of climate change which is covered in Biology subject at both junior and senior level. Biology as a subject is taught with the expectation that students will acquire the basic foundation skills to help them in providing valuable contribution to the nation. One of the valuable contributions to be offered by students who take Biology in



secondary schools is to deal with issues relating to environmental degradation. Kipgokei (2016) explains that various countries in the world have designed their Biology curriculum to impart knowledge and skills for Sustainable Development. For students to achieve such knowledge and skills, there is need to use Participatory practice approaches which provide learners with positive ways in dealing with environmental degradation. According to Zhou (2015), as far as teaching is concerned, teachers are expected to integrate Sustainable Development Goals (SDGs) content in order to transform learners so as to bring real change in the way they think about the environment and practice sustainable use of natural resources. This depicts that transformative learning approach and outcome based education in Biology as a subject can help learner's combat environmental degradation, an aspect of climate change which is goal number 13 of the SDGs. Since Biology is key in promoting sustainable use of resources and in reducing environmental degradation, this study therefore, was to examine the feasibility of the secondary School Biology content and teaching and learning methods in Private secondary schools, Conventional Secondary Schools and Community Day Secondary Schools, in addressing environmental degradation in Malawi.

## 1.1. Background information

Environmental degradation as an aspect of climate change has become a major global and common concern throughout the history of human kind. According to Kumar, Singh and Kumar (2020), Environmental degradation is defined as the deterioration of the environment through the depletion of resources such as air, water and soil, destruction of ecosystems, habitat destruction, extinction of wildlife and pollution. This portrays that if environmental degradation is not addressed now, its effect will be huge and sustainable development is likely to be affected since it has already observable impacts on the environment. According to Greenfield (2020), a 2020 report by the World wildlife Fund found that human activity, specifically over consumption, population growth and intensive farming, has destroyed 68% of vertebrate wildlife since 1970.

The Global Assessment Report Biodiversity and Ecosystem Services published by United Nations'(UN) IPBES in 2019 says that roughly one million species of plants and animals face extinction worldwide from human causes such as expanding human land use for industrial agriculture and livestock rearing, along with overfishing (Watts, 2019). This means that if the environmental degradation is not checked, the whole world will lose all aspects of environment. For instance, in between 1990 and 2014, fourteen countries in Sub Sahara Africa have degraded the land due to the role played by economic growth, nonrenewable and renewable consumption and urbanisation (Elsevier, 2015). Environmental degradation also poses a serious threat to Malawi. Malawi Institute of Education (MIE) 2015, explains that the functioning of Malawi's natural system, with major implications for several weather sensitive such as environment, agriculture, forestry, water resources, energy and fisheries; human systems particularly human health and human settlements, are threatened by environmental degradation.

### 1.1.0. Causes of Environmental Degradation

Environmental degradation is caused by both natural and human factors. Pimm, Jenkins, Abell, Brooks, Gittleman, Joppa, Raven and Roberts (2014) emphasise that capitalism is the main cause of environmental degradation because it is the key factor that affects both production and consumption patterns. Man has a lot of activities taking place on land. MIE (2015) asserts that the causes of environmental degradation can be categorized into natural and human induced groups; however, human activities on land have been the major causes of land environmental degradation. One of the human activities which causes environmental degradation is overpopulation. The rapid population growth has increased human activities such as industrial production, agriculture and urbanisation that have led to a change in land use. According to MIE (2015), Land use change refers to conversion of land vegetation into a different form such as development of settlements, road or agriculture which are associated with deforestation, and in this regard, environmental degradation occurs. Pollution is another cause of environmental degradation. Pollution is the releasing of toxic material into the environment. These toxic pollutants have destroyed the air, water and land. United Nations Environmental Programme (UNEP) (2020) states that only 12% of the cities in the world have air quality that meet World Health Organisation (WHO) standards regardless that in 2019, the world took an important step to drastically reduce the production and consumption of greenhouse gases and other factors that influence pollution. Pollution leads to adverse changes to the natural environment. Furthermore, deforestation is another factor that has led to the cause of degradation of the environment. Deforestation is the cutting down of trees for settlements, industries and agriculture. The use of forest land area for farming, grazing animals and cutting trees for fuel wood are other factors influencing deforestation, hence environmental degradation. Environmental degradation is also caused by natural causes such as windstorms, earthquakes, continental drift, volcanic eruptions and ocean currents (Greenfield,



2020). For instance, if a volcano or an earthquake occurs, it destroys the natural habitat. Hence, degradation of the environment as many species of both animals and plants extinct.

### 1.1.1. Impact of Environmental Degradation

There are many effects of environmental degradation and these have brought harm to the natural environment. Once environmental degradation has taken place, there is loss of natural habitats. The destruction of a habitat is when the habitat is rendered functionally unable to support the biodiversity that is present. Hence, habitat destruction of the site has reduced biodiversity (UNEP, 1994). Biodiversity in the environment is important since it maintains the balance of ecosystem by combating pollution, stabilising climate and preserving water sources. Loss for the tourism industry is also an effect of environmental degradation. Since tourism depends on the natural environment, the environmental damage causes a setback for the tourism industry. Malawi Institute of Education (2015) adds that environmental degradation such as air pollution, has negative impacts on humans. People who are exposed to polluted air are likely to suffer from respiratory diseases such as Asthma and Pneumonia, hence risk of human life. Environmental degradation has also affected the development of the country. If the country experiences degradation of the environment, its economy is hampered since many resources are depleted (Government of Malawi, 2010). In addition to that, environmental degradation leads to climatic changes. Human activities such as pollution, deforestation and land use change the pattern of climate.

### 1.1.2. Integrating Environmental Degradation in Biology Education

Biology education is important in the issues of Environmental degradation as it plays a foundational role in the process of addressing the issues of Sustainable Development (United Nations Educational, Scientific and Cultural Organisation (UNESCO), 2017). This encourages many countries worldwide to integrate environmental degradation in their Biology Education. Kipgokei (2016) explains that various countries in the world have designed their Biology curriculum to impact knowledge and skills for environmental issues. For example, in Germany issues of environmental degradation and climate change are not left out in Biology education (Seguin, 2015). This means that Biology education deals with human and environment relations and is critically important, particularly given the current environmental and social problems such as environmental degradation. The Biology curriculum in Ireland has been developed to cover aspects of human environments and environmental awareness and care (Government of Ireland, 1999), while in Britain the British Biology curriculum puts emphasis on the development of skills needed to carry out Biological inquiry and fieldwork (Clifford, 2013). The Biology education, in most of the African countries, has also incorporated environmental degradation issues. For instance, the objectives of Biology in Kenya require learners to acquire knowledge of available natural resources and demonstrate ability and willingness to utilise them sustainably (Kenya Institute of Education [KIE], 2002). According to Malawi Institute of Education (2013), defines Biology as a natural and social science which involves the study of the physical environment and the interaction of people with the environment. Biology as a subject is taught with the expectation that students will acquire the basic foundation skills to help them in providing valuable contributions to the community, nation and the society, respectively. Biological education can enable learners address issues of the environment and it is important for those students who take Biology subject to be enlightened on environmental degradation. This portrays that Biology subject will enable and equip them with knowledge and skills which address issues of environmental degradation. This is in agreement with Malawi Institute of Education (2014), which points out that the Biology curriculum in Malawi has been developed to cover aspects of human environments and environmental awareness and care. This means that students are given the chance to develop important Biological concepts and skills. Therefore, some teaching methods in Biology which do not allow learners to acquire transformative skills, must be discouraged since these contribute very little to the learning process concerned with environmental degradation. Hence, this study examined the feasibility of the Biology content and teaching and learning methods in addressing environmental degradation in Malawi.

## 1.2. Statement of the problem

There is heavy environmental degradation in the world due to increase in population. United Nations Environmental programme [UNEP] (2008) and UNEP (2011) state that the most pressing environmental issues facing the world today is environmental degradation. Many people suffer due to environmental degradation. For instance, the poor and women are more likely to live and work in areas exposed to hazards since they do not have resources when environmental disasters like droughts strike. Hershberger (2014) states that South East Asia especially Indonesia, is the worst in the region with 30% of the land degraded. In addition, Courtney (1994) hints that frequent fires have increased environmental degradation in Sudbury in Canada, and this has brought negative



impact to the lives of people. But the right to healthy environment is recognized in law by at least 155 member states in the world, and failure of the states to take adequate steps to address environmental degradation may constitute a violation of the right to a healthy environment, as the

United Nations Environmental Programme (UNEP, 2019) warns Environmental degradation has also not spared Africa. Between 1990 and 2014, fourteen countries in Sub Sahara Africa have degraded the environment due to the role played by economic growth, non-renewable and renewable consumption and urbanisation (Elsevier, 2015). This has left people destitute since the environment is polluted. In Sudan's North Kordofan State, women took charge of family farms after environmental degradation drove men to seek work in cities or migrate with live stock to greener pastures (UNEP, 2019). Malawi also faces continued challenges of environmental degradation such as constrained water resources, deforestation, declining fisheries and farming practices that lead to soil erosion and reduced soil fertility, among others (USAID, 2020). This has led to extreme poverty among Malawians. The destruction of Chikangawa plantation due to frequent and harmful bush fires and careless cutting down of trees is a good example of environmental degradation in Malawi. The same is true for river banks, river basins and hill slopes. The world must address the issue of environmental degradation and there is a need for all stakeholders to join hands to rescue the situation from getting worse. Education systems are one of the key stakeholders to halt environmental degradation. Many countries in the world depend on education as one of the main tools that can bring solutions to the environmental problems encountered by people. In Australia, the curriculum provides students with abilities to investigate the current Biological events and allow them to evaluate their findings against the criteria of environmental sustainability (ACARA, 2011). This is in agreement with the Government of Ireland (1999), which explains that the Explains curriculum in Ireland has been developed to cover aspects of human environment and environmental awareness and care. The objectives of Biology in Kenya require learners to acquire knowledge of available natural resources and demonstrating the ability and willingness to utilise the environment sustainably (KIE, 2002). However, Freire (2000) argues that current education in many parts of the world is largely based on the banking concepts of education, whereby the knowledge and skills which students learn are not used immediately. The banking concept has impact on the methods of teaching and learning. Freire further recommended that a 21<sup>st</sup> Century education must be transformative. This approach is also important in the teaching and learning methods. Lotz-Sisitka, Tshiningayamwe and Ulenje (2017) state that Education for Sustainable Development (ESD) which interprets the SDG4, supports Freire's views that a good education must build skills and knowledge that a learner can use almost immediately. Further, the ESD recommends that in addition to academic knowledge and skills, the education system must also build what is known as soft skills or the 21<sup>st</sup> Century competences such as future thinking and critical thinking which address the needs of a human as a social animal. These skills are critical to making a human being more conscious of their environment. Such consciousness is important in viewing the environment with a positive perspective which would translate to taking responsibility for their environment. Biology Education in secondary schools in Malawi has the potential of addressing issues of environmental degradation. However, little is known that the education system and Biology teaching and learning approaches and practices are addressing the issue of environmental degradation in Malawi. Therefore, the aim of the study is to assess the teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi

### 1.3. Objectives of the study

#### 1.3.0. General Objective

The General objective of the study was to assess the teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi

#### 1.3.1. Specific Objectives

The study had the following specific objectives:

1. To assess how success criteria in secondary school Biology syllabi address environment degradation.
2. To investigate the teaching methods used by secondary school Biology teachers that address environmental d degradation.
3. To examine how Biology teachers in secondary schools are prepared to address environmental degradation.

