NEAR EAST UNIVERSITY
GRADUATE SCHOOL OF EDUCATIONAL SCIENCES
ENVIRONMENTAL EDUCATION AND MANAGEMENT
DOCTORAL PROGRAM

ANALYSIS OF ENVIRONMENTAL CONCEPTS FOR PLATEAU STATE CENTRAL, NIGERIA FOR DETERMINING THE MISCONCEPTIONS AMONG STUDENTS

PhD Thesis

Toma Maina ANTIP

Nicosia, 2020

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DECLARATION

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

Toma Maina ANTIP
Environmental Education and Management
Nicosia, 2020

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ABSTRACT

ANALYSIS OF ENVIRONMENTAL CONCEPTS FOR PLATEAU STATE CENTRAL, NIGERIA FOR DETERMINING THE MISCONCEPTIONS AMONG STUDENTS

Toma Maina ANTIP

PhD Thesis, Department of Environmental Education and Management

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This study set out to analyse students and adults understanding on some environmental concepts in a view to determining their opinions on the said concepts in Plateau State Central, Nigeria. Three hundred (300) students participated in the study. The students were split into two groups, the first group comprised of one hundred and fifty (150) students below eighteen (<18) years of age, the second group comprised of one hundred and fifty (150) adult students of above eighteen (>18 years) of age. Instrument used for data collection was questionnaire designed by the researcher and consisted of forty (40) Environmental Concept Achievement Test (ECAT), forty (40) Environmental Concept Understanding (ECU) and an interview schedule. The ECAT determined students achievement on current environmental issues such as Pollution, Global Warming, and Climate Change Demographic factors such as economic level, area, school type, occupation influences academic achievements of students and adults. The ECU sought students understanding on some environmental concepts and was rated, Acceptable Scientific Response (ASR), Unacceptable Scientific Response (USR), No Response (NR) and was scored 3, 2, and 1 respectively.

Results obtained from the analysis indicated that demographic factors such as economic level, school location, school type, gender, age, family system and occupation influences students and adults academic achievement when correlated using Pearson Product Moment correlation Coefficient. On understanding of environmental concepts, students had a higher mean of 1.54 and standard deviation

of 0.28 on their level of understanding of some environmental concepts than their adult counterpart who had a mean of 1.53 and also a standard deviation of 0.29, the variance for students was 0.080 and 0.082 for adults. Students and Adults differ slightly by their mean, variance and standard deviation in their understanding of some environmental concepts. The study indicated a positive linear relationship of students and adults to their demographic studies with the values r = 0.988 for students and r = 0.904 for adults. Abstract of concepts accounts largely for misunderstanding of concepts while prompt evaluation and more practical were seen as remedy or solution to solve misunderstanding of concepts. The study concluded by highlighting the implications of the research work for curriculum planners and teachers in-service education. Appropriate recommendations was made such as making adequate provision of laboratory equipment, more practical be conducted for students in and outside the classrooms. Further research work to cover similar concepts in Biology particularly on topics like photosynthesis, genetics and evolution was recommended**.**

Keywords**:** *Achievement, Environmental Concept, Environmental Education, Misconception, Nigeria, Student.*

ÖZET

PLATEAU CENTRAL, NİJERYA'DA EĞİTİM GÖREN ÖĞRENCİLERDE GÖRÜLEN ÇEVRESEL KAVRAM YANILGILARININ BELİRLENMESİ VE ÇEVRESEL KAVRAM ANALİZİ

Toma Maina ANTIP

Doktora Tezi, Çevre Eğitimi ve Yönetimi Bölümü
Tez Danışmanı: Doç. Dr. Aşkın KİRAZ
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Bu çalışma, öğrenci ve yetişkinlerin, bazı çevresel kavramlar hakkındaki anlayışlarını, Nijerya'daki Plateau State Central'daki söz konusu kavramlar hakkındaki görüşlerini analiz etmek amacıyla yapılmıştır. Üç yüz öğrenci çalışmaya katılmıştır. Öğrenciler iki gruba ayrılmıştır; birinci grup on sekiz yaş altı 150 öğrenciden, ikinci grup on sekiz yaş üstü 150 yetişkin öğrenciden oluşmaktadır. Veri toplamada kullanılan araç araştırmacı tarafından tasarlanmış ve 40 maddelik Çevresel Konsept Başarı Testi (ÇKBT), 40 maddelik Çevresel Konsept Anlama Testi (ÇKAT) ve bir yapılandırılmış görüşme formundan oluşmuştur. ÇKBT, Kirlilik, Küresel Isınma ve İklim Değişikliği gibi mevcut çevresel konularda öğrencilerin başarısını belirlemiştir. ÇKAT bazı çevre kavramları hakkında öğrencilerin anlayışlarını belirlemeye çalışmış ve Kabul Edilebilir Bilimsel Tepki, Kabul Edilemez Bilimsel Tepki ve Tepkisizlik likertleriyle sırasıyla 3, 2 ve 1 puanlanmıştır.

Analizden elde edilen sonuçlar, ekonomik seviye, okul yeri, okul türü, cinsiyet, yaş, aile sistemi ve meslek gibi demografik faktörlerin, Pearson Ürün Moment Korelasyon Katsayısı kullanılarak korele edildiğinde öğrencileri ve yetişkinlerin akademik başarısını etkilediğini göstermiştir. Çevresel kavramları anlama konusunda öğrenciler, bazı çevre kavramlarını anlama seviyelerinde ortalama 1.54'lük bir standart sapma ve 0.28'in standart sapmalarına, 1.53'lük bir ortalamaya sahip yetişkin meslektaşlarına göre ve ayrıca 0.29'lık standart sapmalara sahiptir. Çalışma, öğrenciler ve yetişkinlerin demografik çalışmalarıyla öğrenciler için r = 0.988 ve yetişkinler için r = 0.904 olan pozitif bir ilişki olduğunu göstermiştir.

Kavramların içeriği, kavramların yanlış anlaşılmasından kaynaklanırken, sürekli değerlendirme ve fazla pratik yapmanın kavramların yanlış anlaşılmasının çözümü için uygun olacağı düşünülmüştür. Çalışma, müfredat planlamacıları ve öğretmenlerin hizmet içi eğitime yönelik araştırma çalışmalarının etkilerini vurgulayarak tamamlanmıştır. Laboratuar ekipmanlarının yeterli şekilde tedarik edilmesi, sınıf içi ve dışındaki öğrenciler için daha pratik yapılması gibi uygun önerilerde bulunulmuştur. Biyolojideki benzer kavramları kapsayan, özellikle fotosentez, genetik ve evrim gibi konularda daha fazla araştırma yapılması önerilmiştir.

Anahtar Sözcükler: Çevre eğitimi, Çevresel kavramlar, Kavram yanılgıları, Nijerya, Öğrenci.

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CHAPTER I
INTRODUCTION

The interdependency of man with living and non-living things within the ecosystem is fundamental to human existence. Human beings are in constant interaction with their environment right from birth. At home, they interact with their physical environment and manipulate the resources within their environment for their benefits. Science is a process for gaining knowledge and understanding the natural world, it is a process and a product, a way of thinking and solving problems (Akinmade, et. al. 2003). The distinctive characteristic of scientific knowledge is that it provides explanation for the behaviour of the material world (Miller, 2004). Biology is a science in which ecology is embedded and it deals with the study of life. It is all embracing as it is concerned with the characteristics of living things, their anatomy, physiology, functions and their relationship with one another and with their immediate environment.

Biology in which environmental courses are integrated occupies a unique position in secondary schools. This is evident in the statement of James and Barka (2001) when they opined that biology as a curriculum subject had witnessed high level of enrolment than any other science subject in the senior secondary school final year examination in Nigeria. Furthermore, the World Energy Council (2010) asserts that biomass production which is an essential aspect of ecology contributes about 12 percent of the total global energy supply. Biomass is an alternative source of energy, it can be used to generate electricity and also serve as a fuel. Biomass is environmentally friendly unlike the energy generated from petroleum products which is detrimental to plants and animal growth (Hake, 2002).

One aspect of biology which is of central importance is understanding and application of environmental concepts. Environmental knowledge like ecology deals with the study of the relationship of organisms to one another and their effect on the various factors of the natural environment that is both living and non-living (Garg et al., 2007). Oladele (2008) opined that environmental related topics are vital aspect of biology that has been increasingly recognized. No wonder, the National Policy on Education NPE (2004) stresses that education should aim at inculcating in the child, the spirit of inquiry and creativity through the exploration of nature. Where the

students engage in exploring the natural world, they are said to be studying environment and ecology. Demola and Femi-Adeoye (2004) noted that environmental concepts consist of about 40% of the total learning content in West Africa School Certificate Examination (WASCE) syllabus.

The above assertion is attributed to the fact that environmental studies as an aspect of biology is very relevant and has many applications focused on the maintenance of a healthier and more habitable biosphere for every living being. Such importance has been globally recognized and demonstrated in the recent past. For instance, the December, 2018 United Nation Conference on Environmental Development tagged "Earth Summit" which took place in Poland was as a result of a global concern to save our common habitat-earth. Student's knowledge of the environment enhance their awareness of the various ecological diversity which shows the variation in ecological niches, food chain, food web and nutrient cycle (Garg et al (2007). The productive use and value of environmental diversity is the value assigned to the product that are commercially harvested for sale in formal markets, and are reflected in the national income account. Garg et al (2007) opined that such saleable products include: fish, timber, fuel, wood, silk from silkworms, wool from sheep. They further opined that many industries like paper and pulp industry, silk industry, leather industry, fishery industry are almost totally dependent upon the productive use of environmental and ecological diversity.

The relevance of this environmental and ecological diversity had led to an awesome increase of balance in nature which rests squarely on environmental concepts, hence the need for students to properly understand these concepts. In ensuring that the goal of studying environment be achieved, curricular reforms in biology have taken place in various countries. In Nigeria, for example, the West African Examination Council (WAEC) has revised the examination syllabi and modified it several times to incorporate environmental topics (Obande 2006).

Despite the emphasizes placed on the learning of biology and particular environmental topics owing to the centrality of its importance, several researchers still reveal that students performance in biology and environmental items remain very poor. Oguniyi (2014) observed that the performance in West African Senior School Certificate Examination in biology is always on the decline. Repeated reports as opined by Igwe (2015), Obande (2016) constantly show poor performance in biology at the Senior School Certificate Examination.

Science educators, curriculum designer, corporate examiners and researchers have for too long a time laid the blame for students' low performance in biology and flagrant disregard to conserving our natural resources on the door step of school teachers and the curriculum. Okebukola (2002) for example attributed it to topics difficulty, overloaded curriculum and inadequate facilities in biology laboratories, lack of awareness on the dangers of environmental degradation by government and individuals. Also, Soyibo (2009) laid the blame on poor teaching method employed by teachers of biology.

However, a look at research findings in education does not seem to indicate that the problems students experience in the learning of science are experienced by those in other areas of the liberal Art/Social sciences (Ojerinde 2014). The researcher, however, is of the view that there is something peculiar to science which makes it a little but difficult to learn than the liberal arts and social sciences. Akpan (2002) notes that this peculiarity is linked to the complex structure of scientific knowledge.

Despite high enrolment in biology, the persistence of environmental degradation under achievement due to student's poor performance is a pointer to the fact that there are underlying problems in the teaching and learning of biology. Hence, the researcher deemed it necessary to study the level of students understanding and achievement in some selected environmental concepts.

1.1. Problem Statement

Environment is the source of all our needs on earth. However, the activities of the human race is not environment friendly, thereby putting living and non-living things at the risk of being destroyed, in view of this concern, all hands must be on deck to address such impending catastrophe, this should start right from the classrooms to the outside world. Ecology which addresses much of the environmental concepts should be vigorously taught in schools.

Nwoye (2002) defines ecology as the scientific study of the interactions between organisms and their environment, going by this definition, ecology can be better studied in the environment but most biology teachers often use the laboratory and other teaching aids in the classroom only as their resources or the only resources for teaching biology, while the environment which contains great science in it has

been seriously neglected and overlooked for effective science teaching especially environmental concepts.

Despites its relevance, it has been noticed that students have not imbibe good environmental attitude and they also perform poorly in questions on environmental content during Senior School Certificate Examinations. Obande (2016) opined that poor performance in school's certificate examination is an indication that the environment will be poorly manage by all and sundry in the future. The chief examiners report, WAEC (2016), reveals that students had poor understanding of questions relating to environment, ecology and the nervous system. However, due to the persistence of poor performance of students in biology senior secondary school examinations as revealed by research findings and also due to consistent reports by researchers on the fact that poor attempts at environmental questions is a contributing factor to such low performance in biology, the question that comes to mind is what could be responsible for such low performance of students in environmental questions?

These questions have prompted the researcher to want to analyse the level of students and adults understanding and achievement of some environmental concepts with the view of ascertaining the level to which students and adults understand such concepts to the point of application and also to the point of facing them in their school certificate examination without any problem. The world global temperature is on the increase (Hansen et al 2010), deforestation, pollution, species loss are also on the increase. The question is; "Are the student and adult population aware of the dangers posed by these threats to our planet earth?" This question also prompted the researcher to want to analyse the level of understanding of two groups of students, the first group of students are those that are below 18 years of age and the second group are those above 18 years of age (adults).

1.2. Aims of the Study

Breakthrough in Science and Technology occasion with growth in population is causing a lot of stress in the environment; all hands must be on deck to ensure that the environment becomes a better place for everyone. In view of this, this research aimed at analysing environmental concepts understanding and achievement and determining misconceptions based on students and adults opinion, this is in a view to

catch them young and start proffering solutions to the myriad of problems confronting us on the planet earth right within the school set up so that at the end we will have an environment that is safe for us and also for the generation yet unborn.

Within the parallel of this aim, these sub-objectives were determined for solving the problem of this thesis:

- What are the achievement levels of students and adults in understanding environmental concepts?
- How is the achievement levels of students and adults differ according to their demographic status (type of school, sex, age, area, household, class)?
- What are the understanding levels of environmental concepts of students and adults?
- How is the understanding level of environmental concepts of students and adults differing?
- How is the understanding level of students and adults differing according to their demographic status?
- What are the reasons for misconception about environmental concept?
- How can these reasons be solved or overcome?

1.3. Significance of the Study

This study hopes to be of great importance to biology teachers, students, and curriculum planners and the public. The biology teacher can benefit from the study as it can provide him/her with a better understanding of using the most appropriate methods in teaching environmental concepts. The study will sensitize the teachers on the need to maintain and sustain the ecosystem. The findings would be of benefit to teachers in ascertaining the level of students understanding of particular concepts and how materials can be presented to learners in a sequential order for easy comprehension. The study can benefit the public by making them aware of the dangers of not conserving our natural resources.

The students can benefit from the study because; they will have the opportunity to develop the skill of observation, ability to identify the different organisms in the environment. They can also touch them and feel them and know the dangers of not protecting the plants and animals in the environment. This, will

therefore, enhances the understanding and retention of what they learn. Another significance of this study to the students is that they have the opportunity to observe the living things in their natural environment, how they interact with each other and how they interact with the non-living components of the environment. The knowledge gained by the students in the ecosystem will help them answer questions from this area in their school certificate examination.

Curriculum planners and subject experts may need this study especially in the area of activities for each topic; they can use the findings of this study to formulate and organize curriculum materials, method and processes that will enhance the learning of science concepts. It will help the curriculum planners to focus on topics that will help address the current environmental issues confronting the world today such as global warming and climate change.

Finally, bodies like Abuja Protection Environmental Board (AEPB), Federal Environmental Protection Agency (FEPA), Greenpeace, Biological Science Society (BSCS), Ecological Society of Nigeria, Science Teachers' Association of Nigeria (STAN), and National Educational Research Council (NERC) would wish to consider the findings of this piece of work relevant in trying to promote teaching and learning.

1.4. Limitations of the Research

The study faced some limitations as shown below;

- The study was restricted with understanding of environmental concepts by students and adults based on the Biology Curriculum of the senior secondary schools in Nigeria.
- This research was also limited to 150 students of ages below 18 years and 150 adults of ages 18 and above in Plateau Central Nigeria.
- The resources used in this research are limited with ones that the researcher could reach.

1.5. Operational Definition of Terms

Adult: Early adulthood, middle adulthood, and late adulthood are the three basic stages of physical, emotional, and psychological development. With regard to

physical development, early adulthood is the least dramatic. This stage occurs from approximately 18 to 35 years of age. Adult is a fully developed person from maturity (18 years and above) onward (Ogunsola, 2012).

Alternative Conception: Imaginative or perspective thinking or belief that is contrary to scientific belief (Okebukola, 1990).

Ecology: The study of the relationship of organisms to one another and their effect on the various factors of the natural environment that is both living and non-living. Garg et al (2007) say ecology is the study of the relationship of various organisms to their surroundings.

Environment: The term 'Environment' signifies direct surroundings: all the conditions, situations and impacts surrounding and upsetting all organisms or a group of organisms (Cakir, 2008). The environment includes the surroundings, conditions or influences that affect an organism (Davis, 1989).

Environmental Adult Education (EAE): Environmental adult education (EAE) integrates environmental education and adult learning philosophy to offer realistic and significant educative capabilities to students (both students and adults) with the aim of getting about the desired environmental revolution (Palmer, 1998).

Environmental Education: Developing a world population that is aware and concern of environmental issues which he is working towards finding solutions to them that is developing Education programs that will foster environmental literacy (UNESCO, 1976).

Environmental Management: Organizing different environmental programs to address various ecological issues leading towards making the environment a safe haven for plants and animals (NPE, 2004).

Misconception: Wrong idea or interpretation on a given science concept or phenomenon (Okebukola, 1990).

Performance: The level of success on tasks, in this case, on the given Environmental Concept Achievement Test (Mang, 2009).

Prior knowledge: Knowledge an individual already has about a science concept before he/she is exposing to the concept in a formal classroom (Ango, 2003).

Scheme: Ideas that individual construct within himself as a result of experience with outside realities (Balogun, 2016).

1.6. Abbreviation

AC	Abstractness of Concept
EAE	Environmental Adult Education
ECAT	Environmental Concept Achievement Test
EE	Environmental Education
ECU	Environmental Concept Understanding
ESD	Environment for sustainable Development
LP	Language Problem
OSC	Over Simplification of Concept
SAB	Students Attitude to Biology (SAB)
SSCE	Senior School Certificate Examination
TPP	Teachers Pedagogical Problem (TPP)
TNT	Topics Not Taught
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

CHAPTER II
LITERATURE REVIEW

2.1. The Environment

The word ‘Environment’ is coined from an old French word ‘Environ’ meaning ‘Encircle’. We are surrounded by people, animals, plants and physical objects which are part of our environment. A straight meaning of the word ‘Environment’ is direct ambiances: all the situations, conditions and impacts adjoining and influencing all organisms or a cluster of organisms (Cakir, 2008).

In daily use, the term ‘Environment’ usually refers to the ambiances. The word ‘Environment’ thus comprises of a lot of variables and parameters which control the survival, presence and extension of the organism. Though the humblest significance of the word refers only to somatic and genetic ambiances, its wider explanation has much broader meanings and includes economic, social, political, cultural, economic, and academic doings of man which touch the somatic and genetic components.

The Longman Dictionary of Contemporary English 6th Edition (2015) describes ‘Environment’ as: The physical and social conditions in which people live especially as they influence their feelings and development. It involves the regular condition such as water, air, energy and water, in which organisms thrives. for an environmentalist, environment is just an ecosystem. An ecosystem is the simple functional unit in the ecology and the word refers to any ordinary or false environment wherever living things (i.e. biotic components) are associating with non-living things, abiotic mechanisms (Soyibo, 2009). Therefore, man as a unit within an ecosystem associate and is dependent on other living things including the biochemical, somatic, and socio-cultural issues in the ecosystem (Asay and Orgil, 2010).

2.2 Environmental Problems

The consequences of human actions on the environment are becoming glaring by the day. Studies have shown that humans have succeeded more in destroying

habitats of living organism than creating them. There are quite a lot of factors that led to changes in our environment. Issues like Global warming, Climate change, genetic engineering are common. Human Related Environmental problems are closely related to Natural Environmental Problems. However, this researcher will attempt to group them separately.

2.2.1. Human related environmental problems

Human impact on the environment otherwise known as anthropogenic impact on the environment includes a lot of changes to environments and ecosystems, biodiversity, and natural resources which are directly caused by man in an attempt to make life better for him. The planet earth is endowed with natural environment, known as 'Ecosystem' which includes living and non-living organisms (Soyibo, 2009). These also comprises of natural resources like climate, air, fire and water. Time is ripe for human beings to take action in order to address this problems if not it will spell doom for humanity. These problems include:

Pollution: This is an introduction of contaminants into the natural environment in a quantity that causes adverse change. Human beings are conversant with the devastating effect of pollution but they have a lukewarm attitude towards addressing it. The term pollution does not only refer to soil, water and noise/sound pollutions but also include visual, light, thermal, plastic, littering, point and non-point sources. Soil and water pollution are significantly caused by waste from industries

Climate Change: This is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time, usually decades to millions of years. Climate change includes warming and other side effects of warming like heavier rainstorms, heat waves or frequent drought.

Global Warming: This is a disturbing environmental problem; this is a rise in earth's temperature because of greenhouse gases called methane, carbon dioxide, water vapour and other gases. For several years, the build-up of greenhouse gases have increased tremendously, signifying more heat gets stocked in the atmosphere and little of these gases drip back into the universe. These gases warm up the earth's surface, and leads to global warming. Environmental Protection Agency, EPA, (2019) posited that, the earth's temperature has risen by 0.8 degrees Celsius over the

past 100 years. Global warming can lead to increase in diseases, droughts, heavier rainstorm, hurricanes, and heat waves.

Deforestation: This is a process whereby trees are felled by man for several purposes but without replanting them. Forest acts as sanctuary for rare and endangered animals, they also act as storm breakers protecting town and villages. Continual cutting down of trees by man can lead to flood, soil erosion and rendering the land infertile.

Overpopulation: Other environmental problems have their roots in overpopulation, that is to say it is the cause of a lot environmental crises. Over population causes stress on the environment, it is straining the already few resources. Intensive Agriculture being practice today to produce food, damages the environment through the use of insecticides, pesticide and chemical fertilizer. The world population according to World Bank (2018) is 7.5 Billion as of September 19, 2018, this growth in population is not commiserate with the resources been produced.

Industrial and Household Waste: Most of these wastes contaminate soil and ground water. Thermal pollution is caused when water is used as coolant in a power plant; this goes to increase the temperature of the water there by affecting aquatic lives. Industrial and Household waste constitute serious health risk to humans. Some of these wastes are buried underground in landfills.

Acid Rain: It occurs due to the occurrence of some pollutants in the atmosphere like sulphur dioxide and Nitrogen dioxide. Acid rain runs through to ocean, for example, the acid in fertilizer, Nitrogen, Phosphorous, Potassium, it makes water toxic, it causes human health problems and these are largely cause by human beings.

*Ozone Layer Depletion***:** This cover is a cover of gas that is found 25-30 km above earth's surface. It is a highly reactive molecule that contains three oxygen atoms. This cover is present in the stratosphere (10-15km) and prevents too many harmful UV (ultra violet) radiations from reaching the earth. It serves as an umbrella protecting living organisms from ultra violet rays. The leading reason of depletion of ozone layer is due to too much discharge of chlorine and bromine from man-made compounds such as chlorofluorocarbons (CFCs). CFCs, halons, CH3CCl3 (Methyl chloroform), and methyl bromide have been discovered to have straight influence on the depletion of the ozone layer. Too much of the UV light causes skin cancer.

Genetic Engineering: Genomic pollution and changes of food yield not only have damaging consequences on human beings, but are accountable for critical worry known as 'genetic modification'. Genetically modified food threatens crop diversity, it creates more weeds, and it causes unwanted residual effects.

Urban Sprawl: this is responsible for increase in population resulting to people living rural areas to urban areas or cities. This exemplifies the inability of development measures to keep pace with the rate of population growth. Environmental issues link or related with the increase in growth of includes congestion in housing situations, reduced quality or non- availability of rudimentary infrastructures and community services, such as sewage and water amenities and also poor road network or lack of access roads (Nwoye, 2002).

GeoMining: This has destructively affected natural vegetation and animal life; it subsequently results to leaching of poisonous pollutants and heavy metals that goes to pollute land, air and water.

2.2.2. Natural environmental problems/issues

Earthquakes, volcanoes, tsunamis, floods, tornadoes, hurricanes, avalanches, landslides and forest fires are natural disasters that people and the environment are threatened with. In some cases, the rains become acidic as a result of exploding volcanoes, which produces some gases like sulphur. Microbial activities are also a contributing factor. Lightening in the atmosphere produces nitrogen dioxide. These disasters threatened the lives of all living organisms.

2.2.3. Global environmental problems/issues

Sand mining: Sand mining is causing environmental damage worldwide (Oguueri, 2008). People use traditional and conventional methods to dig out sand from river for the purpose of constructing houses and roads. This has negative effect on aquatic lives once disturbed. *Climate Change:* Climate change is now a much-discussed concept around the globe. The global average surface temperature is believed to have increased by 0.6° + 0.2° C over the last century.

The president of Nigeria during the plenary of the 7th United Nations General Assembly which to place in New York on 24th of September 2019 spoke extensively on the effect of climate change on developing nations. He said the developing nations will also contribute their quota towards ensuring that they work towards

ensuring a clean environment for the present generation and the generation yet unborn. All participating countries are to ensure that they abide by the treaty which seeks to reduce pollutions by the year 2030.

The Inter-Governmental Panel on Climate Change (IPCC) 2019 indicates that land the size of South America has been degraded. The IPCC news report of August, 2019 advised that we should change food production and stop abusing land. The second largest greenhouse gas (GHG) emitters are as shown below (see Figure 1).

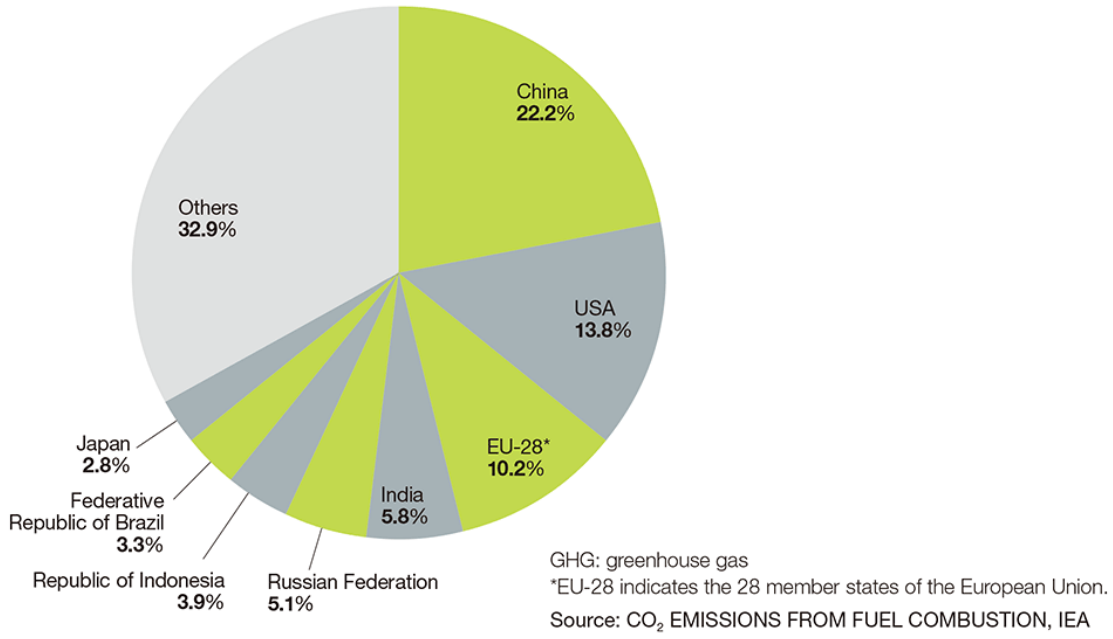

Figure 1. CO_2 emissions from fuel combustion

Figure 1 is frightening from 2013-2014, the Intergovernmental Panel on Climate Change, a body formed by the United Nation in 1988 issued its Fifth Report. It summarizes, it is exceedingly likely that more than half of the detected rise in global average surface temperature from 1951 to 2010 is as a result of human induced activities leading to the release of the rise in Green House Gases accumulations and other human induced sources.