### 1.4. Research Question

- i. Are success criteria in both Junior and Senior Biology syllabi are framed to address issues of Environmental Degradation
- ii. What methods of teaching are used in teaching Biology topics related to Environmental Degradation?



iii.. Do you use fieldwork when teaching topics related to Environmental Degradation?

iv. How do you assess learners' fieldwork/practical activities especially for the topics related to Environmental Degradation?

## 1.5. Significance of the Study

This study would enlighten Biology teachers on issues relating to the environmental degradation and relevance of teaching Biology in secondary schools in addressing environmental degradation. The results of the study would help the Ministry of Education and the curriculum developers to provide training for Biology teachers and how best they can take part in promoting mitigation factors of environmental degradation. Finally, it would assist the secondary schools to form clubs and societies which would enable students to share information about environment.

## 1.6. Scope of the study

This chapter has briefly explained the background information of environmental degradation. The integration of environmental degradation in Biology education is highlighted in this chapter. In addition, statement of problem, general and specific objectives of the study, theoretical framework, the purpose of the study and significance of the study are also presented in this chapter.

## 1.7. Definition of unfamiliar Terms

**Assessment:** Means an integral component of coherent education experience which comprises of any process that provides information about the thinking, achievement or progress of students.

**Environment:** Means any living thing or nonliving thing that surrounds people.

**Environmental degradation:** Refers to the deterioration of the environment through depletion of resources such as air, water and soil; destruction of ecosystems, extinction of wildlife, habitat destruction and pollution.

**Pollution:** Refers to the releasing of toxic material into the environment. These toxic pollutants have destroyed the air, water and land.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0. Introduction

This chapter presents literature review on how Biology content and teaching and learning methods can address environmental degradation. The presentation assessed how the success criteria are framed in addressing environmental degradation, teaching and learning methods that address environmental degradation and how secondary schools Biology teachers assess learners' fieldwork in addressing environmental degradation.

#### 2.1. Main literature

Success criteria are expected outcomes which the learners should achieve after going through the activities of the unit (MIE, 2015). According to Grindsted (2017), the success criteria are the measures that determine whether and how the learners have met the learning intentions. It is a way of making learners aware of what is expected of them and help them to assess their own learning. Biology syllabi in secondary schools have success criteria that enable students to learn by doing things, applying and practicing ideas. This is in agreement with UNESCO (2017) that success criteria in Biology must allow learners to have more practice and action on what they learn in the classroom situation. This depicts that using Biology success criteria, students develop their knowledge and understanding of an issue, and think critically about the issue and their choices of action (UNESCO, 2015). Mphapuli and Luneta (1992) in their study conducted in South Africa, found out that the teaching syllabus for secondary school Biology has success criteria that need learners to develop an understanding of how the environment and climatic factors influence their life. This means that the success criteria in secondary school Biology syllabus can help to address environmental degradation. The secondary school Biology syllabus in Malawi has success criteria which encourage learners to appreciate and interact with the environment in a responsible and sustainable manner, and acquire positive attitudes and skills, apply what they learn to address issues relating to environmental degradation (MIE, 2013). Learners must apply the knowledge and skills by doing, hence they become transformed and develop new ways of dealing with environmental degradation. Mezirow (2009) in his Transformative Learning Theory



emphasises that teaching should be transformed so that learners become active and responsible citizens in taking care of the natural resources and the environment. Therefore, it is important that success criteria in secondary school Biology promote learning by doing to help learners taking care of the environment and addressing environmental degradation.

### 2.1.1. Teaching and learning Methods related to Environmental Degradation

Teaching and learning methods are the strategies that the teacher uses in delivering the lesson. The teaching methods in Biology must involve active learning whereby learners have an opportunity to do much of the work in the learning situation. Gibbs (1998) describes active learning as a teaching approach in which learning is encouraged through doing. This enables learners to use such approaches in dealing with environmental degradation as they are involved in doing and practice during lesson delivery. Teaching and learning methods must help in equipping teachers with knowledge, skills and appropriate attitudes on environmental degradation which they can transmit to students.

One of the teaching methods to be used by secondary school Biology teachers in addressing environmental degradation is Role play. It is a teaching and learning strategy in which the students dramatise a real life situation without prior rehearsals. Lotz-Sistka and Ulenje (2017) assert that role play provides opportunities to students to emphasise and do better understand experiences and complexities of environmental sustainable issues. Learners are given a familiar role in which each participant is assigned a specific role to play and this can enable learners to remember what they have learned. In return students will be able to develop acceptable values and positive attitude which can assist in dealing with issues of environmental degradation. Chakwera, Thawe, Banda, Matemba, January, Saiti, Kampira and Mshanga (2003) stress that role play is the only strategy that gets the learners to identify with situations, and thus allows them the opportunity to perceive how others might feel, think and act. This can assist learners to start caring for the environment, hence addressing the issues of environmental degradation.

Fieldwork in secondary school Biology is one of the methods that teachers use in teaching in addressing issues relating to environmental degradation. It is the teaching and learning activity which is conducted outside the classroom. This method of teaching helps learners to visit areas which are environmentally degraded. For instance, land degradation, water pollution and waste disposal. Upon seeing the negative effects, learners will be able to act positively in addressing environmental degradation. Fieldwork has been valued as a form active and experiential learning involving hands-on activities and for developing practical enquiry skills as well as conceptual understanding and broader insight (Lotz-Sistka & Ulenje, 2017). This gives learners an opportunity to carry out practical activities such as planting trees to cover the bare land and conserving air and water, hence addressing environmental degradation. Chakwera et al. (2003) and Behrendt & Franklin (2014), explain that field work and excursion provide learners with sound and concrete firsthand information which makes learning more meaningful. The firsthand information will enable learners in addressing the issues relating to environmental degradation.

Malawi Institute of Education [MIE] (2015) agrees that field work can help students mitigate adverse effects of environmental degradation in schools and their surrounding communities.

The case study as a method of teaching and learning Biology in secondary schools plays a vital role in addressing environmental degradation. A case study is a narrative account of a series of events or situations that relate to a specific issue that might relate to the lives of the participants (Chakwera, et al. 2003). Gitau (2015) recommends Case study method as a strategy of teaching since it involves problem-based learning and promotes the development of analytical skills in learners. This means that a case study in Biology involves students in solving problems that may be similar to those they face in their daily lives. One of the problems that children face is an increase of the degradation of environment in their communities. Hence, through Case Study method in secondary school Biology, problems of deforestation and pollution are likely to be solved positively by students. Lotz-Sisitka, Tshiningayamwe and Ulenje (2017) add that Case studies provide students with in depth information about a particular issue in a particular context. Learners are given the opportunity to share views and develop skills in analytical thinking, problem solving, group work and communication. This enables learners to analyse and solve issues of environmental degradation.

Project method is also a very important teaching and learning method that can be used by teachers when teaching Biology in secondary schools. Nacino-Brown, Oke and Brown (1994) define project method as a unit of activity carried out by the learners in a natural and life like manner with a spirit of accomplishing attainable goals. Learners in a project investigate and gather information on their own. For instance, they can get information about an environment and bring solutions to any problem relating to environmental degradation. Students go through an extended process of inquiry in response to a design question, problem or a challenge that usually requires more than individual effort to handle and overcome (Chua, 2014). It also contributes to bringing the



classroom close to the profession through the acquisition of knowledge while solving practical and real issues close to environmental degradation (Reid, 2000). This portrays that Project Based Learning method makes learning real by presenting a real task for the students to deal with, such as issues relating to environmental degradation. In Turkestan, Project method of teaching and learning helps students to develop their self-study activity and use the knowledge to solve communicative and informative problems to have an opportunity to study cultural informative competencies (Zhylybay, Magzhan, Suinzhanova, Balaubekov & Adiyeva, 2014). Learners carry out project activities alone, hence learn to plan their work with minimal help in addressing issues of environmental degradation.

Action learning is one of the teaching and learning methods which can be used by Biology teachers in secondary schools in addressing environmental degradation. Action learning involves groups of learners working on real problems, taking action and learning as individuals (Wals, 2010). This encourages learners to engage in learning by doing and make sense of what they learn through participation in a structured learning activity to obtain learning outcomes. Once students identify the problems of environment such as flooding, deforestation and soil erosion, an action is taken to solve the problem such by planting and replanting vegetative cover, including trees. This helps to address the issue of environmental degradation. Most of the countries in Africa, particularly in Southern Africa, secondary school Biology teachers are encouraged to use Action Learning in order to deal with issues of environmental degradation (UNESCO, 2017). Although Action Learning encourages learners to easily solve the environmental problems, in Philippines according to Marie, Lindsay and Edlea (2017), most of the Biology teachers in secondary schools do not use Action learning when delivering lessons in Biology. However, Action Learning helps learners to develop positive attitude towards the environment and in return, they apply the skills, attitude and knowledge to deal with environmental degradation.

## 2.2. Theoretical review

It is important for Biology teachers in secondary schools to be prepared well in assessing learners' fieldwork relating to environmental degradation. Assessment is an integral component of coherent education experience which comprises of any process that provides information about thinking, achievement or progress of students. Assessment involves the use of empirical data on student learning to refine programmes and improve student learning. According to Chakwera et al. (2003), teaching in educational system imposes interesting pedagogical problems and those employed to teach can automatically teach and assess students' work. Lotz-Sistka, Tshiningayamwe and Urenje (2017) stress that the teaching of Biology in secondary schools in the world must promote environmental sustainability. This can be done if Secondary school Biology teachers who impart knowledge and skills to learners should be well equipped with knowledge of assessing learners' fieldwork necessary for responding to environmental degradation. Biology teachers in secondary schools are the direct agent change and innovation, hence teachers be trained to assess learners or collect students' achievement information that play an active, deliberate and effective role in issues of environmental degradation (MIE, 2015). Biology teachers in Asian countries are trained to enhance them to have a good idea of environmental knowledge and skills, and other environmental assessment skills (Mckeown, 2015). In Zambia secondary education teachers are trained in order to prepare themselves with assessment knowledge and skills related to the environment (Lotz-Sistka, Tshiningayamwe & Urenje, 2017).