The report went further to elaborate states that restrictive temperature increase to less than 2°C above pre-industrial levels will a long way to reducing global Green House Gases emissions by 40–70% of 2010 levels by 2050, and emission levels is required to abridge to zero or less by 2100 (see Figure 2).

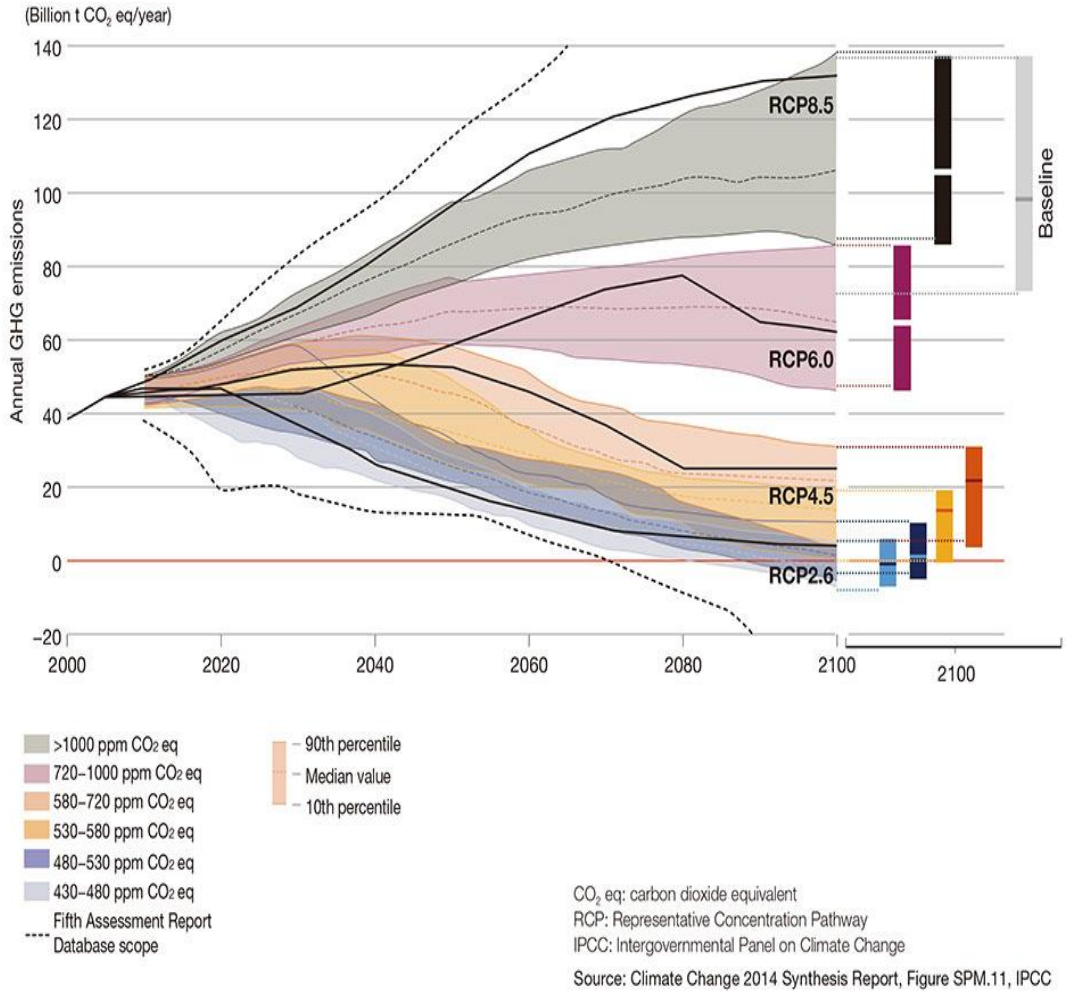

Figure 2. Climate Change 2014 synthesis Report

This report also gives situations for anthropogenic Green House Gas emissions. To match the standard issues, one has a very Green House Gas emission level due to changes in climate and socio economic development policies (RCP8.5), two intermediate situations (RCP6.0 and RCP4.5), and a very thoughtful moderation situation (RCP2.6). Reducing the future temperature increases to a reasonable less than 2°C above pre-industrial levels relates to RCP2.6.

The consequences of climate change are as listed below:

- Change in hydrological cycle and water supply
- The Inter-Tropical Convergence Zone (ITCZ) may move northward in the northern hemisphere causing rapid changes in rainfall pattern
- Increase in tropical and temperate cyclones, cloud cover, tornadoes and storms
- Changes in pressure belts and atmospheric circulation

- Warming of ocean water may endanger the corals worldwide
- Expansion of deserts and more desertification within deserts
- Effect on food supply and international trade of grains
- National parks, sanctuaries and biosphere reserves may be altered
- Countries such as Maldives and greater parts of Netherlands etc. may submerge under water
- Climate change is making food crops less nutritious

Population Explosion & its Pressure on Environment Finite Resources: Most resources being finite since the very beginning and natural limit to resource generation being slow, constant rise in population and putting pressure in the limited resources on earth, road construction and human habitation is affecting the natural habitation.

More People, More Demand, and More Waste: With the advent of science and technology man's need for comfort and luxury has multiplied many times. More people demand more resources and generate more waste. Clearly one of the challenges of a growing population is that the mere presence of so many people sharing a limited number of resources strains the environment.

Urbanization and Industrialization: This has negative effect on the vegetation, threatening lives of animals many of which are on the verge of extinction. Power plants/Machines/ automobile have added a great number of pollutants to the environment. As a result, environmental degradation has risen to an irrecoverable level. Industrialization places greater burden on the earth due to the waste that are released by these industries, standard that are normally set out for them by constituted authorities or government are usually not followed or disregarded and still penalties are not meted on them (Obande, 2006).

Over Consumerism: This usually has a tremendous effect on the planet earth. The natural resources we are limited, they have a life span, they are not endless, and man's feeding habit puts these resources at risk. Man has developed an unprecedented craze for a mushrooming number of products and services available in the world market. Approximately 2 billion people belonging to the "consumer class" are characterized by desire for processed food, desire for bigger houses, cars, durables, etc. to maintain their desired lifestyles. Consumerism has become more acute in developing countries such as India, China and Nigeria than that in developed countries due to the rise in population.

Biodiversity: Human beings destroy the habitat of species on daily basis. It should be noted that when we exterminate one species, it has a knock on effect on another species in the food chain which in turn upset the ecosystem, this is often referred to as the sixth extinction. The International Union of Conservation of Nature (2019), placed 27 per cent (27,000 species) of access species on Red list. They note that many species are threatened with extinction thus:

1 out 8 of birds

1 out of 4 mammals

1 out of 4 conifers

1 out of 3 amphibians

6 out of 7 marine turtles

75 percent of genetic diversity of agricultural crop lost

75 per cent of the world's known species risk extinction if the global temperature rises by 3.5ºC.

2.3. The Relations between Environment and Education

First, learning is about relationships. Living organisms live in the environment, the ecosystem, the biosphere that sustains lives. Since living organisms live in the environment, proper knowledge of the environment is required to manage where we live, this can be gotten formally or informally in an educationally set up or in the community. We can be educated on the environment in school hence there is a strong bond between environment and education. The concept of environment and education began as a reaction to an increasing fear about human society's effect on the environment (Taiwo, 1980).

2.4. Definition of Concept

The understanding of a concept in any subject is needful in creating meaning in order to make sense of the events of our life and sorting them into categories. Concepts to Abdullahi (2005) are group of words or symbols which may represent the meaning or definition given to an object or phenomenon. Graf and Bercky (2000) posited that a concept consists of the following parts: term, cognition, definition. To them, a person has a concept if he has adequate knowledge of all parts. In addition, a

concept refers to as the knowledge a person has about the term. For example, a student may identify that quadrates are made up of metal, wires or wood and are of different sizes and shapes. The accumulation of these prepositions, images and episodes with accompanying skills of using the quadrates in various population study is the person's concept of quadrate.

In another view, Child (2004) noted that concept could exist either as concrete or abstract. Concrete concepts denotes things or ideas that can easily be recognised by their attributes, like gene, photosynthesis, pollution and so on, while abstract concepts are appeal to the senses. In line with this, Abdullahi (2005) also stresses that two kinds of concepts exist: the first he labels empirical concept' which are concerned with observable and demonstrate phenomenon, and may be define operationally. Such, he said are derived from experiences such as sensations, impression, perception and so on, the second are 'theoretical concepts' which are not derived or indirect sensory stimulation. The term concept has been used to designate both mental construct of individual and also identifiable public entities that comprises part of the substance of the various disciplines. The child for example has the concept of big things and small things, wetness and dryness. The child usually modifies these concepts in some ways or perhaps tries to develop new concepts in situation where the concept he already has about a thing proves inadequate. In most cases, new concepts may be related in some way to the concepts the child already has (Orukotan and Balogun, 2003).

For the researcher, concepts are words, group of words, class of objects, all the ideas an individual has about an event or phenomenon grouped together on the basis of common attributes, and such ideas about a thing or phenomenon could be modified from time to time on the basis of daily encounter or new experience of the object or phenomenon.

2.4.1. The concept of ecology

Ecology is an important and fundamental aspect of biology; it tries to clarify the issues and intricacies involved in life. As an aspect of biology, it has been defined differently in different texts and by different researchers. Ango(2003) sees ecology as promoting the study of nature in its natural setting and that it engage learners in numerous activities and interactions. Differently put Garg et al (2007) say ecology is the study of the relationship of various organism to their surroundings, since a human

being is also a living organism, the study of his environment is also part of ecology. They further opined that depending upon whether an ecologist is studying an individual organism or group(s) of organisms, ecology has two major branches: autecology and synecology.

Garg et al., (2007) further stressed that studying a particular lizard, and finding out about where it lives, what it eats, how many eggs it lays and so on is an aetiological study, and in the contrary, if you are interested in a particular river and want to investigate the kinds of terrain it is flowing through, the kinds of fishes and other animal that live in it, the type of plants found in it, the inter-relationship of plants and animals and the physicochemical factors of water and the like, then the study is synecology. The study of ecology however is the drawing of connections between strands of components of ecosystem, hence it is becoming more and more important, as human being are modifying the environment around them through various activities and actions.

2.4.2. Importance of ecology

Study of ecology as a whole is very relevant, and life without some form of ecological knowledge is risky (Obande, 2006). Life generally depends on the inter-relationship of the organisms (both plants and animals) with the physical, chemical, hydrological, geological and biological as well as atmospheric component of the natural environment. The importance of ecology cannot be overemphasised especially in teaching of science and in particular the biology curriculum. Field studies council and British Ecology Society (2002) have described such importance as providing a balance perspective because links other biological discipline and this provides a good foundation unto which decisions can be taken for further studies and actions on community levels

Obande (2006) and Garg et al., (2007) also noted that ecological knowledge is important in our environment because you will learn about:

- Causes and prevention of pollution
- The wise use of natural resources to conserve for future generation
- Afforestation which will help to uplift the world's oxygen balance upset by the loss of forest which have endangered many species of plants and animals

- Preventing indiscriminate destruction of plants and animals for man's use leading to extinction of such animals like the Hawksbill turtle, Amur Leopard, Javan Rhino, Mountain Gorilla
- Education through public enlightenment on ecological problems which do a lot of harm to nature and man himself.

It can be rightly said that the study of ecology is of paramount importance to the existence of man; hence the need for students to understand the basic concepts enshrined in ecology and other environmental concepts, this entails knowing the basic principle underlying the existence of organisms, their interaction with each other and with the environment in which they live.

2.4.3. The concept of understanding

The basic goal of science teaching is understanding; hence students are expected not only to remember but to understand what they are taught (Eisen and Stavy, 1992). They further noted that it is only when students understand concepts that they are able to generalize beyond specific stimuli and to a variety of instances or problems.

Understanding is the knowledge that somebody has about a particular subject or situation. Hornby, (2000) in Eisen and Stavy (1992) has suggested three meanings to understanding. First, we understand something when we are able to visualize it by forming a clear mental picture of it (visual imagery). Visual imagery as used by Howard refers to those visual representations that illustrate and help to foster understanding. Secondly, understanding something means the ability to construct a useful mathematical model of it. The third view is based on the scheme theory. He looked at scheme as a mental representation of a category, thus he regarded an idea as some information in memory that allows a person to sort various stimuli into similar and dissimilar category. Hence to Howard, understanding is the product of these three views. Nevertheless, Okoye, (2007) explains that the ability of an individual to acquire, retain and recall that which he had learn signifies he has understood it, hence he viewed understanding as the acquisition, retention and recall or remembering of an information. Learning Connection and Research Education (2007) had identified four levels of understanding.

1. Literal- which deals with facts, known information and description of factors involved like what? Where? Who? When?

2. Lateral- deals with context (Historical, political, geographical. Factual comparison with other events of life, effect of the event, involvement of other parties, relationship between elements and forced involved and answering questions like how? What for? Meaning what?
3. Critical- Depth of analysis involved, what is really happening? Where does the power recite? Question to be answered here involved was it original? Where does it come from? Why? Why not? How useful is it? Is it true? What impact does it have?
4. Speculative- what will happen next? What if certain change is made? What change may improve the situation? What is required to solve the matter? Questions to be answered include- could it happen differently? What is needed? What next? What leads on from here? What will advance or regress?

To them, answering the questions at the various levels, one could be said to have had an understanding of the matter on ground. The importance of understanding lies in the fact that principles and concepts that are understood are highly resistance to forgetting. Mallum and Haggai (2002) see forgetting as loss of information from any of the memory stores so that the individual is incapable of retrieving such information. So understanding the principles and concepts underlying a particular subject ensure that material or experience learnt are not forgotten. It is only when this happens that students can be said to have learn.

2.4.4. Concept of achievement

Henry Murray's is been credited with his studies on human needs which later lays the foundation of understanding achievement. His work on Exploration in Personality (1938) shades a lot of light on the concept of achievement. His extensive work on achievement embraces most subsequent work on how to accomplish difficult task, to manipulate, to master and how to overcome challenging task and be at a higher level of life/achievement. (Murray 1938, p. 164)

Academic performance and achievement are specific task set out in schools or institutions to achieve a determined goal. In schools they are usually measured by percentages, mean, grade point average, cumulative grade point average (Obande, 2006). This normally indicates to which extent a student will progress in his academic pursuit.

This research work focuses on determining the understanding, achievement and opinions of students and the adult population on environmental concepts in a view to advising relevant bodies (Government and non-governmental organizations) of the dangers posed by not effectively managing our environment well.

2.4.5. Misconceptions in environmental courses

Misconceptions in relation to the field of environment within the secondary school as contained in the Federal Ministry of Education (2009) biology curriculum. Misconceptions relating to field of Ecology as shown in Table 1 below:

Table 1. Misconceptions in Ecology

Misconceptions	Author
Misconceptions relating to food webs and food chains	
Varying the population of an organism will only affect the others that are directly connected through a food chain	Munson (1994), Griffiths and Grant (1985)
Chemical pollutants undergo no change in form as they move through food chains	Hogan (2000)
Misconceptions relating to ecosystems	
Some ecosystems have limitless resources and provide an opportunity for limitless growth of a population	Munson (1994), Brody and Koch (1990)
Misconceptions relating to plant–herbivore interactions	
Plants are stationery, cannot defend themselves against herbivores	Stamp (2004)
Misconceptions relating to carrying capacity	
Population normally exist in states of either constant growth or decline depending on their position in a food chain	Munson (1994)
More herbivores exist than carnivores because people keep and breed herbivores	Leach et al. (1996)
Some ecosystems are limitless resources and provide an opportunity for limitless growth of a population	Munson (1994)
The relative sizes of prey and predator populations have no bearing on the size of the other	Gallegos, Jerezano, and Flores (1994)
Misconceptions relating to limiting factor	
All factors are limiting except the most abundant one	Eyster and Tashiro (1997)
The most limiting factor is the least abundant one	Eyster and Tashiro (1997)
Misconceptions relating to succession	
Without human intervention, old fields either remain largely barren or in a perpetual state of weedy growth	Brehm, Anderson, and DuBay (1986)
Soil decreases in fertility over time	Brehm, Anderson, and DuBay (1986)
Soil is fertile only if humans intervene	Brehm, Anderson, and DuBay (1986)

2.4.6. Environmental concepts of teaching and learning

Concepts are best understood in which they are used. For Environmental concepts to be properly understood by students to the point of application, it is eminent that teachers should devote their time to the teaching of environmental/ecological topics and all relevant avenues, opportunities and experience be provided to students to aid them learn the various concepts enshrined in ecology and to make use of concept learned to solve their problems.

Mallum and Haggai (2002) observed that to a lay man, education is the acquisition of understanding, attitudes, skills, values and attitudes through practice or encounter with the environment. Ango (2002) contributing further on this said that learning is a transformation in behavior of person regardless of the processes responsible for the change. This view about learning agrees with the view of psychologists as stated in Mallum and Haggai (2002) that the learning is a relatively permanent change in observable behavior that occurs as a result of experience. Nevertheless, from the behaviorist point of view, learning is an enduring change in observable behavior as a result of experience (Ango, 2003). Furthermore, cognitive theory of learning defines learning as change in individual mental structure that enhance the individual capacity to demonstrate change in behavior. Important points to note here is that learning is change and such change result from individual daily encounter or experience of novel situations around him and such experiences alter the mental structure and makes the learner to see things differently, hence, a relatively permanent change in behavior results.

Piaget and Inhelder (1969) discovered that many students found abstract subjects like science difficult to learn. The difficulty is believed to be associated with students intellectual development as Deboer (2005) has maintained that age plays an important role in the understanding of science concepts. This is to say at Senior Secondary level which is one of the emphases of this research work, argue that the child at this level should be operating at a higher cognitive level (formal operational stage) for easy comprehension of concepts in science.

2.4.7. The concept of education

The term “Educatum” denotes the act or process of imparting or acquiring particular knowledge or skills, as for a profession or the process of teaching or learning, especially in a school or college, or the knowledge that you get from this (Cambridge dictionary,2019). The overall objectives are make an individual conscious of his surroundings, to enable him takes conscious decision that will liberate him from ignorance. Education enables the learner to effect changes in his immediate environment if there is need to do so. He knows the advantages of every decision he takes and makes sure his decision is for the best interest of the society. An educated individual cannot take a decision that is at variance to the will of the people, he can take decision that will endanger the lives of people now and also for

the generation yet unborn hence education is the weapon that will liberate every nation from the shackles of ignorance and poverty.

People are enlightened when they are educated. Messages that will be put across to an educated population can be easily assimilated if such messages are for the overall interest of every one. For the campaign on sustainability to be effective, educating people must take a center stage hence the need to teach environmental education so that pupils will grow with the culture of sustaining the environment.

2.5. Cognitive Development and Concept Formation in Children

The learning of a particular concept matches with the development, thinking pattern and abilities of students. The Piagetian stage theory states that intellectual development takes place in four stages thus:

The sensory motor stage (0-2 years): Piaget (1969) suggests that infants are given birth to with a set of cognitive reflexes that allow them to explore their world, that their initial schemes are formed through the differentiation of the congenital reflexes. The sensory-motor stage according to Piaget, marked the development of relevant spatial abilities and understanding of the world occurring in six sub-stages

i. The reflex scheme stage
ii. Primary circular reaction phase
iii. Secondary circular reaction phase
iv. Coordination of secondary course round modest circular reaction
v. stage (object performance)
vi. The tertiary circular reaction phase (little scientist)
vii. Beginning of symbolic representation

Learning at the sensory-motor stage is said to begin right from birth or conception, at birth, a child can sense or perceive a concrete object from the immediate environment. For example, the presence of mother's breast, cold or warm environment. Duguryil, (2004) and Fellow (1994) opine that a child comes out of the mother's womb with inherent biological characteristics and the mental process by which a child is sensitive to the environment is referred to as perception.

The Pre-operational stage (2-7 years): At this stage, children are at the age of pre nursery/nursery school and primary school, here, the child is not capable of any mental operation but learn particularly by interacting with the physical environment

(Akinmade 2008). Piaget notes here that children at this stage represent image by word, they classify objects by a single feature for example, and they group red together regardless of shape, size and so on the child here, work by imitation and interaction mostly with concrete objects like stones, sticks, ball, clay, empty cans and the like. At this stage, they are very vibrant, active and restless. Atwater and Bonita (1990) stressed that emphasis should be laid on the student's intellectual growth. They further maintain that the thoughtful and resourceful usage of scientific abilities is based on the subjects' side by side intellectual growth. Hence, it becomes eminent that knowledge of the cognitive competence of the child enable educators to developed a developmentally based curriculum such that the content to the learned are at a student level of maturation which in turn promote meaningful learning and also concept formation and understanding.

The concrete operational stage (7-11 years): Piaget explain that at this stage, the child is characterized by several types of conservations, thus numbers, length, liquid, mass, weight area and volume. The child at this stage undergoes serration by sorting objects in order of size, shape colour gradient, identify set of objects can include another decentering by taking multiple aspect of a problem and solving them and reversibility that is the recognition that objects can change and return to their original state. That is to say that a child at this stages the child has a poor mental imagination because the child's reasoning skill is better with concrete objects than with abstractions (Akinmade, 2008).

The Formal Operational Stage (11 years and above): This stage is branded by the gaining of the capacity to reason more theoretically, and to arrive at conclusion from the data that has been gathered. At this level, young adults understand such things as 'love', shades of 'gray' logical proofs and values that is, according to Piaget. Following this view, the formal operational stage where the young adult is able to deal with more than the concrete objects. The child can reason logically about things that are out of view, but existing in the mind and he seeks to understand the abstract through seeing relationships about previous and new situation in the logical mind.

Davis (1998) suggested that all the formal operational level, children's formal reasoning is not well developed, however, they can give names to whatsoever concepts as well as give examples or not belonging to a set and also give the basis of such inclusion.

2.6. Environmental Education

The objective of natural instruction is 'to build up a total populace that knows about, and worried about the ecological and its related issues, and which has the information, abilities, inspirations and duty to work exclusively and all in all towards arrangements of current issues and the anticipation of new ones' (The Belgrade Charter, UNESCO, 1976). Ecological instruction depict the interrelationships among life forms, the earth and every one of the variables, which impact life on earth, including barometrical conditions, natural ways of life, the water cycle, and so forth. It is an essential science about our earth and its day by day exercises, and in this manner, this science is significant for everybody.

Environmental education enables learners to develop a structure of knowledge about the world and seek knowledge that they can use and develop throughout their lives. Environmental education empowers learners by enabling them to participate in a sustainable future. Thus, the foundation for a lifelong learning is laid by environmental education.

2.6.1 The development of environmental education

The first International Union of Conservation of Nature (IUCN) conference in Paris, held in 1948, was the first time that the term natural instruction was utilized (Emmelin, 1976). Nonetheless, it was not until the 1960s that the term started to acquire normal utilization. In 1970, at an IUCN meeting in Nevada, US, the official definition of natural training was authored (IUCN, 1970), however it was not until the late 1970s that the first global gatherings were held specifically regarding the matter of ecological instruction (UNESCO, 1970, 1972). In 1980 the World Conservation Strategy was propelled (IUCN et al, 1980), trailed by the Tbilisi Plus Ten Conference and The Brandt Report (UNESCO, 1989), all of which served to merge the worldwide standards of natural training set out the prior decade. The Brundt land Report was later amended into Caring for the Earth: A Strategy for Sustainable Living (IUCN et al., 1991), which was broadly viewed as an opportune commitment to the discussion on the definition of natural instruction, with its attention on interpreting thoughts and standards of maintainable living into commonsense actions(Palmer, 1998). The announcement of 2005 to 2014 as the Decade of Education for Sustainable Development proclaims another stage in the

nonstop advancement of ecological training and its backup, preservation instruction. This activity, for which UNESCO is the lead office, is a global instructive exertion that plans to empower changes in conduct that will make a progressively supportable future as far as natural honesty, financial reasonability and an only society for present and people in the future (UNESCO, 2006).

Ways to deal with ecological training have developed significantly from their common science base of the 1960s to a sociologies orientated point of view during the 1990s and present day (Sam and Okafor 2006). Initially, ecological training was viewed as basically nature studies and it was distinctly during the 1970s that natural examinations and protection instruction first rose. During the 1980s, the advancement of ecologically capable conduct turned into the essential objective of natural instruction (Hine et al (1987), with the goal that the wide title of ecological training presently included worldwide instruction, governmental issues and improvement considers. In the last 15 to 20 years this has been extended to fuse limit building and activity look into focused on the goals of financial issues (Sam and Okafor 2006). Essentially natural instruction has become training for conduct, individual and social change (Hine et al (1987)).

Nurudeen and Usman (2010) proposed the embodiment of ecological instruction that people should know the earth through training and present mindfulness and cognizance about the connection between abstract wants and needs and the earth, just as right and mirror the dispositions towards and estimation of the interest and use of regular habitat. Palmer (1998) explicitly clarified that ecological instruction was not just to equitably know the earth, however unbiasedly know and comprehend the connection between people's emotional wants and esteem and the earth just as know about and develop how to self-oblige and self-mirror the changeless connection between human endurance and living and common habitat. The need to secure the earth consequently the bases for natural training emerges because of the accompanying:

1. Condition is the premise of all life and accordingly merits appropriate consideration and the board.
2. On the off chance that the earth is undermined consistently, various issues which would comprise a risk to human presence could emerge.
3. The earth is a piece of our social legacy which ought to be passed on to thriving.
4. A few assets of the earth are not effectively replaceable and ought to be overseen on a supportable premise, to forestall the eradication of specific parts of the earth, for example, plants and creatures.

5. There is have to improve the rational soundness and tasteful nature of our condition so as to advance solid living.
6. The earth is a piece of nature and should be saved for the wellbeing of its own.

2.6.2. The goals of environmental education

The objectives for environmental education can be outlined as the accompanying:

1. A significant goal of environmental education in Nigeria as dug in National Policy on Education, NPE (2004) is the arrangement of the aptitude that can use logical information towards the protection and arrangement of natural issues. Information about the progressions that have adjusted nature - land, water, climate, and vegetation; social, social and world of politics are fundamental segments of ecological instruction. Thusly, the overall population ought to be outfitted with all these to have the option to take care of the issues of nature.

2. Nigeria's financial advancement (like some other less created nation) is immovably established on the misuse of the characteristic assets in our condition. Land, water, woods and other mineral assets use is the predominant aspect of rustic economy with agribusiness the main thrust. Uncontrolled and inappropriate abuse of these assets has suggestions on nature causing interruption in the expectation for everyday comforts, starvation, dislodging and human affliction. Ecological Education is in this way important to make consciousness of the circumstances and end results of these issues tight clamp: nourishment and water shortage, contamination, flare-up of scourges and catastrophic event, for example, flood, disintegration and desert infringement.