Furthermore, conducting of in service training involving assessment of learners' practical activities about Environmental degradation should be done so that Biology teachers in secondary schools must have full knowledge for addressing environmental degradation. In Ghana, secondary school Biology teachers have environmental training that involves teaching and the assessment of learners' fieldwork in tertiary institutions to improve environmental knowledge and skills. This portrays that teachers for Biology in secondary schools are prepared for environmental issues through training. Behrendt & Franklin (2014) explain that field work and excursion provide learners with sound and concrete firsthand information which make learning more meaningful. Therefore, it is important for Secondary School Biology teachers to assess or evaluate the practical activities done by learners in the field concerning environmental degradation. Let students be allowed to identify the problems of environmental degradation and find solutions to such problems and will enable learners to analyse situations concerning environmental degradation.

This can also be done at school level whereby Biology teachers can hold an inset sensitising each other on issues relating to Environmental degradation and on how to assess learners' activities relating to environmental degradation. The Teacher Training Colleges in Swaziland train Biology teachers to assess students' practical work by equipping them with knowledge and skills on how to deal with Environmental issues (Dhlamini, 2011).



Similarly, MIE (2013) states that the Ministry of Education, Science and Technology in Malawi is responsible for organising in service training for Biology teachers on issues of environmental degradation. In addition, Biology teachers should be well trained in the methodology to enable them in the selection of appropriate teaching methods for Biology content and assessment tools which can contribute to issues of environmental degradation. Biology teachers can also be prepared for addressing environmental degradation through workshops which are conducted by different stakeholders. For instance, UNESCO organises workshops in public university colleges in Malawi such as Chancellor College and the Polytechnic to train teacher educators on how secondary school Biology teachers can help to evaluate learners and their fieldwork activities relating to environmental issues through Biology education (UNESCO, 2017). Regardless of workshop initiatives, some Biology teachers still have problems in promoting Environmental Education (UNESCO, 2016). This means that such Biology teachers cannot select appropriate teaching methods, content and assessment methods which address environmental degradation. However, Transformative Learning Theory by Mezirow (2009) and Learn-Think-Act Approach by (UNESCO, 2015) emphasise that teaching and learning methods should help to transform learners on how they can interact and preserve the environment. Hence, there is need for Ministry of Education, Science and Technology in conjunction with Malawi Institute of Education (MIE) to organise trainings with the aim of equipping secondary school Biology teachers on how they can address environmental degradation through teaching and assessment methods.

### 2.3. Conceptual Review

This chapter has presented literature review in relation to this study. It has reviewed literature on how the success criteria are framed in Secondary School Biology Syllabi to address environmental degradation; teaching and learning methods used by Biology teachers in secondary schools to address environmental degradation and the assessment of learners' fieldwork in addressing environmental degradation.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.0. Introduction

The main purpose of this study was to examine the feasibility of Secondary School Biology content and teaching and learning methods in addressing environmental degradation in Malawi.

This chapter comprises of the research paradigm, research design, study location, target population, sampling procedures and sample size, research instruments (qualitative and quantitative research instruments), reliability, validity, data collection procedures, data analysis and logical and ethical considerations.

A research paradigm is the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed. The research will use a pragmatic paradigm in this study. Mittwede (2012) defines a pragmatic paradigm as a world view that focusses on what works rather than what might be considered absolutely and objectively true or real. This paradigm advocates the use of mixed methods in research to explain a solution to a research problem. Tashakkori and Teddlie (2003) emphasise that there cannot be one way to solve one problem, but a mixture of approaches can better help solve the problem and find the truth. Pragmatic paradigm gave freedom to the researcher to use any procedure or method associated with qualitative or quantitative research. This is in agreement with Creswell (2014) who explains that pragmatic paradigm does not commit to one system of reality or philosophy. The researcher applied this paradigm because the study needed mixed methods when collecting data. Quantitative paradigm was used and questionnaires used five point likert scale to measure variables and the numerical values were assigned to the responses which were structured according to the objectives of the study.

#### 3.1. Research design

Durrheim (2006) defines Research design as a strategic framework that guides research activities to ensure that sound conclusions are reached. In this research, the researcher used mixed methods of both Qualitative and Quantitative. According to Creswell (2014), mixed methods research is an approach to inquiry involving collecting both, quantitative and qualitative data integrating the two forms of data and using different designs that may involve philosophical assumptions and theoretical frameworks. It is important to use combined quantitative and qualitative approaches because they provide a more complete understanding of a research problem than using either approach alone.





Bitsch (2005) attests that qualitative data analysis is a systematic process of selecting, categorising, comparing, synthesising and interpreting data to provide explanations of a single phenomenon of interest. Qualitative approach helped the researcher to ask questions with the aim of finding out how information teachers prepare themselves to address environmental degradation and hence, it was easy for the researcher to collect data which was not quantified.

Quantitative research is an approach for testing objective theories by examining the relationship among variables (Creswell, 2014). This approach simply measures or counts attributes through answering the “how many” questions. Data is interpreted numerically for easy analysis and the researcher used Computer excel software package for the interpretation of data using tables, a graph and a pie chart.

### 3.2. Population of the study

The researcher got a sample from the target of secondary schools in the study with a target sample of secondary school Biology teachers in the Northern Education Division. A sample of sixty (60) Biology teachers was obtained from a target population of eighty five Biology teachers. To come up with a sample of sixty Biology teachers, the researcher used purposive sampling whereby two Biology teachers were selected from each of the fifty sampled secondary schools.

### 3.3. Sample procedure

The researcher used purposive sampling to make sure that each school had one teacher from junior section and another one from senior section. Purposive sampling involves selecting participants based on the researcher’s judgement about certain characteristics being sought to meet the objectives of the study (Cohen, Mario & Mourisson, 2007). Out of 50 Secondary school that is, 25 public secondary Schools that is, Conventional and Community Day secondary schools (CDSSs) and 15 private secondary schools only 40 secondary school in Karonga where the research study was conducted, forty (40) schools were sampled for this study using a statistical formula for calculating sample size in known population taking into consideration the p-value of 0.5, level of confidence 90%, and a margin of error of 10% (Creswell, 2014). The researcher used purposive sampling in the selection of specific schools where the study was conducted per district, because it gave chance to both private and public secondary school to take part in the study.

### 3.4. Sample size

Sample size refers to the number of participant or observation included in the study. Sixty Biology teachers out of 80 b Biology secondary school teachers were selected randomly across Karonga District to be part of the sample. These teachers were chosen regardless of the sex. According Tayie, (2005) explains that for degree of precision 25 and 45 percent can be accepted for wider population so the sample is in line with what is recommended.

### 3.5. Sampling Area

The study was carried out in forty secondary schools within Northern Education Division (NED) in the Northern Region of Malawi. The study took place in secondary schools found in Karonga. Only Biology teachers took part in the research since the purpose of the study was to assess teaching and learning methods for secondary school biology subject content as an approach to addressing environmental degradation in Malawi. Case study of Karonga district. The researcher chose that Biological area for the study because there is an alarming rate increase of environmental degradation due to an increase of infrastructure, destruction of Karonga cultivate cotton plantation, rice and cassava farming activities. Hence, by conducting the research in this study location, it helps Biology teachers in secondary schools to find solutions or mitigation measures for Environmental Degradation when delivering lessons related to environmental issues.

### 3.6. Sources of data

The data collected was both secondary and primary. The secondary data was portrayed when syllabi of biology of both junior and senior was collected to analyse success criterion. The primary data was when questionnaire was employed for data collection



### 3.7. Methods of data collection

Data collection methods and instruments are ways of collecting data from research participants using instruments such as interviews, observation and questionnaire, and document analysis.

#### 3.7.1 Quantitative Data Collection Instrument

##### 3.7.1.0 Document Analysis

O'Leary (2014) defines document analysis as a systematic procedure for reviewing or evaluating documents either printed or electronic material. This indicates that in document analysis various procedures are involved in analysing and the interpretation of data of a particular study. Mogalakwe (2006) explains that document analysis involves the study of documents relevant to the research topic. That means document analysis as a form of quantitative research uses a systematic procedure to analyse documentary evidence and answer specific research questions. The researcher used document analysis to assess how the success criteria in secondary school Biology syllabi are framed to address environmental degradation in Malawi, hence helped to draw upon many sources of information in corroboration with the use of different data sources and methods. This is in agreement with Bowen (2009) who supports the use of document analysis that it helps in the triangulation of data, hence research credibility.

##### 3.7.1.1. Questionnaire

Questionnaire is another data collection instrument which was used in the research study. According to Kothari (2004), questionnaires are the most widely used instruments for obtaining information from individuals. Questionnaire is a tool designed for the collection of qualitative data widely used in the construction research (Silverman, 1998). This data collecting instrument is good for the collection of standardised data and making generalisations. Close ended questions were used in the questionnaire to target numerical data such as methods of teaching selected topics and rate of assessment of learners' fieldwork. Questionnaires provided responses quickly and the design of the questionnaire reflected the aim and objectives of this research.

#### 3.7.2 Qualitative Data Collection Instruments

The main data collection instruments used to source qualitative data in the research study were interview guide and smart audio recorder.

##### 3.7.2.1 Interviews

Interviews are a tool mainly for qualitative data collection. Kothari (2004) defines interviews as a qualitative method of data collection which is a presentation of oral verbal stimuli and reply in terms of verbal responses. It deals with active interactions between two or more people leading to a negotiated contextually based result. The researcher therefore, used interviews using semi structured questions for the collection of data about the teaching methods and assessment of learners' fieldwork in Secondary School Biology. Semi structured interviews, according to Tayie (2005) and Jones (1985), is a qualitative research instrument that combines a pre-determined set of open questions with the opportunity for the interviewer to explore particular themes or responses further. This means that if the researcher uses this type of interview, there is a provision of reliable and comparable qualitative data with different participants or interviewers. Since semi-structured has a flexible structure, the researcher encouraged the participants or interviewees to give more information. Data was collected using digital audial smart recorder and interview guide.

### 3.8. Data Analysis

Data analysis, according to Mwituria (2012), is the process of looking at and summarising data with the intent to extract useful information and develop conclusions. The data collection of this research study was organised according to the objectives of the study. Qualitative Data Analysis was done by identifying the main themes. Ranjit (2005) emphasizes that Qualitative research employs interpreted and naturalistic approach to the world, seeking to compile a detailed account of the phenomena in its natural setting, and makes a comprehensive interpretation of human experiences from the perspectives of the participants. Qualitative data analysis was done by first editing the responses from the participants, which was analysed using descriptive statistics, discussed and finally, conclusions were drawn. For example, qualitative data that was collected through interviews was analysed by the researcher by transcribing verbal responses following the order of interview schedule. The audio interview was played repeatedly to maintain accuracy as Cohen, Mario and Mourisson (2007) elaborate, that for the researcher to transcribe the right information and maintain accuracy, there is need to replay the audio interview repeatedly. Qualitative data was also analysed by using NVIVO which is one of the computer assisted qualitative data analysis software. Wickham and Woods (2005) assert that NVIVO software allows for



qualitative inquiry beyond coding, sorting and retrieval of data, and it integrates coding with quantitative linking, shaping and modelling. This means that NVIVO assists qualitative researchers in managing their data.