3. Natural training is expected to encourage universal co-activity and comprehension. The created nations depend on the high innovation for the misuse of characteristic assets while creating nations like Nigeria thoroughly rely upon Petroleum, in this way prompting escalated and over-abuse of the normal assets and these have genuine ramifications on the assets.

4. Open edification on the effect of government strategies on neighbourhood condition ought to be helpful both to the legislature and the nearby individuals.

5. Attention to such worldwide natural issues is a basic part of ecological instruction which conventional resident ought to know about.

6. Natural instruction for the general social and monetary liberation of ladies and kids. These structure a generous rate in the use of regular assets particularly at the provincial setting.

7. Ecological instruction is additionally extremely basic for our endurance on earth. The regular assets and social legacy should be ensured for this age as well as for group of people yet to come.

2.6.3. Objectives of environmental education in school

2.6.3.1. Objectives of environmental education at primary level

As indicated by the National Policy on Education's by-law in Nigeria the goals of environmental education at primary level is characterized as beneath (2004):

(a) To know and see genuine parts of the earth when all is said in done.

(b) To know and comprehend the collaboration between warm blooded creatures, among human and their condition and connection between the different components and parts of the earth.

(c) Build getting, mindfulness and affectability towards causes and endeavours of the class that constantly happen in the public eye and our general surroundings.

(d) To assemble and create aptitudes in deduction, thinking, enquiring, assessing and settling on choices concerning human and their general surroundings.

(e) Inculcate the frame of mind in utilizing the information and abilities towards taking care of issue and issues identified with people, society and nature.

(f) To fabricate the qualities and dispositions towards the need and need to live respectively in congruity with regards to the heterogeneous society.

2.6.3.2. Objectives of environmental education at secondary level

Natural training to be instructed as incorporated science in which ecological instruction ideas are incorporated.

(a). To accentuate the significance of science to everyday life.

(b). To build up a logical frame of mind in understudy.

(c). To familiarize the understudy's with different regular marvels.

(d). To build up a standpoint which underscores the strategy utilized in various orders of science.

2.6.3.4. Parts of environmental education underscored at adult or tertiary level

(a) Population - development, emerges and issues of spontaneous populace.

(b) Law - Land use, land recovery and land and soil preservation.

(c) Resources - asset utilizes, protection, reusing.

(d) Food and Nutrition - Food generation, nourishment corruption and conservation, balance diet and so on.

(e) Conservation - Causes of untamed life, plant, soil, water and preservation of other non-sustainable common magnificence.

(f) Pollution - Pollution of water, air and soil, commotion contamination, contamination by bug spray and different synthetics and waste transfers.

(g) Health and Hygiene - Individual, family, nation and social wellbeing and cleanliness, wellbeing dangers and so forth.

(h) Humans and Nature - Other mixes of air, ecological quality and future on earth.

2.6.3.5. Requirements to executing ecological training

(1). Unbending Specialization.

(2). Unpredictability of between disciplinary estimation of Environmental training.

(3). High student - educator proportion for arranging understudy interest programs.

(4). Lack of qualified prepared ecological teacher.

(5). Absence of legitimate assets as far as gear, strengthening materials and reference materials.

(6). Inclination to oppose changes.

2.6.4. Environmental adult education (EAE)

Environmental adult education (EAE) integrates eco-friendly education and adult education theory to deliver a realistic and significant educative understandings to beginners (both students and adults) aiming towards getting the desired ecological transformation.

Palmer (1998) recognizes environmental adult education as a more effective way to solve environmental problems. He identifies the formal, financially supported

university environment as a good venue for environmental adult education, but also argues that non-formal programs are possible within organizations. This early work stresses that environmental adult education must be taught effectively to make a true impact. Also, the author notes that EAE can be both non-formal and formal.

A major contribution to environmental adult education research in the 1980s involved a case study of seven ecologically minded adults. Finger (1989) revealed that environmental adult education must be an adult transformation in order to have a true impact. Another trend during this period is that authors place environmental problems in a global context, and educators note that learners need tools to bring local issues to the global stage. Without that connection, practitioners assert, learning is far less comprehensive because it fails to communicate the urgency and scope of global environmental degradation. Scholars emphasize humans and their relationship to the Earth during the teaching and learning process in order to bring the global context into the process (Nickerson, 1992; Mische, 1992). The first mention of the environmental inequalities between wealthy and poor nations appears in the early 1990s, and environmental adult educators are encouraged to address those inequalities in their teaching (Mische, 1992; Viezzer, 1992).

Environmental adult educators use indigenous education theory as a foundation for Environmental Adult Education because it emphasizes connections to the Earth as a framework for pedagogy. Indigenous theory stresses a deep connection to the Earth, and considers nature a teacher and spiritual guide. During the 2000s, environmental adult educators encourage learners to engage in dialogue to find answers to their problems, and identify the causes of those problems. Environmental Adult Education is defined not as top-down, monological learning, but rather as a dialogical, community based approach to finding answers for environmental problems (Butterworth and Fisher, 2002; Clover, 2002b; Belanger, 2003). Literature during this period considers environmental problems as an outgrowth of social, political, economic, and cultural issues (UNESCO, 1989), and ignoring these issues in environmental teaching and learning is irresponsible.

Significant contributions during this period identify Environmental Adult Education as transformation, and link Environmental Adult Education to experiential learning and social movements. In the early twenty-first century, environmental adult educators enforce the notion that EAE should move away from the knowledge acquisition model, and suggest including transformation as a key element.

In summary, while environmental knowledge contributes to EAE, it must be a transformative, inclusive process to be truly effective (Finger, 1989; Clover, 2002b). Furthermore, environmentalism is not just taught or learned, but is a way of living and being (Mische, 1992). Teachers use nature to remind learners (students and adults) of their connections to the Earth and to help them appreciate natural wonders through experience with them (Clover, 1997).

2.7. Education System in Nigeria

Instructive arrangement in Nigeria has gone through two critical stages, the pioneer and post-freedom periods. Prior to the appearance of our British provincial ace, the nation was separated into northern and western parts containing chiefdoms, realms and domains, while in the focal parts their exist chiefdoms so likewise in the southern part, these chiefdoms have a similarity to semi-independent networks. In the northern parts, Islam was profoundly settled in both in the strict conviction and instructive direction of the individuals who had a uniform Qur'anic training strategy (Ozigi and Ocho, 1981). In the southern parts, Christianity and conventional religion was settled in their strict convictions and instructive direction The educational programs which is casual involves building up the youngster's physical aptitude, character, scholarly abilities and feeling of having a place with the network just as teaching regard for seniors, and giving explicit professional preparing and the comprehension and valuation for the network's social legacy (Fafunwa, 2004). This was the idea of the unstructured instructive framework before the appearance of the Christian teachers in 1842. They got through the waterfront territory of Nigeria and presented the present western instruction whose sole point was to empower individuals perused the Bible in English Language and furthermore to prepare priests, catechist, and school ace. The evangelists likewise train local people on farming and planting. Ozigi and Ocho (1981) noticed that despite the fact that the Christian teachers' significant goals of building up schools were the engendering of their confidence, their most noteworthy heritage which stood the trial of time was their instructive work and the advancement of nearby dialects into composing.

Be that as it may, in 1914, the amalgamation of the Northern and Southern protectorates occurred. This amalgamation brought individuals of various confidence and ethnic gatherings together as one indissoluble nation prompting a pluralistic

culture that required the reception of a government structure for Nigeria. Additionally, the then British strategy of roundabout guideline restricted crafted by the Christian evangelists in the predominately Muslim Northern protectorate in this manner, diminishing the spread of Christianity and western training (Fagbumi, 2005), along these lines making a major instructive hole between the northern and the southern pieces of the nation. Likewise when allows in help were given to Christian missions and wilful offices' schools, the Qur'anic schools were not given in light of their particular educational program (Imam, 2003). The pioneer government progressed in the direction of getting individuals among the locals who will bear the duty of giving western training especially first in the Northern piece of the nation. In this game plan, three types of instruction: Qur'anic, conventional and western training existed together next to each other with the north and south each having an alternate pace of advancement as far as western instructive fulfilment. This was the situation by 1944 which proclaimed the approach of globalization in the post Second World War period that harmonized with the procedures of majority rule change and national freedom from imperialism. From that point forward, the instructive strategy in Nigeria was formed towards financial, political and national advancement contemplations.

2.7.1. Historical development of secondary school in Nigeria

The historical development of Nigeria's education system has been described by Igbuzor (2006), as an aspect of the march to the nationhood. By 1843, the date of the establishment of the first formal school in Nigeria (Badagry) in Lagos state, the British rule in Nigeria was at its infancy. In essence, colonial rule was yet to plant itself firmly in the area now known as Nigeria and while British colonial officers were busy consolidating British presence in Nigeria, it was neither economical nor was it in the interest of the British to change into the establishment of educational institutions.

Before 1859, Nigerians who needed to acquire post primary education had to travel outside the country for that purpose. The credit for providing such opportunities in fact goes to Henry Venn who through his Native Agency Commission founded and funded with the help of his public spirited friends, some technical/industrial training for those Nigerians selected. Among the early beneficiaries of this programmed were T.B Macauley (CMS Training College

Islington), Samuel Crowther (Kings College London); Henry Febbin and Josiah Crowther (attached to Thomas Clegg factory), Josiah Brown and Alfred Lewis (CMS Grammar school, Freetown) and host of others. Therefore the quest for more and more education whether at home or abroad by Nigerians is not just a 21st century phenomenon (Fagbumu, 2005). With explicit reference to optional schools in Nigeria, the consistently developing extent of offspring of school age that raged the accessible elementary schools made an impression and incredible energy in the evangelists and the provincial government that there were requirements for secondary training

The first Grammar school established by CMS in 1859 (Abdullahi, 2005). After a successful take-off of CMS school in 1859; other earliest and reputable educational institutions were established and managed by private organizations (most especially religious body) among them were CMS Girls' Grammar school in 1872, St Gregory College Obalande in 1876, Methodist Boys' High school in 1878, Methodist Girls' High school in 1879, Baptist Academy Lagos 1885, Igbobi College Yaba, 1932; Hope Wadel Training Istitute Calabar in 1895, Eko Boys' High school 1913, Anwarul-Islam college,Agege; formerly Ahmaddiya College in 1948, Asar-udddeen College, Isolo, 1958; and Ansar-ud-deen Grammar School, Surulere, 1958. Therefore, many years, the business of opening schools was the preclusive area of the Christian missions. In this sense, it could be conveniently claimed that what has grown to be the Nigerian educational system began as a private venture by bodies that drew their funding and management personnel's from outside the country (Khalid, 2003).

The earliest attempt made by the colonial government between 1870 and 1876, to assist schools in Lagos was referred to as "spasmodic" (Fafunwa, 1974:93). According to Adetoro (2005), these were the first signs of colonial interest in Nigerian education. By the end of 1912, there had been established 51 government Primary schools and 91 mission schools receiving aid from the government. The count of schools on the other hand, also show a preponderance of private mission schools, a private African initiative and one government secondary school, that is, Kings College, (Ndiomo, 2007). According to Abdullahi (2005), endeavours were made in 1883 by the frontier government to take-over from every one of the missions their optional instruction foundations, leaving with just essential training. This endeavour was opposed and at last dismissed, making the improvement of auxiliary

instruction a tripartite exertion by frontier government, private associations and people.

In northern Nigeria, the district was separated based on religion in dominatingly Muslim territory, the Muslims felt and emphatically too that western training was the way to Whites labor or else they become Christians and acknowledge the school as a movement of the congregation. With this conviction, western instruction was eagerly opposed; optional training advancement here was basically by provincial government. The Provincials' schools in Kano, Sokoto and Katsina the same were in every one of the twelve Northern regions with a normal participation of 733 understudies. With this measure confined development of schools under cautious supervision was sought after. In the Christian commanded region, evangelists take an interest effectively in the foundation and organization of optional schools. In 1916, there were 58 Mission schools with a normal of 913 understudies in participation (Abdullahi, 2005)

Protectorate, Lord Lugard proposed three sorts of optional training with the point of adjusting the requirement for instruction of the kids in the two protectorates to the labor needs. The schools were provincials' schools, the rustic and non-administrative schools. The inhabitant and the central boss in the region where these schools were found were to aid the supervisions of the schools. The contestant was between 12-14 years old. Between 1919 and 1940 there was substantial growth in secondary education which was mostly by the Phelps-stoke Commission Report on education in Africa. By 1926, government has 56 elementary schools and one secondary school in Nigeria (Nwagwu, 2007). By the years also, it has attached training department to the three existing mission secondary schools. There were 192 voluntary agency elementary schools on the assisted list, 3,578 voluntary non-assisted elementary schools, 17 voluntary secondary schools and 9 voluntary agency teachers training colleges. According to Odukoya (2009), the ever-growing enthusiasm for education was such that when owing to the financial difficulties arising from the great economic depression, the government was force to cut down expenditure on schools; the number of primary and secondary as well as their enrolment continued to increase. In 1929, government built two secondary schools, one in Umuahia and the other one in Ibadan. Igbobi College was built by the CMS and the Methodist missions. The Roman Catholic mission founded the Igbo Boys Institute Uzuakoli in 1923. The CMS mission founded the Dennis Memorial

Grammar school Onitsha; in 1925 the Baptist mission founded the Baptist. Boys' school Abeokuta in 1923 and other missions founded several schools.

During the period 1926-1950, Nigerians became extremely important factor in the spread of western education. Among the forces that contributed to spread of education partially at the secondary school level were 'tribal unions' which begin to make their influence felt after 1930 (Fafunwa, 2004). Accordingly, the tribal unions in the towns like Calabar and Lagos place the promotion of education among their members high in their list of worthwhile activities. It was meant to promote education among people of particular ethnic groups that led to the foundation of the Ibibio state college, Ikot Ekpeme in 1946; Urhobo College Efferum in 1949, Egbado College,Ilaro in 1950 and Igbo state College Aba in 1952 (Odukoya, 2009).

The belief in education as a factor of unlimited usefulness was shared by all the members of the Nigerian elite of the periods 1930-1950. They therefore work to realize the dream of converting fellow Nigerians into an educated population. One of the ways in which they wanted to achieve the objective was by the establishment of new secondary schools. Example of such schools established by the members of the elite groups includes: Ennitoma High school Port Harcourt, founded by Rev L.R Potts Johnson in 1932, Aggrey Memorial College Arochukwu, founded by Alvan Ikoku in 1933, Ogbomosho People's Institute Calabar founded by Eyo Eta in 1938, and Ibadan Boys' High school, Ibadan founded by O.L Oyesina in 1938; as time went on many of such schools were established such as: New African College Onitsha founded in 1943, Western Boys' High school Benin-city, founded in 1947;Okpe Grammar school Sapele, founded in 1941; Zik's Academy Sapele founded in 1943; Christ High school Lagos founded in 1934; New Era Girls' secondary Surulere, founded in 1948 and several others. According to Abdullahi (2005), before 1951, Richard's 1948 composition had separated the country into western, eastern and northern provinces.

The Macpherson's constitution of 1951 further given that every district should have an authoritative arm veto capacity to order enactment, viable inside the limit of the area on the scope of subject which training is one. The arrangement achieved a division of the instruction office into three parallel offices, one in every area under a local chief. In the southern locale (west and east), auxiliary training was of five years term and optional school confirmation assessment was taken in class five (Fafunwa, 2004). In the northern area, there was six years auxiliary instruction (structure 1-6)

and the optional educational program was guided by the prerequisite for the school affirmation assessment (Cambridge or Oxford local people). Specialized instruction was still busy early stages arrange. In western district during the period, Universal Primary Education program was broadcasted and this affected the development of optional instruction. By 1959 there were 420 current schools, 138 Grammar schools and 97 instructors preparing school in the district (Abdullahi, 2005).

The equivalent instructive development was obvious in the eastern locale. In any case, before the program was at long last deserted, it had impacted to an enormous degree the pace of development in auxiliary training in the locale. In the Northern district, the pace of western instruction was exceptionally delayed because of the social and strict components. It development was along these lines, attached to the accessibility of educators and the degree of the requirement for western testament work force. Instruction was free in most government and Native Authority schools Nurudeen and Usman, 2010). Indeed, even in deliberate office schools, grants were given by the Native Authority to those unfit to pay their school expenses. By 1958, there were 31 optional schools and 36 educators preparing College in the district. Optional school's enrolment expanded from 3,904 out of 1956 to 4,804 of every 1959.

The decade 1960-1970 saw a quick extension in auxiliary training in Nigeria, due to the affected of the Ashby Commission Reports in 1960 called "interest in instruction". Whatever progress that was recorded, the military takeover of the administration in January 1966 in the end finished into a common war had untold negative effect on the advancement of training in the country. After the war and the military having disappointed the white collar class by ending the popularity based government in Nigeria, instruction turned into a topical issue in the national talk and this prompted the national strategy on training (Fafunwa, 2004). In the interim, the areas had been partitioned into states in 1966 and like in the period of regionalism, optional instruction was on the leftover rundown; the ramifications of this is, each state authorized her instructive laws as per auxiliary instructive requests. In any case, as a method for encouraging national solidarity, the Federal government set up solidarity schools called Federal Government Colleges, one in each state in which youth everywhere throughout the country overwhelmingly went after confirmation through a broadly controlled regular placement test (Abdullahi, 2005).

While trying to utilized instruction to assist all residents in Nigeria, regarding its importance to the requirements of the individual and the longing of the general public, the government in 1973 brought a meeting of recognized instructive specialists under the chairmanship of SO Adebo to consider on all part of the national arrangement on training. The arrangement was first distributed in 1977 and updated in 1981, third version in 1998 and fourth release in 2004 (FRN, 2004).The broad goals of secondary education as contained in section 5, sub-section 20 of the policy (NPE, 2004) was:

I. To prepare the individual for a useful living within the society.

II. To prepare the individual for higher education.

Government thusly, arranged optional training for a long time span in two phases; junior auxiliary instruction and senior auxiliary training, every one of the three years term. According to the NPE (2004), junior secondary education shall be pre-vocational and academic. It shall be tuition free, universal and compulsory. It shall teach basic subjects which will enable students to acquire further knowledge and skills. Abdullahi (2005) posited that understudies or students who leave school at the middle school stage may then go into an apprenticeship framework or some other plan for out-of-school professional preparing.

The senior optional school will be exhaustive with central subjects configuration to expand understudies' information and out-look (NPE, 2004).Government also welcome the participation of voluntary agencies, communities and private individuals in the establishment and management of secondary schools. Likewise state government shall prescribe minimum condition to be met by the communities and individuals' wishing to establish secondary school. Government shall regulates the establishment of schools, supervised and inspect schools regularly and ensure that all schools followed approved curricula and conform to the policy on education (NPE, 2004).

2.7.2. Nigerian curriculum in secondary schools

The word curriculum was authored from the Latin word "currere" signifying "race course", alluding to the course of deeds and encounters through which youngsters develop to become full grown-ups (Collins English Dictionary, 2003). An educational plan is prescriptive and depends on an increasingly broad prospectus, which just indicate what themes must be comprehended, and to what level to

accomplish a specific level or standard. That is, an educational program might be alluded to as all courses offered at a school. As indicated by Kelly (2003), "Educational program is all the realizing which is arranged and guided by the school, regardless of whether it is done in gatherings or separately, inside or outside the school". Moreover, educational plan depict in explicit terms what we will in general accomplish and how we can approach accomplishing it.

Nigeria is a sovereign nation in West Africa; it has the number of inhabitants in 150m (Census, 2006). The instructive arrangement is shared between the three arms of government, the federal, state and local government. The Federal Ministry of Education controls and guarantees its quality. The nation has requires nine years of necessary training , the initial six years of essential and the following three years of junior optional. The Primary school is educational cost free, and its objective is understudy proficiency. For an understudy to progress to the lesser school, he/she should sit for the lesser auxiliary school declaration assessment in elementary school. To advance to the senior secondary school, students are required to sit for the examination that will lead them to senior secondary school.

The senior secondary school offers both academic and vocational courses. On completion of the Senior Secondary School, students are expected to sit for the Senior Secondary School Examination in order to obtain the Senior Secondary School Certificate. This certificate will enable a student sit for the Joint Admission Matriculation Examination (JAMB) where he/she will be admitted to a University or any higher institution of learning depending on what he/she wants to study. Students are expected to have a credit in English language and Mathematics and any other three subjects in other to be admitted in a higher institution.

2.7.3. The nature and structure of biology curriculum

A look at the conceptual structure of the National Curriculum for Senior School Biology (2009) as it affects Senior Secondary School I-III, has the following major themes:

i. Organization of life
ii. The organism at work
iii. The organism and its environment
iv. Continuity of life
v. Organization of life

vi. The organism at work

vii. The organism and its environment

viii. The organism at work

ix. The organism and its environment

x. Continuity of life

Table 2. Environmental/ecological themes in biology textbook

Major Topics		Content
Classification of plants	1.	Botanical classification
	2.	Agricultural Classification
	3.	Plants classified on the span of their Life cycles: Annual, Biennials and Perennials
Transport System	1.	Define Diffusion and Osmosis
	2.	Materials for Transportation
Nutrient Cycle in Nature	1.	Carbon and Oxygen Cycles
	2.	Water cycle
	3.	Nitrogen cycle
	4.	Decomposition in nature
Ecological Management	1.	Types of Association: Symbiosis-
	2.	Symbiosis Mutual benefits;
	3.	Parasitism Harmful to host
	4.	Mutualism Beneficial to both
	5.	Features of Biological importance
Tolerance	1.	Concepts of min and max range of tolerance
Adaptation	1.	Adaptation in form and function of Living organisms due to environmental conditions
	2.	Effects of availability of water on adaptive Modifications. (i) Structural adaptation of Tadpoles and fish to life in water (ii)Structural adaptation of birds
Pollution	1	Pollution of the atmosphere (i)Nature, names and sources of air pollutants (ii)Effects of air pollutants (iii)Effects of noise Pollution
	2	Pollution of Water and Soil (i)Types and composition of pollutants (ii)Side effects
Regulation of Internal Environment	1.	Homeostatic organs; substances Involved In homeostatic- the kidney, liver.
Ecology of population	1.	Causes and effects of food shortages on the size of a population
	2.	factors affecting population
	3.	Dynamic equilibrium or balance in nature
	4.	Family planning

Each major topic has been broken down into subtopics or varied areas to be handle at three levels of senior secondary school based on the degree of complexity of the topics. The aim is to enable students learned contents appropriate with their cognitive level of maturation. Nevertheless, since the researcher is working on students and adult's level of understanding of some environmental concepts, he deemed it necessary to highlight the major areas covered in the teaching of environment particularly in senior secondary which is the area for discussion for this research work as outlined in the themes in Table 2.

The nature and curriculum of biology content on environment is seen to involve this area of ecology as drawn out by the researcher. But the question is how many students and the adult population could truly demonstrate knowledge to application level as an evident to the fact that they have understood these concepts?

2.7.4. Environmental education in Nigeria

Environmental education, though relatively new and still developing has indeed came to stay in Nigeria, and can only get better as the years go by. In the 1980s Environmental education was only taught at the tertiary levels of education, but from 1990 to date, environmental studies have been incorporated into several school subjects from primary up to secondary school levels. The need for environmental education cannot be over emphasised especially in the developing world like Nigeria. Scope of Environmental Education for elementary and primary school levels as compiled by the Nigerian Education Research and Development Council NERDC (2015) is focused under three theme, thus: • Human condition/Development

• Environmental change/sway

• Sustainable improvement

As per the educational program, the methodology considers goals inside a topic to be consolidated into existing school subject both at the essential and auxiliary schools. Fuse of ecological instruction into the current elementary school subjects implies that pertinent points and issues inside each topic are organized into execution destinations, content, student's exercises, showing materials and assessment rules and is deliberately fused into six grade school subjects for proper usage. These are:

• Environmental instruction through essential science

- Environmental instruction through social examinations
- Environmental training through essential science
- Environmental training through English language
- Environmental training through Islamic Religious examinations
- Environmental training through Christian Religious Studies.

This joining of Environmental Education into the school educational plan brought a great deal of concern and stresses from the instructors, who took a gander at the mix as over-burdening of the educational program that has just been stacked. A definitive want of ecological researchers, instructors, Non-State Actors and different associations, is to have natural training educated/contemplated as its very own subject simply like Biology, Mathematics, Geography, Physics Agriculture and so on perhaps from the Universal Basic Education to the senior optional level and past. This, whenever done will bring the much discussed mindfulness and abridge the manner in which nature is being misused by one and all.

2.8. Summary of the Relevant Literature

Environmental problems discussed in the literature include: Pollution, Climate Change, Global Warming, Deforestation, Over Population, Industrial and Household wastes, Acid Rain, Ozone Layer Depletion, Genetic Engineering, Urban Sprawl, Mining, Nanotechnology and future effects of Nano pollution / Nano Toxicology. Also, based on the literature reviewed so far, it is evident that students over the years had difficulty in answering questions that deals with environmental terms (Mang,2009), this is associated with poor understanding of ecological and environmental concepts, hence low performance each time the school certificate result is released (Ajewode and Okebukola 2010). Chief examiners report, 2013,2014,2015,2016 revealed that environmental concepts are aspect of biology that are not well taught (Ogunsola, 2012) and also often skipped by teachers in an attempt to rush and cover syllabus (Balogun, 2016). In fact, the review also revealed that wrong pedagogy is employed in teaching, teachers are incompetent, students lack practical field experience and attitude of both teachers and students to field practical were identified to constitute problems to environmental teaching particularly when it comes to understanding of environmental concepts.

Educators frequently are astounded to discover that in spite of their earnest attempts, understudies don't get a handle on central thoughts canvassed in class. Indeed, even the absolute best understudies offer the correct responses however are just utilizing accurately remembered words. At the point when addressed all the more intently, these understudies uncovered their inability to see completely the hidden ecological ideas. Hardly any understudies are frequently ready to utilize natural ideas to take care of issues related with a spotless situation without totally understanding the fundamental logical idea.

Other than offering understudy's data and accommodating models, we should show them the thinking forms that lead to reasonable speculations. Incorporation of reasonable inquiries and early stamping of tests and assignments are another approach to underscore the significance of this part of critical thinking (Okeke and Ochuba, 1986). Okebukola (2002), placed that understudies in his science class had remembered conditions and critical thinking abilities, yet performed ineffectively on trial of applied comprehension. Furthermore, the FRN (2006) and Ojeride (2014) also said; the complexity of the environment, imbalance between content and skills, the reputable nature of environmental courses, lack of manpower, preparation for field practical in ecology and the periodicity of ecology had all posed serious problems to the effective teaching and learning of environmental concepts.

Mukirest (2014) said that despite government effort to bridge input and output, lots of misconceptions on science concepts leading to students performing poorly in questions related to environmental topics, the trends keep growing by the day. Infrastructure deficit is another constrain that is threatening the effective management of environmental related problems. He also emphasis environmental adult education programs for the adult folks in order to keep them aware of the challenges posed by environmental degradation.

Ajewode and Okebukola (2010) corroborated the assertion that students poor grasps of basic terms and concepts in environmental topics leads to poor performance in schools and this also reflect on the way we manage environmental issues in the environment, we demonstrate lukewarm attitude in conserving our natural resources and these have led to the extinction of many plants and animals. People are not conscious of the pending catastrophe that awaits us if we fail to cater for the living and non-living organisms found in the environment. They emphasis attitudinal change by all and sundry in order to cope with the environmental

challenges. Beforehand misconceptions can be rectified, they ought to be recognised (Zoller, 1990).