Quantitative data is defined as the value of data in the form of numbers where each data sets unique numerical value associated with it (Daniel, 2010). This means that the data or information can be used for mathematical calculations. Quantitative data for this research would be analysed using quantitative data analysis software such as Microsoft Excel, Microsoft Access and SPSS. Data was prepared, validated to find out if it was collected using set standards. Later, it was edited and coded. In quantitative research study, the researcher analysed the data from the questionnaire using SPSS computer software to produce tables and find percentages of respondents who answered various questions (Creswell, 2014). Both qualitative and quantitative were done concurrently to avoid time consuming and reduction of transport and material costs.

### 3.8. Trustworthiness and Credibility of research instruments

Trustworthiness in the research refers to validity and reliability. According to Shenton (2004), asserts that trustworthiness is all about establishing credible, transferable, confirmable and dependable research. This means the degree of confidence in interpretation of data and the methods used to ensure the quality of the study. For trustworthiness to be achieved in the study, the researcher depended on triangulation data (Rossmall & Rallis, 2003). This is where multiple sources like questionnaire, interview and document analysis were used as instruments for collecting data. Since trustworthiness was a key characteristic of this study, reliability of the questionnaire was tested through a pilot survey into two schools which were not part of the sampled schools for the study.

#### 3.8.1 Validity of Research instruments

Validity is concerned with whether the instrument used actually measures what is supposed to be measured. According to Kummar (2001), validity is the ability of an instrument to measure what it is designed to measure. To ensure that the instruments for the research were appropriate and were measuring what they were supposed to measure, the researcher sought the expertise and opinions from the supervisor. Suter (2006) attests that content validity is concerned with determining whether the content that the instrument contains is an adequate sample of the domain of content it is supposed to represent. This depicts that the extent to which the instrument measures is what it was designed to measure. Clarified questions and good use of the appropriate language will achieve validity. Questions were asked from all objectives of the study with the purpose of achieving Criterion validity and Construct validity. These were achieved by making sure that the instrument was only used to examine secondary school Biology content, and teaching and learning methods, and assessing learners' fieldwork that address environmental degradation.

#### 3.8.2 Reliability of Research instruments

Fraenkel and Wallen (2009) define reliability as the consistency of scores or answers from one administration of the instruments to another, and from one set of items to another. This means that the instruments used in collecting data would produce the same results over many trials. To achieve the reliability of research instruments, the researcher conducted a pilot study with the aim of testing the questionnaire. The test re-retest technique was used and reliability coefficient was calculated using both scores of the first and second tests using Pearson Product Moment Correlation formula.

The coefficient was above 0.5, hence the questionnaire was automatically accepted as being reliable.

#### 3.8.3 Ethical considerations

The researcher first got permission ST. Eugen University of Zambia, the Education Division Manager (EDM) (N) and head teachers of secondary schools where the research study was done before starting the research. The participants were assured that the information collected would only be used for the study with privacy and confidentiality. In addition, the privacy of teachers involved in the research would be respected. Pseudonyms were used instead of real names, and each Biology teacher participating in the study signed a consent form for acceptance. Fraenkel and Wallen (2009) explain that ethical issues are the general right principle one ought to do when conducting a research study.

### 3.9. Limitation of the study

The research study had some limitations. Some respondents delayed in filling the questionnaire. The delay might have negatively affected the validity of their responses. The researcher interviewed Biology teachers in Secondary schools. Some of them were invigilating term three tests hence were in hurry when filling the questionnaire and responding to interviews. Hence, this might have affected the quality of data that was collected.

## CHAPTER FOUR

### PRESENTATION OF THE RESULTS

#### 4.0 Introduction

This chapter presents the results of the study according to the objectives of the study that was conducted in the Northern Education Division (NED) in Karonga. There were three research objectives from which research questions for the study were derived. The research objectives are:

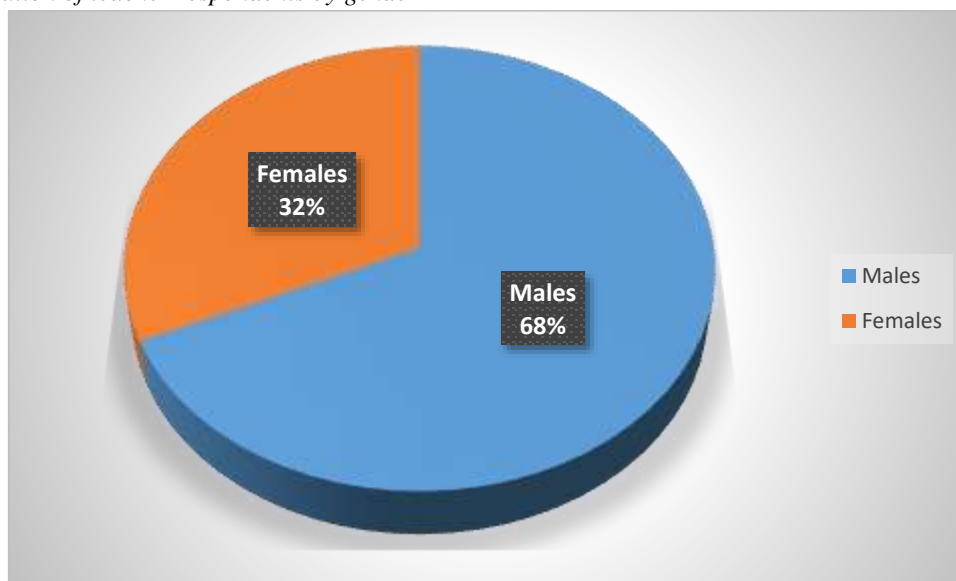
- To assess how the success criteria in secondary school Biology syllabi are framed to address environmental degradation in Malawi.
- To investigate the appropriateness of the methods of teaching and learning Biology selected topics that address environmental degradation in Malawi.
- To examine how Biology teachers assess students' fieldwork that is required by the syllabus.

#### 4.1 Quantitative Data

Below is the presentation of the results from quantitative data:

##### 4.1.0 Demographic data of respondents

###### 4.2.0.0. Distribution of teacher respondents by gender



**Figure 1** Distribution of teacher respondents by gender

Data on gender of respondents showed that 19 Biology teachers representing (32%) were females and 41 Biology teachers representing (78%) were males as shown in the Figure 1 above. The findings indicated that more than half of the respondents were males while the females were below half of the respondents, indicating that in the Karonga, there are very few female Biology teachers. The percentage of females is smaller compared to percentage of males because in most of secondary schools in the Northern Education Division, there were no Biology female teachers. This disparity would have an effect on the responses as the gender ratio was included in order to gain a perspective on the general understanding of Environmental Education by males and females who participated in the study.



4.1.0.1 Highest qualification for respondents

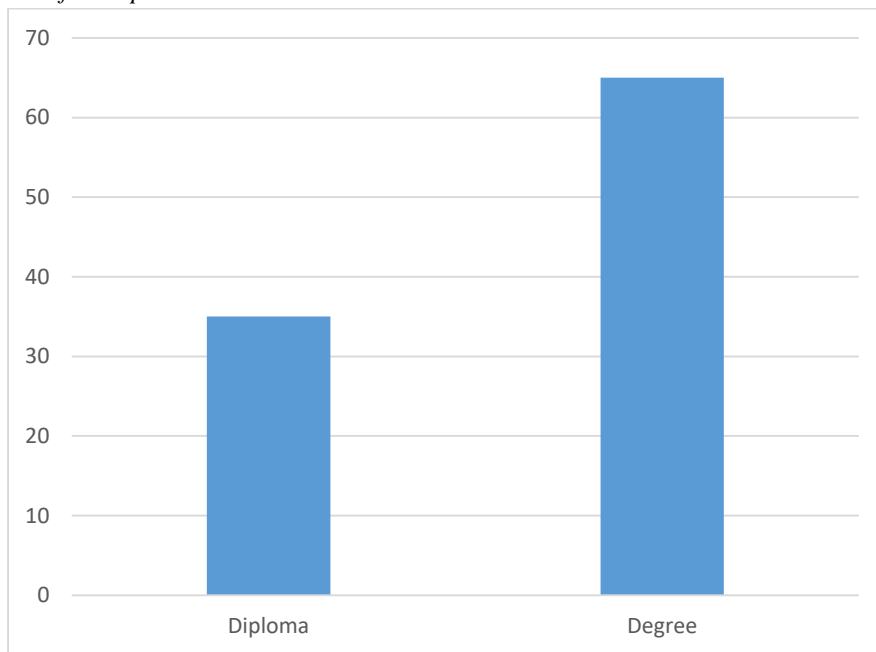


Figure 2. Percentage of highest qualification for respondents

The results of Biology teachers’ qualifications in Figure 2 above indicates that 35 Biology teachers had diplomas, representing (35%), while 65Biology teachers had Bachelor of education, representing (60%). Hence, all respondents had the required qualification to teach Biology subject in secondary schools.

4.1.1 Objective 1: Assessing how the success criteria in Secondary school Biology are framed to address environmental degradation

Table 1: Analysis of success criteria in the Junior Secondary School Biology syllabus

Junior Secondary School Biology content	Success Criteria address environmental degradation	Success criteria do not address environmental degradation	
Selected topics related to Environmental Degradation	Frequency (f)	Frequency (f)	Total Frequency (f)
Organisms and their environment	1	3	4
Plant diversity	0	4	4
External features of flowering and non-flowering plants	1	3	4
Plant structure and functions	0	2	2
<b>Total</b>	<b>2 (14%)</b>	<b>12 (86%)</b>	<b>14 (100%)</b>

Success criteria address Environmental degradation = 14%; Success criteria do not address Environmental degradation=86%



The topics indicated in Table 1 were selected from the Junior Secondary School Biology syllabus using purposive sampling technique in order to choose the topics related to environmental degradation. The findings in Table 1 which were the summary document analysis of success criteria showed that 2 success criteria representing 14% of the sampled topics address environmental degradation while 14 success criteria representing 86% of the total frequency of success criteria in the sampled topics do not address environmental degradation. Most action verbs that were used in the success criteria do not encourage learners to learn through practice in all different activities. Therefore, they would not help to transform their minds. For example, the action verbs “explain, describe and state” are frequently used in the success criteria which would retard critical thinking in the learners, hence would not transform their minds.

**Table 2:** Summary of document analysis of success criteria in senior secondary school Biology syllabus

Senior secondary school Biology Syllabus content	Success criteria address environmental degradation	Success criteria do not address environmental degradation	
Selected topic related to Environmental degradation	Frequency (f)	Frequency (f)	Total frequency
Ecosystem	2	5	7
Climate change	2	0	2
Ways of mitigating the impact of climate change	2	0	2
Plant structure and its function	1	4	5
<b>Total</b>	<b>7 (44%)</b>	<b>9 (56%)</b>	<b>16 (100%)</b>

Success criteria address environmental degradation= 44% Success criteria do not address environmental degradation =56%  
 The researcher selected the topics as shown in Table 2 from Senior Secondary School Biology syllabus using purposive sampling technique. This was done in order to select the topics that would help in addressing environmental degradation. The results in Table 2 which was the summary of document analysis of success criteria showed that 7 success criteria representing 44% of the total frequency of success criteria in sampled topics address environmental degradation, while 9 success criteria representing 56% of the total frequency of success criteria in the sampled topics do not address environmental degradation. Most action verbs that were used in the success criteria do not encourage learners to learn through practice in all different activities, therefore, would not help to transform their minds. For example, the action verb “explain” is frequently used in the success criteria does not promote creativity and critical thinking in the learners, hence would not transform their minds.

**4.1.2 Objective 2: Investigating the appropriateness of the methods of teaching and learning Biology selected topics that can address environmental degradation in Malawi**

**Table 3:** The Methods of teaching and learning Biology for the topic of Ecosystem

Item	Selected teaching methods	Agree		Not Sure		Disagree		Total (f)	Total (%)
		f	%	f	%	f	%		
1	Field work	42	70	6	10	12	20	60	100
2	Case study	40	67	15	25	5	8	60	100
3	ICT e.g videos	15	25	10	17	35	58	60	100
4	Inviting a specialist	12	20	18	30	30	50	60	100
5	Explaining	55	92	3	5	2	3	60	100
	<b>Average percentage (%)</b>		<b>55</b>		<b>17</b>		<b>28</b>	<b>60</b>	<b>100</b>



Table 3 shows the selected teaching methods for the topic of Ecosystem from both Junior and Senior Secondary Biology syllabi using purposive sampling technique. Data from the table above indicate that most of the Biology teachers (92%), in secondary school used explanation method in teaching the topic of ecosystem. The average of 55% of Biology teachers used the methods of teaching the topics related to environmental degradation such as ecosystem, Plant diversity, Organisms and their environment

**Table 4:** The Methods of teaching and learning Biology for the topic of Climate change

Item	Selected teaching methods	Agree		Not Sure		Disagree		Total (f)	Total (%)
		f	%	f	%	F	%		
1	Field work	48	80	2	3	10	17	60	100
2	Case study	12	20	26	43	22	37	60	100
3	ICT e.g videos	10	17	10	17	40	67	60	100
4	Inviting a specialist	15	25	20	33	25	42	60	100
5	Explaining	56	93	2	3	2	3	60	100
	<b>Average percentage (%)</b>		<b>47</b>		<b>20</b>		<b>33</b>	<b>60</b>	<b>100</b>

Key: f=Frequency; % = percent

Table 4 indicates the selected teaching methods for the topic of Climatic Change from Senior Secondary school Biology syllabus and Senior secondary school syllabus respectively, using purposive sampling technique. Data from table 4 above shows that most of the Biology teachers (93%) used explanation method more than any other method in teaching the topic Climate. About 47% of Biology teachers in secondary schools used the teaching methods that can address environmental degradation Including in Junior secondary and other related topics like: Plant diversity, Organisms and their environment

**Table 5:** Summary of teaching methods for the selected topics (Ecosystem and climate change)

Item	Selected teaching methods	Topic		Average %
		Ecosystem	Climate change	
1	Fieldwork	70%	80%	75%
2	Case study	67%	20%	44%
3	ICT eg Videos	25%	17%	21%
4	Inviting specialist	20%	25%	23%
5	Explaining	92%	93%	93%

The data in Table 5 shows that when teaching Ecosystem topic, 70% of Biology teachers used fieldwork, 67% used case study, 25% used ICT, 20% used a specialist and 92% used explanatory method. For Climate Change 80% of Biology teachers used fieldwork method, 20% used case study, 17% used ICT, while 25% used a specialist, and 93% used explanatory method.

An average of 75% of Biology teachers used fieldwork, 44% used case study, 21% used ICT, 23% used a specialist, and 93% used explanatory method when teaching the selected topics of ecosystem, wildlife and wetlands which are related to environmental degradation. An average of 53.5% of Biology teachers used teaching and learning methods that address environmental degradation when teaching the following topics: Ecosystem, Wild life and wetlands, which are related to environmental degradation. However, most of the teachers used explanatory method in teaching the topics indicated in Table 5 above. This indicates that if most of the Biology teachers used explanatory method in teaching the topics related to environmental degradation, it would be difficult to address environmental degradation since explanatory method does not create critical thinking in learners.



4.1.3. Objective 3: Examining how Biology teachers assess students’ fieldwork that is required by the syllabus

Table 6: Assessment of practical/fieldwork

Item	Selected assessment instruments	Agree		Not sure		Disagree		Total (f)	Total (%)
		f	%	f	%	f	%		
1	Analysing situations found in the field regarding environmental degradation	45	75	10	17	5	8	60	100
2	Finding solutions to problems identified in the field regarding environmental degradation	30	50	20	33	10	17	60	100
3	Practising quantification (weighing and measuring dealt with in the field of environmental degradation	46	77	12	20	2	3	60	100
4	Describing what students deal with in the field regarding environmental degradation	15	25	40	67	5	8	60	100
5	Evaluating (weighing positives and negatives) what students deal with in the field regarding environmental degradation.	36	60	16	27	8	13	60	100
6	Asking students to write a report of what they see in the field regarding environmental degradation	38	63	10	17	12	20	60	100
7	Displaying samples in the classroom as evidence of the field activity on environmental degradation	45	75	5	8	10	17	60	100
8	Asking examination questions that generate solutions to environmental degradation	43	72	7	12	10	17	60	100
10	Conducting quiz and debate in class on topics related to environmental degradation	31	52	22	37	7	12	60	100
11	Asking students examination questions that transform their thinking to reduce ED	45	75	5	8	10	17	60	100
	<b>Average percentage</b>		<b>62%</b>		<b>25%</b>		<b>13%</b>	60	<b>100</b>

Key: f= Frequency; %= percent





The data in Table 6 indicates that 62% of the Secondary school Biology teachers agreed that they assessed learners' fieldwork/practical with the aim of addressing environmental degradation. About 25% of Biology teachers were not sure and 13% of them disagreed using assessment methods that could address environmental degradation. This shows that although Biology teachers in Secondary Schools carry out assessment and evaluation of students' fieldwork activities they do not put much emphasis on issues relating to environmental degradation.

## 4.2 Qualitative Data

This section presents qualitative data collected based on objectives of the study through interviews. Three (3) Secondary School Biology teachers were interviewed on the same day 1<sup>st</sup> March, 2023. The aim of the interview was to triangulate the findings from the questionnaire.

### 4.2.0 Assessing how success criteria in Secondary School Biology syllabi are framed to address Environmental Degradation in Malawi

All three Secondary Biology teachers were asked to explain how success criteria in Secondary School Biology syllabi are framed to address environmental degradation

#### Respondent X:

*“Only in the senior syllabus topics have success criteria that can address Environmental Degradation. For example, in the senior syllabus, the success criteria in these topics ecosystem and climate change in Malawi can address issues regarding environmental degradation. But in the Junior syllabus, topics such as Living things and environment three quota of success criteria are not related to address environmental degradation.”*

**Respondent X** *“Yes, the topics in both Junior Certificate and Malawi School certificate Biology teaching Syllabi have good topics that can deal with environmental issues like Environmental degradation but success criteria are not in depth addressing environment degradation. There are topics like Ecosystem and Climate change in the senior level have success criteria which address Environmental degradation in Malawi.*

Respondent z:

*“I do not agree that the success criteria in Biology syllabi address environmental degradation. This is because of the way the success criteria have been framed, and there are no fieldwork activities attached to the topics related to environmental degradation. In addition, if you can look at our Biology syllabi, they are examination oriented whereby learners get information for them to pass the examinations. Even for us as teachers, we deliver the lessons for students to do well during examination.”*

Responses from Respondents X, Y and Z show that Junior and Senior Secondary school

Biology Syllabi are not framed to address environmental degradation. On the other hand, same respondent hinted that Success criteria in Biology senior Secondary School syllabi address environmental degradation.

### 4.2.1. Investigating appropriate methods of teaching Biology selected topics that can address environment degradation in Malawi

Respondents M, N and P were asked to explain the teaching methods used in Biology lessons related to address environmental degradation.

Respondent M:

*“In my case I normally use question and answer, or sometimes question and answer assists students quite a lot through explanations. In my case I prefer question and answer to other methods, explanation, lecturing and even sometimes, group discussion can also be part and parcel of the method which I normally use. These are the most teaching and learning methods which appear in the syllabi.”* *“Normally, I do not use such kinds of things like field work because I have got the reasons behind why I am saying like this, and a good example that I can say is because the school has no resources. When I talk about resources, obviously resources can be inform of human resources as well as financial resources. But in our case, our school has no money for the trips to prone areas of environmental degradation. Henceforth, we find problems to attend such kinds of trips, so we cannot have field work.*

**Respondent N:**

*“As a Biology teacher, I use different methods of teaching the subject and most of the methods used frequently are class discussions, question and answer, case study and explanation. Yes, I involve learners in fieldwork but not often. I once took my students to Leha*



river to see how carelessly trees were cut down by brick moulders who used them for burning their bricks. Students felt very sorry about it.”

#### Respondent P:

“ Well, our traditional methods for teaching Biology lessons are explanation, question and answer, group and class discussion with the aim of finishing the syllabus in time. You know, we teachers want students to pass with flying colours. So we want our students to memorise everything and pass the public examinations.

From the statements above, the methods of teaching which are mostly used by Biology teachers are explanation, question and answer and class discussion. Biology teachers emphasised that the traditional methods of delivering Biology lessons were used since they help learners to memorise subject matter for them to pass examinations. These methods promote drilling content, so learners cannot be transformed. Respondent M stated that he could not use fieldwork as one of the teaching methods of Biology topics or lessons relating to environmental degradation. Respondent N said that he used different methods of teaching Biology such as explanation, question and answer, group discussion and case study. But most of the teaching methods used by Respondent P could not help to address environmental degradation, except for case study which would allow learners to analyse the problems of the environment and bring the solutions to such challenges, hence addressing environmental degradation. Respondent P explained that the methods of teaching Biology were question and answer, explanation, group and class discussion with the aim of finishing the syllabus and for the learners to pass well in the examinations. The teaching methods of such kind never allow learners to have critical thinking about environmental degradation since they are not effective to equip learners with skills and knowledge to address issues of environment.