To overcome such misconceptions, ways suggested by students and adults as solutions were more practical and prompt evaluation simple and use of teaching aid (UTA) and more time for questioning as shown in Appendix IV. Supporting these suggestions given by the students, Cohen et al (2001) and Hersback (1995) opine that teachers can ask student open ended and probing question and also spend more time on exploration and artistic excursion that provoke critical thinking. Additionally, small group discussions and office hours provide effective forums for identifying student misconceptions. With practice and effort, a teacher can learn to probe a student's conceptual framework (often by simply listening) without resorting to authority or embarrassing the student

The question one would tend to asked is what could be responsible for this persistence low performance in environmental items? Is it true that students do not understand the dangers posed by mismanaging the natural resources we have on earth? Could it be true that they are not aware of environmental problems? Could it be true that teaching method employed by teachers as noted in the review was responsible for the low performance and lack of proper care for the environment? Could it be true that the problem lies with the teachers and the students? And what could be responsible for such lack of understanding? Considering the literatures reviewed so far, not much has been done in probing the understanding of students and adults in some selected environmental concepts with the aim of ascertaining the extent of their understanding and performance on such concepts. In the analysis of misunderstood environmental concepts among students and adults, there is no known literature that has an input, this research sought to fill such gap.

CHAPTER III
RESEARCH METHODOLOGY

Research technique has been described as an orderly and target means of assembling, recording and breaking down pieces of information to resolve issues (Bless and Higson, 1995; Babbie, 2001). Furthermore, Bailey (1982) characterizes investigation as an efficient and sorted out exertion to research a particular issue that requires an arrangement. In a lot of researches, there is a presumption that the specialist needs to discover or make a unique commitment to a wonder or something new.

This chapter discussed the research design, population and study sampling technique, instruments for data collection, data analysis, scoring of the instrument reliability validity of the instruments, administration of the research instruments and ethical considerations. The exploration worldwide received in the investigation is talked about. The strategies adopted looks to diagram and clarifies the connection between students and adults and how they understood or misunderstood environmental concepts. As indicated by Cohen, Marion and Morrison (2001), the point of the strategy is to assist specialists with understanding the procedures and the results of the examination. The part finishes up by tending to the moral issues that were considered in the examination.

3.1. Design of the Study

Polit and Hungler (1999) portray the examination structure as a diagram, or framework, for directing the investigation so that greatest control will be practiced over elements that could meddle with the legitimacy of the exploration results. The exploration configuration is the specialist's general arrangement for acquiring answers to the examination addresses controlling the investigation. Consumes and Grove (2001) expressed that structuring an examination causes specialists to plan and actualize the investigation such that will assist them with getting the expected outcomes, consequently expanding the odds of acquiring data that could be related with the genuine circumstance. The design of a research topic is used to explain the type of research (experimental, survey, correlational, semi-experimental, review) and

also its sub-type, experimental design, research problem, descriptive case-study (Adi, 2019).

In this study, mixed method (containing both types of variables) was used; these are qualitative and quantitative research methods. In the study, comparative design was used. Comparative design essentially compares two groups in an attempt to draw a conclusion about them (Susan, 2011). Researchers attempt to identify and analyse similarities and differences between groups. In this study, the two groups that were compared are students and adults. Also, in this study, data were collected firstly with a survey. Samples were selected from a population of study on the basis of randomization for the purpose of discovering the level of understanding of students and adults on the variables to be studied. Survey research is defined as "the collection of information from a sample of individuals through their responses to questions" (Check & Schutt, 2012). Qualitative research contains factors that depict characteristics of the objects of intrigue (Adi, 2019). These qualities are called classifications, likewise alluded as levels or modalities. The sexual orientation of a new-born child is a case of a subjective variable.

Questionnaires were distributed through direct contact with individuals, the duration for the questionnaire to filled is 1 ½ hours as shown in Appendix II. The researcher waited and collected the filled questionnaires. Interviews were conducted by the researcher on one - on - one basis for 60 minutes and it was also audio recorded.. Qualitative data assortment strategies shift utilizing unstructured or semi-organized systems. Some normal techniques incorporate centre gatherings (bunch talks), singular meetings, and investment/perceptions. The example size is normally little, and respondents are chosen to satisfy a given share (Adi, 2019).

According to Patton, (1980), qualitative research has the following characteristics:

- Qualitative research is concerned with "why"
- Qualitative research is a push to comprehend circumstances in their uniqueness as a component of a specific setting and the cooperation there.
- All types of subjective research is that the analyst is the essential instrument for information assortment and investigation.
- A subjective research is that is utilizes an inductive research procedure. This sort of research manufactures deliberations, ideas, speculation, or hypotheses as opposed to tests existing hypothesis. Quantitative research contains

factors that depict amounts of the objects of intrigue (Adi, 2019). The qualities are numbers. The heaviness of a newborn child is a case of a quantitative variable. Quantitative research technique is utilized to measure the issue by method for creating numerical information or information that can be changed into usable insights. Measurable apparatuses utilized for calculation in this investigation incorporate, rates, mean, middle, standard deviation, difference, t-test. Information are utilized to measure mentalities, suppositions, practices, and other characterized factors – and sum up results from a bigger example populace (Susan, 2011). Quantitative Research utilizes quantifiable information to define realities and reveal designs in look into. Quantitative information assortment techniques are considerably more organized than Qualitative information assortment strategies. The information assortment strategies incorporate different types of studies – online overviews, paper reviews, versatile studies and stand studies, eye to eye interviews, phone interviews, longitudinal examinations, site interceptors, online surveys, and precise perceptions (Adi, 2019).

The quantitative section of this study, numeric information were gathered and measurably dissected about students and adults. As posited by Cresswell (2003), that a scientist utilizing the quantitative strategy utilizes a post positivist way to deal with learning. The investigation in this way pursues a quantitative strategy and additionally a study and a relationship explore configuration utilizing a positive worldview. It answers the “how many” questions and provides results that can be projected onto a broader population.

The quantitative technique will generally control with the sole aim of actualizing and comprehending a target population looking to direct understanding to give significant information (Laws and McLend, 2004). It is a kind of instructive study that depends on gathering of information exposed to quantitative investigation. Simply put, it can be refer to as a method for testing objective speculations by inspecting the relationship among variables (Creswel, 2009; Johnson and Onwuegbuzie, 2004). It is said that the scientist in quantitative research chooses what to contemplate, tight inquiries, and gathers quantifiable information from members’ investigation utilizing insights like finding the combined recurrence, the mean, median and mode (Creswell, 2008). According to Burns & Grove (1997) quantitative research has the following characteristics:

- Quantitative research is concerned with "what"

- There is a solitary reality that can be characterized via cautious estimation.
- It is generally compact.
- It depicts, looks at connections, and causality among factors, where conceivable.
- Statistical investigation is led to decrease and sort out information, decide noteworthy connections and distinguish contrasts or potentially similitudes inside and between various classes of information.
- The test should be illustrative of an enormous populace.
- Reliability and legitimacy of the instruments are significant.
- Comprehensive information gathered by utilizing various strategies and additionally instruments should bring about a total depiction of the variable or the populace considered.
- It gives an exact record of qualities of specific people, circumstances, or gatherings.

3.1.1. Research worldview

From a positivist worldview, the presumptions depend on the social world, which can be considered almost the same as the regular world. Reichard and Rallis (1994) posited that this kind of positivist was ruined before the World War II and was supplanted by post-positivism. In early positivist thinking, the analyst and the subject of the examiner were believed to be autonomous (Lincoln and Guba, 2000). The positivist worldview, beginning from the edification perspectives of Comte and Spencer (Turner, 2003), created in the nineteenth century in the wake of the achievement of physical sciences in propelling our comprehension of the world (Benton and Craib, 2011).

The positivist believes is that the method of characteristics of sciences could be related in the social world (Evans and King, 1991; Yates, 2004). Positivist are of the believed that the structures that make the realistic request in public activity can be found and examined in indistinguishable target path from the regular world. The method is observational such that it demonstrates something really exists through perceptions to definite information.

3.2. Sample of the Study

Seaberg (1988) described population as the aggregate set from which the people or on the other hand units of the investigation are picked. As for Polit and Hungler (1999), they posited that population denotes a total number of items, themes or individuals that adjust to an arrangement of particulars. Monyatsi (2002) further described population in a research as a discrete gathering of units of investigation, for example, associations or schools. This is the reason most schools are picked as tests for the examination rather than instructive organisations.

The study took place in Plateau State Central, Nigeria. The research centred on students in a biology class and adults who are in the school and have also learned and being taught biological courses. From these viewpoints, it can be said that the target population in this study is referring to 150 students below ages of 18 years and 150 adults above the ages of 18 years. A research population is the total target group who would be subjects of the study and about whom the researcher is trying to say something (Punch, 2009). Eligibility criteria requires respondent to be in senior secondary school and must have read biology or is presently reading biology as a course, this specify the characteristics that people in the population must possess in order to be included in the study (Polit& Hungler 1999:278).

3.2.1. Sampling technique

As indicated by Vockeli and Asher (1995), sampling denotes procedures which empower the specialist to choose a subclass as a research for creating derivatives about the bigger gathering. The researchers used the table of random numbers to sample the schools. A sampling frame of 258 approved schools within the study area was obtained and numbered serially from 001-258. A two digit column table of random number was used to draw ten schools from the sampling frame. The table of random numbers was entered at some random starting point on the table. A pen will be used to put a mark on the table in asterisk, this was the starting point for drawing samples from the mark down-ward, numbers which were not less than 001 or greater than 258 were selected to represent the sample schools.

However, in other to draw subjects from the 10 selected schools, the stratified random sampling techniques was used to select 150 students from total number of 787 students and 150 adults from a total number of 750 adults. The sampling fraction

for the students was 150/787 = 0.191 while the sampling fraction for the adults was 150/759 = 0.198 respectively. The research sample therefore composed of one hundred and fifty students (150) below the ages of 18 years and one hundred and fifty students above the age of 18 years from these 10 schools of the five Local Government of Plateau Central, Nigeria. They are: Pankshin, Mangu, Bokkos, Kanam and Kanke as seen on Table 3 below:

Table 3. Names of schools and sample sizes

S/N	Name of School	Type	Total No of Students (S)	Total No of Adults(A)	Sample Size		Total
					S	A	
1	Good Shepherd College Pankshin	V.A.School	49	93	9	18	27
2	G.S.S.Pankshin	Govt. School	69	92	11	18	29
3	M.S.S. Mangu	V.A. School	76	81	34	22	56
4	G.S.S. Mangu	Govt. School	172	146	23	23	46
5	All Nation Academy Bokkos	V.A. School	31	13	6	3	9
6	G. S.S. Bokkos	Govt. School	67	76	13	15	28
7	G.M.C. Kabwir	V.A. School	43	73	8	15	23
8	G.S.S. Kabwir	Govt. School	138	76	19	15	34
9	International College of Languages Kanam	V.A. School	56	37	11	7	18
10	G.S.S. Gar Kanam	Govt.School	86	72	16	14	30
	Total	10	787	759	150	150	300

V.A. School = Voluntary Agency School; G.M.C. = Gonerit Memorial College; A=Adults
G.S.S. = Government Secondary School; M.S.S. = Mangu Secondary School; S=Students

In the participant information sheet and informed consent form, section A, background information, some demographic variables were outlined to which students and adults were required to fill appropriately. The demographic variables/status is as shown in tables 4 and 5 below:

Table 4. Students' demographic status

PROFILE	F	%
Economic Level		
Low Income <1.025 $	146	97.33
Lower middle income 1,026-3,995	0	2.66
High income > 3,995	0	0
School Location		
Urban	22	14.66
Rural	128	85.33
School Type		
Public	90	60
Private	60	40
Age		
10 – 17	150	100
18 – 30	0	0
Gender		
Male	95	63.33
Female	55	36.666
Family system		
Monogamy	90	60
Polygamy	60	40
Polyandry	0	0
Single Parenting	0	0
Occupation		
Student	121	80.66
Farming	9	6
Petty Business	20	13.33

Table 5. Adults' demographic status

PROFILE	F	%
Economic Level		
Low Income <1.025 $	146	97.3
Lower middle income 1,026-3,995	4	2.66
High income > 3,995	0	0
School Location		
Urban	26	17.33
Rural	124	82.66
School Type		
Public	91	60.66
Private	59	39.33
Age		
10 – 17	0	0
18 – 30	150	100
Gender		
Male	92	61.33
Female	58	38.66
Family System		
Monogamy	90	60
Polygamy	60	40
Polyandry	0	0
Single Parenting	0	0
Occupation		
Student	112	74.66
Farming	9	6
Petty Business	29	19.33

3.3. Data Collection Tools

The underlying need for data collection is to capture quality evidence that seeks to answer all the questions that have been posed. Through data collection business, management can deduce quality information that is a prerequisite for making informed decisions. Data collection includes gathering, storing, accessing, and using the original information; these tools are interviews, observation, case study, surveys or questionnaires. The tools were designed by the researcher with the aid of the supervisor.

Leading overviews is one type of essential research, which is said to be the social affair information direct from its source. The data so far gathered may likewise be gotten to in this way by different gatherings in auxiliary research. Review research can be utilized to assemble the suppositions, convictions and sentiments of

chose gatherings of people, similar to the case in this exploration work frequently picked for segment testing. These socioeconomics incorporate sexual orientation, age, pay levels or ethnicity. Regular kinds of overviews incorporate surveys and meetings which included different decision polls, sentiments and surveys. Below are the tools.

3.3.1. Research instrument

The instruments used for the collection of data for this research work were:

Structured Questionnaire with Modified Likert Responses was used, the scale ranges from Strongly Disagreed (SD), Disagreed (DA), Neutral (N), Agreed (A) and Strongly Agreed (SA) Environmental Concept Achievement Test (ECAT)

Rating scale for Environmental Concept Understanding (ECU)

Interview schedule for reasons and solutions for misconception on the selected Environmental Concepts.