#### 4.2.2 Examining how Biology teachers assess students’ practical/fieldwork that is required by the syllabus

##### Respondent A

From the findings, all three respondents do not evaluate or assess learners’ field activities with the aim of addressing environmental degradation but for learner to excel in their public examination.

For instance, Respondent A in his response said, “*In a nutshell, we ask questions for students to do or pass well in examination not for addressing issues of environmental degradation.*” This is in agreement with Respondent B and C who emphasised on assessing learners for the orientation of examinations. Therefore, assessment in the fieldwork or practical work cannot promote issues of environment, hence difficult to address environmental degradation. Respondent B hinted that the fieldwork assessment or evaluation is examination oriented. For instance, he said, “*Most of the times when we are evaluating or assessing our students in all Biology topics, we are examination oriented. We ask questions that will help them pass MSCE and JCE exams.*” From this statement, learners are not given tasks for practice and do not have the skill of critical thinking. In this case, environmental degradation cannot be addressed with such motives of assessing learners. Respondent C stated that question and answer is the most used method of teaching Biology topics, related to environmental degradation. However, she was quick to say that fieldwork or practical work was assessed. For instance, she said, “*sometimes we also take them out of the school and give them fieldwork, may be planting trees as one way of restoring the environment.*” Taking students out for fieldwork enables them to interact with the environment. Therefore, learners engage in finding solutions to the issues of the environment. Fieldwork has been valued as a form of active and experiential learning involving hands-on activities, and for developing practical enquiry skills as well as conceptual understanding and broader insight (Lotz-Sistka & Ulenje, 2017). This gives learners an opportunity to carry out practical activities such as planting trees to cover bare land and conserve air and water hence addressing environmental degradation.

#### 4.2 Conclusion

This chapter has presented the quantitative and qualitative data. The presentation of the findings was guided by the order of objectives of the research study. The results have shown that most of the success criteria in both junior and senior secondary school syllabi do not address environmental degradation issues. The data in this chapter has shown that most Biology teachers do not use the teaching and learning methods that can help in addressing environmental degradation because learners do not learn through practice. The results also revealed that most Biology teachers do not assess learners’ fieldwork or practical activities for them to help them in addressing environmental degradation.



## CHAPTER FIVE

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 5.0 Introduction

This chapter mainly focuses on the discussion of the findings, suggestions and recommendations, Areas of further Research, conclusion, Reference and Bibliography, Appendices and Questionnaire/interview guide that were found in the research study.

#### 5.1 Discussions of Findings

##### 5.1.0. Discussion on objectives 1: to assess how the success criteria in secondary school Biology syllabi are framed to address environmental degradation in Malawi.

From the findings in Tables 1 and 2, most of the success criteria 86% in Junior and 56% in Senior Secondary School Syllabi respectively, do not address environmental degradation. The success criteria of the topics regarding environmental degradation would have addressed the issues of environmental degradation if they were well formulated. Most of the success criteria do not encourage learners to engage in practice, in all different activities related to environmental degradation. Hence would not help to transform their minds. This is quite different from UNESCO (2017), which recommends that success criteria in Biology must allow learners to have more practice and action on what they learn in the classroom situation. According to the findings by Guo and Lane (2018) in their study in China, recognised that Success criteria in Secondary School Biology must allow learners to have more fieldwork activities, and develop an understanding of the environment. It would be better if Biology syllabi in both Junior and senior levels in Malawi have the success criteria that transform and encourage learners to appreciate and interact with the environment, and address issues relating to environmental degradation.

One of the topics in the Junior syllabus “*Environment*” indicated in Table 1, has no Success criterion that demands learners to practice ways of maintaining the environment. For example, the success criterion “*Students must be able to explain how the components of the environment and the earth are related*”. This success criterion cannot help learners to have a transformative mind in managing or preserving the environment. This means that learners cannot be able to carry out fieldwork activities in addressing environmental degradation. For students to be involved in addressing environmental degradation, it would be better to have a success criterion, “*Students must be able to suggest ways of managing the components of the environment*”. This success criterion would help teachers to prepare lessons which require students to carry out fieldwork activities in addressing environmental degradation such as planting trees and digging pit latrines to manage waste. The managing of the environment would discourage environmental degradation activities such as pollution, deforestation and poaching.

In both Junior and Biology syllabus, the document analysis in table 1 and 2 indicate that most of the topics related to environmental degradation have success criteria with action verbs ‘*explain, describe and state*’ which retard learners to have creativity, critical thinking and transformative ideas. Davies and Summers (2015) state that action verbs such as ‘*explain*’ lead to little learning and retention. This suggests that success criterion with action verb ‘*explain*’ cannot help students address environmental degradation. In Germany, according to Grindsted (2017), the success criteria in the syllabus for secondary school Biology have action verbs which help students to learn by practice or doing. For instance, action verbs like demonstrate, create, apply, design, practice, analyse and evaluate, would help students engage in field activities which address Environmental Degradation. Once learners acquire practical lessons in the classroom situation, they would be able to do such activities when they go back home. Hence, issues of environmental degradation would be addressed accordingly.

When interviews were conducted, Respondents X, Y and Z, were asked to explain if the success criteria in both Junior and Senior Biology syllabi are framed to address environmental degradation. Respondents X and Y in pages 40 and 41 agreed that success criteria in senior Biology topics address the issues of environmental degradation but not in Junior Biology.

Regardless that both Respondents M and N agreed that both Junior and Senior Biology syllabi have success criteria that can address environmental degradation, what they responded seems to be untrue since it is not reflected in the document analysis. The document analysis in Figure 1 and Figure 2 show that the success criteria in the Biology syllabi cannot address environmental degradation, as they lack action verbs which can provide fieldwork activities and promote learning by doing to deal with environmental degradation. For example, some of the topics in the Junior Syllabus have no success criteria to address environmental degradation even though they are related to Environmental issues. The topic of “*Atmosphere*” has success criteria “*Students must be able to explain the term atmosphere; explain the composition of gases in the atmosphere; describe layers of the atmosphere and explain the importance of*



*the atmosphere*". These cannot help learners to have future thinking and critical thinking which address the issues of the environment. Zhou (2015) states that as far as Biology teaching is concerned, teachers are supposed to integrate SDGs content in order to transform learners so as to bring real change in the way they think about the environment, and practice sustainable use of the natural resources. This depicts transformative learning approach and outcome based education in Biology, can assist in addressing environmental degradation.

### 5.1.1. Discussion on Objective 2: Investigating the appropriateness of the methods of teaching and learning Biology selected topics that can address environmental degradation in Malawi

The results in Table 5 show more than half of Biology teachers (75%) conducted Fieldwork as a teaching method in Biology lessons relating to environmental degradation such as Ecosystem and climate change. This would lead to address environmental degradation. This concurs with what Mohammed (2016) found out in his research in Ethiopia, that 87.4% of

Biology teachers used Fieldwork. This is in agreement with Lotz-Sistka, Tshiningayamwe and Urenje (2017), who explain that fieldwork is very important in the teaching of Biology which assists in promoting SDGs, including environmental issues. For example, on the topic "*ecosystem*", it would be necessary for students to have visits to places with wetlands such as forest. Students would appreciate the beauty of vegetation, hence would engage themselves in finding and suggesting ways of conserving and protecting wetlands in Malawi. In this case, Biology as a subject would address environmental degradation.

In Table 6, about 44% of Biology teachers used case study in teaching Biology topics like

Ecosystem and climate change. This is different from what Kagoda (2016) discovered in Uganda whereby 67% of teachers in secondary schools used 'case study' in teaching Biology. The case study as a method of teaching and learning Biology in secondary schools plays a vital role in addressing environmental degradation. However, with the findings, most Biology teachers in Malawi do not use 'case study' as a method of teaching biology, especially the topics related to environmental degradation. This cannot assist learners to be involved in addressing environmental degradation. Gitau (2015) recommends case study method as a strategy of teaching Biology which involves problem-based learning and promotes the development of analytical skills in learners. This means that a case study in Biology involves students in solving problems that may be similar to those they face in their daily lives. For instance, one of the problems that children face is an increase of the degradation of the environment in their communities, and through case study method, problems of deforestation and pollution are likely to be solved positively by students. Lotz-Sistka and Ulenje (2017) add that case studies provide students with in-depth information about a particular issue in a particular context. Biology teachers in Malawi use case studies in the teaching of Biology, it would help learners share views and develop skills in analytical thinking, problem solving, group work and communication. Hence, addressing issues of environmental degradation.

Item 3 in Table 6, 21% of the Biology teachers in secondary schools used Information and Communication Technology (ICT). This portrays that most of Biology teachers did not use ICT as a method of teaching topics related to environmental degradation. This contradicts with Asongu, Le Roux and Biekepe (2017), who explain that the use of ICT can reduce dependence on environmental resources in order to decrease environmental pollution. For instance, the use of hydro-electric power (HEP) generated from water discourages cutting down of trees. This can assist in addressing environmental degradation by keeping the environment intact. Through technology, learners can acquire information about the sustainability of environment. The findings do not correspond with the recommendation by UNESCO (2017), which says that teachers should use teaching methods that allow learners engage in fieldwork in Biology, with the aim of addressing environmental degradation. It is good for Biology teachers to use ICT when teaching topics related to environmental degradation since it encourages learners to sustain it.

Item 4 in Table 5 indicates that 23% of Biology teachers admitted that they invited specialists when teaching topics related to environmental degradation. This cannot assist in addressing environmental degradation. Environmental specialists have vast knowledge about environmental challenges, including environmental degradation. If most of the Biology teachers did not invite Environmental specialists, learners would not able to get first-hand information about environmental degradation. The findings are against Alvarez-Garcia, Sureda-Negree and ComasForgas (2015), who reported that secondary school Biology teachers in Canada involved Environmental Educationists to provide them with new knowledge about environmental issues. This helped them to discover new teaching methods that encouraged learners to have more practical activities within the environment, hence addressing environmental degradation. This is in line with the Development Education Theory which suggests that teaching should assist learners to acquire education that would help them understand the world its, environment and contribute to environmental sustainable development (O'Flaherty & Liddy, 2017).



In Table 6, the majority of teachers, 93% of Secondary School Biology teachers agreed that they used explanatory method in the teaching of Biology topics related to environmental degradation. This implies that most of the Biology teachers do not use teaching and learning methods that would help in addressing environmental degradation. For instance, if 93% of Biology teachers used explanations in teaching Biology topics related to environmental degradation, that means there is no creativity and critical thinking in learners as students get knowledge and memorise it without application or doing practice. In this case, learners are not transformed and would not learn by doing things, applying, exercising and practicing ideas. Hence, would not think about the environment or could interact with the environment in a negative manner.

Dermici, Kesler and Kaya (2015) observed that most Biology teachers do not use methods that enhance learners in addressing environmental degradation. Explanatory method of teaching Biology does not encourage learners to have transformative minds and critical thinking. It encourages rote learning. This is not supported by Transformative Learning Theory which explains that teaching should help learners change the values on how they view the world and interact with the environment (Sterling, 2011). If learners change values and have positive interaction with the environment, issues relating the environmental degradation are likely to be addressed. Gitau (2015) explains that that 'explanatory method' is largely a passive process and does not arouse learners' interest. This gives a clear picture that the method would not address environmental degradation because learners' thinking would not be transformed. United Nations Educational, Scientific and Cultural Organisation [UNESCO] (2017) recommends the use of teaching methods that would assist learners have more practice so that they would be fully transformed on how best they would interact with the environment. This would help in addressing environmental degradation.

### 5.1.2. Discussion on Objective 3: Examining how Biology teachers assess students' fieldwork as required by the syllabus

Item 1 in Table 6 shows that 75% of Biology teachers agreed that they ask their students to analyse situations they find in the field regarding environmental degradation. This was similar to what Frankenberg and Babiuk (2016) explain that Biology teachers in secondary schools in China help learners to develop the ability to assess and analyse situations relating to the field of environmental degradation. Respondent A also agreed that Biology teachers ask students to analyse field work situations by saying "*we also ask learners to describe the activities that they have actually seen in a particular area where we have gone.*" If learners are sensitised in analysing situations, it promotes them to think positively about the environment. For instance, learners would analyse the situation of deforestation in their communities whereby trees are lost in order to make space for residential, industrial and commercial projects. Hence, they would develop the skills of critical thinking and problem solving to address issues of environmental degradation, by finding means and ways of discouraging deforestation.

Item 2 in Table 6 indicates that 30% ask their students to find solutions to the problems they would have identified in the field regarding environmental degradation. This shows that teachers do not assess learners' fieldwork or practical activities on topics related to environmental degradation, with the aim of addressing issues of environmental degradation. Kagoda (2016) stresses that teachers should give chance for learners to investigate and analyse the problems themselves, and justify that there are. Therefore, Biology should encourage learners develop the skill of investigating the problems of any issue related to environmental degradation, and later students or learners would discover the ways of solving the problems and take part in civic education. But if most of the teachers do not encourage learners to find solutions to problems related to environmental degradation, Biology in Secondary Schools would not address environmental degradation.

Item 3 in Table 6 shows that 35% of Biology teachers ask their students to practice quantifying (measuring or weighing) what they deal with in the field regarding environment degradation. Most of the Biology teachers do not involve learners in quantifying the magnitude of environmental degradation in the affected areas. This indicates that learners would not be able to find out the magnitude of the environmental degradation and it contradicts with Mezirow (2009) who explains that teaching should assist learners to understand the world and develop new values and beliefs about the environment. This would be done if teachers help their learners to practice quantifying what they deal with in the field regarding environmental degradation.

Item 4 in Table 6 indicates that 77% of Biology teachers ask their students to describe what they deal with in the field regarding environmental degradation. It is good for teachers to help learners to explain and give description of what they deal with when having field work regarding environmental degradation. This would create transformative skills in learners which helps them to develop positive attitude toward the environment (Bekele, 2015). For instance, preservation of the environment such as trees which would help to reduce soil erosion, flooding and provision of habitats for wild animals. In this case, environmental degradation would likely be addressed. United Nations Educational, Scientific and Cultural Organisation [UNESCO] (2016) adds that when Biology



learners are involved in education values, they develop characters that lead to the sustainability of the environment. This would be done if Biology teachers ask their students what to deal with in the field regarding environmental degradation.

Item 5 in Table 6 shows 60% Biology teachers agreed to ask their students to evaluate (weighing positives and negatives) what they are dealing with in the field regarding environmental degradation. Evaluation of learners' activities regarding environmental degradation help them to play a role of improving and preserving the environment. Learners must be able to assess or evaluate fieldwork activities when dealing with environmental degradation. Falkenberg and Baibuk (2016) explain that Biology learners in China are involved in the ability to assess, analyse, synthesise and evaluate the environmental challenges with confidence and accuracy. This would be done if Biology teachers ask their learners to weigh positives and negatives when dealing with issues of environmental degradation. For example, one of the topics in Biology Senior Syllabus is "Ecosystem." In this topic, learners should be asked to evaluate environmental issues such as climate change, destruction of ecosystem, waste management and soil depletion. In this case, learners would find out the problems facing the environment such as pollution, drought, loss of soil fertility, environmental resource depletion and flooding. This would enable learners come up with solutions to such problems like controlling population growth, civic education, enactment and enforcement of the laws. These solutions to environmental issues would likely protect the environment hence environmental degradation could be addressed. However, more than half of the respondents do not engage students to evaluate issues regarding the field of environmental degradation. The findings contradicts with Behrendt and Franklin (2014) who explain that teachers should allow students to evaluate and assess their fieldwork activities. This helps learners to find solutions to the problems relating environmental degradation.

Item 6 in Table 6 shows that 63% of Biology teachers agreed that they assessed their students by asking them to write a report of what they see in the field regarding environmental degradation. This is in agreement with Shroder (2014), who explains that in Afghanistan, learners are asked to write reports once they have field work activities related to environmental degradation. For instance, learners write reports on wind, water and land pollution on the topic of ecosystem. If learners write reports on issues of environment, they can have a positive mind in the way they think about the environment.

Item 7 in Table 6 indicates that 75% of Biology teachers agreed asking their students to display samples in the classroom as evidence of field activity in environmental degradation. Most of the Biology teachers do not allow students to bring samples collected from the field. This depicts that learners would not remember and practice what they had seen in the field regarding environmental degradation. This would not assist learners to have tasks that will assist them on how they would solve environmental problems. This is against what O'Flaherty and Liddy (2017) stress that the minds of the learners can be transformed if there is an integration of principles, values and practices of Environmental Sustainable Development into all aspects of learning. If Biology teachers in secondary schools ask learners to display samples of field activities in class, their minds would be transformed. Hence, develop positive attitude towards the environment.

Item 8 in Table 6 shows that 72% of Biology teachers agreed to ask their students examination questions that generate solutions to Environmental Degradation. More than half of the Biology secondary school teachers interviewed indicated that the examination questions address environmental degradation. This is similar to what O'Neill, Doyle, Boyle and Clipson (2010) say that when Biology teachers develop examination or assessment questions, they should consider activities that stimulate real-life context to enable learners generate solutions to the problems. This is very important as it would assist learners deal with environmental problems that affect their daily life. Hence, addressing issues of environmental degradation. For example, in the topic of Climate change, students can be asked to suggest ways how they could contribute to climate change mitigation and adaptation in Malawi. Such questions would likely help the learners to promote critical thinking, hence developing transformative minds.

Item 10 in Table 6 shows that 52% of Biology teachers agreed to conduct quiz and debates in class on the topics related to environmental degradation. This indicated that most of Biology teachers in secondary schools do not involve learners to conduct quiz and debates after field work or practical activities. However, quiz helps learners to learn with practice and enables them to develop critical thinking and get into the habit of innovative learning. This critical thinking would enable learners assess and evaluate environmental problems. For instance, learners would think of water pollution as one of the challenges or problems of the environment. They would discover that dumping wastes into water would lead to water-borne diseases such as cholera and dysentery and would endanger the life of aquatic animals like fish. Since quiz encourages critical thinking in learners, these findings contradict with Falkenberg and Baibuk (2016) who explain that Biology teachers in secondary schools in China emphasise using the skill of critical thinking when teaching Biology.



Debate in Biology education encourages teachers and learners to engage with and reflect on environmental key issues such as deforestation, pollution and climate change. Since most of Biology teachers do not involve debate which can enable students reaching their own informed judgement of the environment with deeper knowledge and understanding, it would be difficult to address environmental degradation. The findings are not in line with Mtunda and Safuli (1986) who strongly say that debate provides learners with in depth study of controversial and emerging issues. For instance, learners can debate on the negative impact of climate change and come up with suggested ways of dealing with climate change. Hence, be able to address environmental degradation. After debate, learners can engage in civic education on how to mitigate the impacts of climate change. They can also engage in waste management, afforestation and reforestation, prevent land, air and water pollution. Therefore, it is important for Biology teachers to encourage learners to conduct quiz and debate which would help them address environmental degradation.

Item 11 in Table 6 shows that 75% of the Biology teachers agreed to ask their students the examination questions that transform their thinking to reduce environmental degradation. According to the findings in Table 6, it was discovered that most of Biology teachers in secondary schools do not ask examination questions for learners to address environmental degradation. Respondent P also agreed that Biology teachers ask their students the examination questions for students to do well during the examination, not to transform them to deal with environmental degradation. This was what Respondent B said, “*We ask questions that will help them pass MSCE and JCE exams*”. This contradicts with what Lotz-Sisitka, Tshiningayamwe and Ulenje (2017) explain that teachers should ask examination questions which support learners to become more engaged with environmental stewardship. This portrays that assessments such as examination questions should always be transformative. Hence, learners should understand the world and develop new values about the environment in which they live. This is in agreement with Lovat (2011) who explains that learners are empowered to take responsible actions by keeping in mind environmental integrity and a just society, both for the present and future generations.

Teachers should give learners tasks or examinations that would help them in taking care of the environment.

## 5.2 Suggestion and Recommendations

Basing on the findings of the research study, the following recommendations could be made:

- The Ministry of Education through Malawi Institute of Education (MIE) should revise the success criteria in both Junior and Senior Secondary School Biology Syllabi to promote practical activities. This would help learners addressing environmental degradation as they will be able to interact with the environment in a positive manner.
- Biology teachers in secondary schools should conduct fieldwork/field visits for Biology topics which are related to environmental degradation to have firsthand information about the environment.
- The Ministry of Education should provide training to Biology teachers to promote Environmental Education. This would help them to acquire new ideas about issues of environment
- Biology teachers in Secondary schools should hold insets at cluster level to share views on issues relating to Environmental Education.
- Secondary School Biology teachers should use Education for Sustainable Development (ESD) lessons that would stimulate meaningful learning and application of knowledge to address problems, issues and questions relating to Environmental Degradation.
- Biology being a core subject the curriculum developers should add much information in both junior and senior information so that if student complete secondary should be fully equipped with knowledge.

## 5.3 Areas for Future research

- Evaluating Secondary school Biology text books in promoting topics related to environmental degradation
- Exploring the role of Secondary School Biology teachers in promoting Education for Sustainable Education
- Examining challenges facing Secondary School Biology teachers in addressing environmental degradation
- Investigating the role of Secondary School Biology students in addressing environmental degradation



- Assessing the feasibility of Secondary School Biology Teaching and Learning materials in addressing environmental degradation.

#### 5.4. Conclusion

The researcher in his hypothesis before carrying out the study, had in mind that teaching Biology in secondary schools can address issues relating to environment degradation in Malawi. However, on the ground after the research study was carried out, it was found out that the teaching of Biology in secondary schools in Malawi cannot address environmental degradation due to a lot of challenges. Regardless that UNESCO encourages Transformative learning through teaching subjects including Biology, which is one of the configuration of a vehicle amongst many equally important vehicles that are capable of contributing to learners' Environmental Education;

Biology has a lot of failures to address environmental degradation. Therefore, MoEST through MIE should revise the success criteria in both Junior and Senior Secondary School Biology Syllabi to allow Biology as a subject address issues of the environment. There must be a consideration of training Biology teachers so that they acquire more and new information about Environmental Education (EE), hence would be able to transform the students so as to bring real change in the way they think about the environment and conduct themselves positively.

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APPENDICES

Appendix 1: Research authorization letter from DMI-ST.Eugen University

**DMI-ST.EUGENE UNIVERSITY**

(Run by Sisters of Daughters of Mary Immaculate and Collaborators)

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Ref. No. DMISEU/ACA/11536-21/PG-63

09<sup>th</sup> March, 2023

**TO WHOM IT MAY CONCERN**

This is to certify that Jacob Eston Chiyombo is a bonafide student of DMI – St. Eugene University, Zambia. He is pursuing a Master's in Education Programme and currently in semester IV of the Master Programme. He is a well-disciplined student of good conduct and therefore, any assistance offered to him would be highly appreciated.

Dr. C.Glorindal  
PG-Coordinator





Appendix 2: Research Authorization by Education Division Office





**Appendix 3: Letter seeking permission from the EDM (N)**



Date: 27<sup>th</sup> February, 2023

From: Jacob Eston Chiyombo, Chilumba Secondary School, P/Bag 2, Chilumba.

To: The Education Division Manager, P. O Box 133, Mzuzu.

Dear Sir,

**REQUEST TO CONDUCT A RESEARCH STUDY IN SECONDARY SCHOOLS IN NED SPECIFICALLY KARONGA DISTRICT**

I am Jacob Eston Chiyombo, a teacher in the Northern Education Division. Currently, I am studying Master's degree in education at ST. Eugen University of Zambia . As a requirement for award of the master's degree, I am conducting a research titled "*Assessment of teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi*". I would like to request for permission to carry out the research study in 40 secondary schools both Private and public secondary school, in Karonga District from 1<sup>st</sup> March, 2023 to 1<sup>st</sup> April, 2023.

The research study will help to assess how Biology teachers address Environmental Degradation through the teaching of Biology. The choice of teachers will be based on those who are qualified and with teaching experience. The privacy of participants and the schools will be upheld throughout the study and all the information to be collected will be treated with confidentiality. I hope that the participation of Biology teachers in the research study will be of significance to them in improving the teaching of Biology.

I shall be very grateful if this request reaches your favourable consideration.

Yours faithfully,

Jacob Chiyombo

**Appendix 4: Consent letter to Head teachers**



**Seeking Permission from Head teachers**

I am Jacob Chiyombo, a teacher in the Northern Education Division. Currently, I am studying Master's degree in education at ST Eugen University of Zambia. As a requirement for award of the master's degree, I am conducting a research titled *Assess teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi*. I would like to request for permission to carry out the study in 40 secondary schools from 1<sup>st</sup> March, 2023 to 1<sup>st</sup> April, 2023.

The research study will help to assess how Biology teachers address Environmental Degradation through the teaching of Biology. The choice of teachers will be based on those who are qualified and with teaching experience. The privacy of participants and the schools will be upheld throughout the study and all the information to be collected will be treated with confidentiality. I hope that the participation of Biology teachers in the research study will be of significance to them in improving the teaching of Biology.

If you allow your school to take part in research study, I would like to be crystal clear that your participation is entirely voluntary and no negative consequences will result from your participation and confidentiality of the information collected will be treated accordingly. Throughout the research study, the privacy of the participants will be upheld. I shall provide you with a summary of my research results, should you be in need of it.

Thank you

Name of the researcher: Jacob Chiyombo.



**Appendix 5. Consent form for participants**



Researcher Name: JACOB CHIYOMBO


I am Jacob Chiyombo, a teacher in the Northern Education Division. Currently, I am studying Master's degree in Education with ST. Eugen University of Zambia. The Purpose of this study is *to Assess teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi*. The study will be a wakeup call for the Ministry of Education, Malawi Institute of Education and Curriculum developers to start promoting Environmental Biology through Biology teaching. This research study will require teachers to take part in the study with consideration that addressing Environmental Degradation starts with teachers.

Your participation in this research study will hold your privacy and the data to be collected will not interfere with your work.

Participant's permission

I have read the consent form and conditions of this study. I hereby voluntarily agree to participate in this research study.

Participant's name \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher's name: JACOB CHIYOMBO Signature:  Date: \_\_\_\_\_

**Appendix 6: Information sheet for teacher**




I am Jacob Esto Chiyombo a teacher in the Northern Education Division. Currently, I am studying Master's degree in Education with ST Eugen University of Zambia. As a requirement for award of the master's degree, I am conducting a research titled "*Assess teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi*". I would like to request for permission to carry out the study in 40 secondary schools from 1<sup>st</sup> March, 2023 to 1<sup>st</sup> April, 2023.

The research study will help to assess how Biology teachers address Environmental Degradation through the teaching of Biology. The choice of teachers will be based on those who are qualified and with teaching experience. The privacy of participants and the schools will be upheld throughout the study and all the information to be collected will be treated with confidentiality. I hope that the participation of Biology teachers in the research study will be of significance to them in improving the teaching of Biology. If you allow your school to take part in research study, I would like to be crystal clear that your participation is entirely voluntary and no negative consequences will result from your participation and confidentiality of the information collected will be treated accordingly. Throughout the research study, the privacy of the participants will be upheld. I shall provide you with a summary of my research results, should you be in need of it.

Thank you

Name of the researcher: Jacob Eston Chiyombo Cell Numbers: 0995 482407

Email: zotonkhata68@gmail.com Signature:  Date: \_\_\_\_\_



Appendix 7: Questionnaire for Secondary School Biology teachers



Dear participant,

My name is **Jacob Eston Chiyombo** a student at ST. Eugene University of Zambia. I am conducting out a research on “Assessment of teaching and learning Methods for Secondary School Biology subject content as an approach to addressing Environmental degradation in Malawi, Case study of Karonga District. This research study is a required for Masters of Education..I humbly request you to fill this questionnaire honestly. The information that will be gathered will from you will be confidential and solely for academics purpose.

**Instruction**

- Do not write your name
- Tick the response of your choice where applicable
- Provide your responses on the spaces provided
- Do not share your response with anyone except the researcher

**SECTION A : Personal Information**

Sex Male [ ] Female [ ]

Qualification

Diploma [ ]

Degree [ ]

Master’s Degree [ ]

Others: specify \_\_\_\_\_

**SECTION B**

**Questionnaire for Secondary School Biology teachers** Objective 1: *To evaluate current Secondary School Biology content and teaching and learning methods as an approach to addressing environmental degradation in Malawi*

To respond items 1 to 15, use the following key and tick the box under a number that represents your answer

1. **Strongly agree** 2. **Agree** 3. **Unsure** 4. **Disagree** 5. **Strongly Disagree** 1. I use the method of **field**

**work** in teaching the topic of Ecosystem

1	2	3	4	5





2. I use the method of **case study** in teaching the topic of Ecosystem and climate change

1	2	3	4	5

3. I use the method of using **ICT** e.g. using videos, photos, etc in teaching the topic of and climate change

1	2	3	4	5

4. I use the method of **inviting a specialist** to teach the topic Ecosystem and climate change

1	2	3	4	5

5. I use the method of **explaining** in teaching the topic of Ecosystem and climate change

1	2	3	4	5

6. I use the method of **field work** in teaching the topic of Ecosystem and climate change

1	2	3	4	5

7. I use the method of **case study** in teaching the topic of Ecosystem and climate change

1	2	3	4	5

8. I use the method of using **ICT** e.g. using videos, photos, etc in teaching the topic Ecosystem and climate change

1	2	3	4	5

9. I use the method of **inviting a specialist** to teach the topic of Ecosystem and climate change

1	2	3	4	5

10. I use the method of **explaining** in teaching the topic of land degradation and climate change

1	2	3	4	5



11. I use the method of **field work** in teaching the topic of ecosystem and climate change

1	2	3	4	5

12. I use the method of **case study** in teaching the topic of ecosystem and climate change

1	2	3	4	5

13. I use the method of using **ICT** e.g. using videos, photos, etc in teaching the topic of ecosystem and climate change

1	2	3	4	5

14. I use the method of **inviting a specialist** to teach the topic in teaching the topic of ecosystem and climate change

1	2	3	4	5

15. I use the method of **explaining** in teaching the topic of ecosystem and climate change

1	2	3	4	5

Objective 3: Assessment of practical/Field work Instruction:

To respond items 1 to 10, use the following key and tick the box under a number that represents your answer

**1. Strongly agree 2. Agree 3. Unsure 4. Disagree 5. Strongly Disagree**

1. I ask my students to analyse situations they find in the field regarding environmental degradation

1	2	3	4	5

2. I ask my students to find solutions to problems they would have identified in the field regarding environmental degradation.

1	2	3	4	5

3. I ask my students to practice quantifying (measuring or weighing) what they deal with in the field regarding environmental degradation.

1	2	3	4	5



4. I ask my students to describe what they deal with in the field regarding environmental degradation

1	2	3	4	5

5. I ask my students to evaluate (weighing positives and negatives) what they are dealing with in the field regarding environmental degradation.

1	2	3	4	5

6. I assess my students by asking them to write a report of what they see in the field regarding environmental degradation,

1	2	3	4	5

7. I ask my students to display samples in classroom as evidence of the field activity on Environmental degradation.

1	2	3	4	5

8. I ask my students examination questions that generate solutions to Environmental degradation.

1	2	3	4	5

9. I ask my students to sketch or draw maps of what they see in the field regarding environmental degradation

1	2	3	4	5

10. I conduct quiz and debates in class on the topics related to environmental degradation

1	2	3	4	5

11. I ask my students examination questions that will transform their thinking to reduce Environmental degradation.

1	2	3	4	5



**SECTION C**

Semi structured interview guide for Secondary School Biology teachers

Are success criteria in both Junior and Senior Biology syllabi are framed to address issues of Environmental Degradation

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1. What methods of teaching are used in teaching Biology topics related to Environmental Degradation?

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2. Do you use fieldwork when teaching topics related to Environmental Degradation?

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3. How do you assess learners' fieldwork/practical activities especially for the topics related to Environmental Degradation?

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END OF INTERVIEWS  
THANKS FOR YOUR PARTICIPATION

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