3.3.1.1. Environmental concepts achievement test (ECAT)

The test items for the achievement test were drawn from the forty concepts, Pollution, Global Warming, Climate Change, Adaptation, Biosphere, Desert, Overcrowding, Xerophyte, Biome, Climax Vegetation, Ecology, Tropical rainforest, Wilting, Primary producer, Savannah, Edaphic factor, Energy transfer, Biotic factor, Food Chain, Ecological niche, Biomass, Bush fallowing, Pollutants, Environmental Awareness, Aquatic Habitat, Photic Zone, Gills, Xerophyte, Environmental Protection, Industrialization, Modified food, Aestivation, Afforestation, Competition, Environmental Problems, Attitude, Endangered species, Poikilithermy, Nuclear Energy.

The test comprised objective questions of forty 40 items all selected from biology curriculum and past senior secondary certificate examination question (WAEC/NECO) particularly on topics covered by the Senior secondary students. For each test question, Likert scale was adopted to answer the questions (Strongly Disagreed, Disagreed, Neutral Agreed, and Strongly Agreed). Respondents will respond by ticking the correct one.

3.3.1.2. Ecology concept understanding (ECU)

This Section consisted of a list of some forty (40) selected environmental concepts questions in the curriculum. In front of each concept were three columns "Yes", "No" and brief explanation of concept understood. Respondents responded by a tick in front of each column whether or not they understand a concept. A tick under "Yes" indicated that the respondents understood the concept and a tick under "No" will show that the concept was not understood. Where a respondent ticks yes for a particular concept, brief explanation will then be given to show the extent of understanding of such concept by the respondent.

3.3.1.3. Interview schedule

An interview schedule of two questions intending to determine the student's reasons/solution for misconception on the selected environmental concept. The questions were:

What is the reason(s) for misconception on concept you do not understand?

What can be done to help you understand these concepts better?

Respondent's responses on the reasons for misconception were classified under seven factors adopted from Mang (2009)

i. Over simplification of concept (OSC)
ii. Language Problem (LP)
iii. Teachers Pedagogical Problem (TPP)
iv. Misinformation from about concept
v. Students Attitude to Biology (SAB)
vi. Topic not Taught by Teachers (TNT)
vii. Abstractness of Concept (AC)

3.4. Data Collection Procedure

Data assortment is characterized as the methodology of gathering, estimating and breaking down precise experiences for inquire about utilizing standard approved systems (Adi, 2019). An analyst can assess his theory based on gathered information. As a rule, information assortment is the essential and most significant advance for look into, regardless of the field of research. The methodology of information assortment is distinctive for various fields of study, contingent upon the necessary

data. The most basic target of information assortment is guaranteeing that data rich and dependable information is gathered for factual investigation with the goal that information driven choices can be made for look into.

Instances of information assortment techniques include:

In-Person Interviews

Geniuses: top to bottom and a high level of certainty on the information

Cons: Time devouring, costly and can be rejected as recounted

Mail Surveys

Geniuses: Can arrive at anybody and everybody – no obstruction

Cons: Expensive, information assortment mistakes, slack time

Telephone Surveys

Aces: High level of certainty on the information gathered, reach nearly anybody

Cons: Expensive, can't self-regulate, need to employ an organization

Web/Online Surveys

Experts: Cheap, can self-regulate, low likelihood of information blunders

Cons: Not every one of your clients may have an email address/be on the web, clients might be careful about unveiling data on the web.

With the end goal of this investigation, the accompanying information assortment technique was utilized:

Questionnaires: The questionnaire comprised of questions and opinions to be filled by respondents. Questionnaires are distributed through direct contact with individuals as is the case in this research work.

Interviews: This collection procedure was used to obtain information on one-one-basis. The researcher went to the target group and conducted interviews directly with the respondents.

Randomized response technique was also adopted by the research to reach target group. This technique allows the researcher to obtain sensitive information while also guaranteeing privacy of respondents. The method also encourages cooperation from respondents and reduces their motivation to falsely report their attitudes, this method claim to yields more valid point estimates of sensitive behaviour (Rueda and Arnab 2016). Responses from respondents were immediately collected for analysis after questionnaires administered and interviews conducted.

3.5. Data Analysis

Data investigation is the way toward creating understanding and afterward seeming well and good and significance out from the information gathered in the examination (Merriam, 2009). In the expository procedure, information is typically made reasonable by arranging them, deciding significant data, deciphering it and distinguishing repetitive examples that develop (Marshall and Rossman, 1999). Before the surveys were disseminated and meets led, the respondents were advised on the idea of the examination, the desires from them and the obligation of the scientist.

Descriptive and inferential statistics were used. Descriptive statistics outlines raw data with the objective for it to be visualized and enables the investigation to be able to introduce the data in a more significant manner which warrants less complex translation of information. Frequencies, percentages, mean, standard deviation and t-test, the person product moment correlation coefficient were used for the analyses. The Cronbach's coefficient Alpha method was used to establish the reliability.

The scientific researcher found the focal inclination of a variable, which is the normal score of a member on a given report measure. These are processes of describing the universal position for a frequency distribution for a group of a data by using the mean, median and mode. Significant analysis of the data was presented in tables because it is very easy to identify outliers. Cross tabulation was also used to compare relationships between nominal variables such as environmental concepts, teaching and understanding.

3.5.1. Scoring of the instrument

In scoring the forty-item ecological concept achievement test, numerical value which ranges from 1-5 was used, this range gives the weight of the responses
For example, if the total respondents is 150 and the scale range is 1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree and 5= Strongly Disagreed, and from the data if 15 strongly agree, 15×1=15; 20 Agreed 20×2=40; 30 are neutral 30×3=90; 40 Disagree 40×4=160; 45 strongly disagreed 45×5=225. Total score =15+40+90+160+225 = 530/150 =3.533. You can conclude that the respondents disagreed to the item because it falls approximately 4, that is within the range of

disagreed. While for the reason/solutions for misconception, the frequencies and percentages of the factors identified as the reason/solution were computed.

3.5.2. Reliability of the instrument

To establish the reliability of the Environmental Concept Achievement Test, the split half method was used. The forty objective test items were administered to forty (40) secondary schools biology students (both students and adult) during the pilot study. The items were split into odd and even equivalent halves for scoring purpose. Odd number item (1,3,5,7,9,11,,13----------39) were scored separately from the even number 2,4,6,8,10,12,14----------40 items). A score for each student was obtained based on the 20 odd and 20 even number items. These two separate scores were correlated using the person product moment correlation coefficient.

$$\mathbf{r} = \frac{\Sigma \mathbf{x}\,\mathbf{y}}{\sqrt{\Sigma\,(\chi 2)(y2)}}$$

Where

r= Pearson Product moment corrélations coefficient

X=Odd number items

Y=Even number item

Σχy= Sum of all the product of deviations, each x deviation multiplied by its corresponding y deviation.

Corresponding y deviation

Sum of:

Σχy =23.623

$\Sigma\chi^2$=387.80

Σy^2=289.00

The correlation between the two halves ECAT objective test items

Was(r) of 0.71

To estimate the reliability of the scores based on the full length of the instrument, the spearman Brown prophecy formula was applied. The formula is given as

$$r = \frac{2x\ \text{reliability of } ½\ \text{test}}{1x\ \text{reliability of } ½\ \text{test}}$$

r = is the reliability of scores on total test. The odd-even correlation between the two 20 item test was 0.71, the reliability of the total test score was obtained by substituting in the formula thus.

$$r=\frac{2x0.71}{1x0.7}=\frac{1.42}{1.71} = 0.83$$

The correlation coefficient of 0.83 was determined for the test.

Furthermore to establish the reliability of the Environmental Concept Understanding Rating Scale (ECU). The researcher grouped the brief explanations of respondents on the concept they claimed to have understood under: Accepted Scientific Response (ASR), Unaccepted Scientific Response (USR) and No Response (NR). The Cronbach's coefficient Alpha method was used to establish the reliability. The variances of the individual text items were computed based on 3-point scale:

- Accepted scientific response =3
- Unaccepted scientific response =2
- No response =1

After the computation of the variances of the individual forty items for a group of forty students, the sum of the variance of the individual test item Σs^2 was found to be 16.18. On the other hand, the variance of the total test scores of the forty items was computed from the Accepted Scientific Response and Unacceptable Scientific Response by scoring those 2 and 1 respectively and was found to be 195.38. The coefficient of 0.94 can be regarded as high and good hence the ECU item was also considered reliable.

3.5.3. Validity of the instrument

The research instruments were design by the researcher. The forty concepts were selected from the biology curriculum, and the forty ECAT questions were set based on these concepts and from past West Africa Examination Council (WAEC)/National Examination Council (NECO) questions. The questions were scrutinized by the supervisor who is also an expert in environmental and biological subjects. Items discovered as invalid were restructured with the help of the supervisor or deleted completely.

3.5.4. Administration of the research instrument

In administering the research instruments, three hundred subjects in ten schools were used. To ensure success, the researcher explained to respondent what they were required to do in responding to the questionnaire items. The Environmental Concept Achievement Test (ECAT) questionnaire was presented alongside with the Environmental Concept Understanding (ECU) questionnaire and it lasted for 1 hour 20 minutes. All test items were returned because they were administered by the researcher himself with the aid of the subject teachers. However 60 minutes was also used by the researcher to interview 10 students and 10 adults in each of the schools on the following questions:

i. What was the reason(s) for misconception on concepts you do not understand?

ii. What can be done to help you understand these concepts better?

Frequencies of respondent's responses were written down under the factors identified by Mang (2009) as reasons for students misconception in Genetics and the solution for misconceptions were also computed in frequencies.

3.6. Ethical Consideration

This part discussed the management of ethical issues through and afterwards the study. There are various reasons why it is critical to embrace to a couple of moral principles in inquire about. These consolidate advancing and propelling the goals of the examination. For example, social values, information and truth, common regard and human rights (Shamoo and Resnik, 2009). Morals are regarded as managing convictions about those things that are correct and those that are wrong (McMillan and Schumacher, 2009). The association of human subject in research believed that ethical issues are watched. On watching ethics, Slaving (2007) posited that it is necessary for the scientist to dodge open worry over potential embarrassment and maltreatment of members and information by the analyst. This investigation and ethics contemplations helped the researcher to be original and genuine all through the processes and trust the educators. The researcher's understanding of ethics contemplations is that it ensures and guides both the researcher and the participants.

In this study, students were informed about their voluntary participation and their right to withdraw from the study without any penalty. Students were asked not

to write their names, initials or apply any signature which may eventually lead to personal identity. Students were informed that the findings would be presented anonymously without revealing their identities. Information received from respondents was managed with complete privacy (Shamoo and Resnik, 2009; Lincoln and Denzin, 2000) and will be kept for two years before it will be deleted from the researcher's system.

CHAPTER IV
FINDINGS AND INTERPRETATION

In this chapter, the findings obtained after the research have been shown in the tables and they have been explained. In addition, students and adults' level of understanding of environmental concepts were compared. The test items as presented in chapter III consisted of Environmental Concept Achievement Test (ECAT) consisting of forty questions selected from West Africa Examination Council (WAEC) question covering Biology Curriculum and the six level of understanding thus: knowledge, comprehension, application, analysis, synthesis and evaluation (Check and Schutt 2012). Students are required to response by ticking the appropriate answer, either Strongly Disagreed, Disagreed, Neutral, Agreed, or Strongly Agreed. The item also consisted of Environmental Concept Understanding (ECU).

Respondents were requested to indicate with a tick whether or not they understood the concept by a "Yes" or "No" response, were their responses were Yes, they were further requested to explain in brief in other to ascertain their understanding. Their responses were presented under the following:

Acceptable Scientific Response (ASR)

Unacceptable Scientific Response (USR)

No Response (NR)

The last item is an interview schedule where there were two questions meant to probe students' reasons and solution for misconceptions on the selected forty concepts.

The data gathered were analyzed for achievements, demographic factors, understanding, misconceptions and how to solve or overcome it. Test was administered to determine achievement test levels of students and adults. Understanding indices were determined for the forty concepts and the responses were also computed. Responses of the respondents were given under Acceptable Scientific Response (ASR) Unacceptable Scientific Response (USR) and No Response (NR). Interviews were also conducted for the respondents (students and adults).

4.1. The Achievement Levels of Students and Adults in Understanding Environmental Concepts

The first sub-objective of this study is "What are the achievement levels of students and adults in understanding environmental concepts'? This sub-objective was determined using frequencies, percentages and mean. Questionnaires were administered to students and adults and the results computed as shown below.

Table 6. Students mark (scores) on the environmental concepts achievement test (ECAT)

Marks (scores) X	Frequency	FX
32	1	32
28	1	28
27	2	54
26	1	26
25	1	25
24	4	96
23	2	46
22	3	66
21	2	42
20	8	160
19	10	190
18	9	162
17	9	153
16	3	48
15	4	60
14	12	168
13	7	91
12	9	108
11	5	55
10	13	130
9	7	63
8	9	72
7	7	63
8	9	72
7	7	49
6	5	30
5	6	30
4	3	12
3	1	3
2	2	4
1	2	2
0	2	0
TOTAL	Σx **150**	ΣFx= 2005
Mean	**13.37**	

The mean mark (scores) of the students in the environmental concepts achievement test was 13.37. The test was scored over forty and a score of 1-19 was considered failed, 20-30 was considered credit/pass and 31-40 was considered

distinction/pass. From table 6 only 25 students got 20 marks and above which was 16.67% of the students (respondents) 125 of them, representing 83.33% failed the test. Therefore, from the table 6 above, it can be said that the achievement test level of students is 16.67%.

Table 7. Adult mark (scores) on the environmental concepts achievement test (ECAT)

Mark (scores)	Frequencies
26	1
25	0
24	2
23	0
22	0
21	1
20	5
19	8
18	8
17	3
16	2
15	16
14	7
13	11
12	12
11	10
10	9
9	11
8	7
7	13
6	8
5	3
4	3
2	1
TOTAL Σf=150; Σfx= 1830	
Mean12.20	

The mean mark (score) of the adult students in the environmental concepts achievements test as presented in table 5 was 12.20. Only 9 adult students scored 20 and above which is 13.33% while 141 of the adult respondents representing 94% failed the achievement test. Therefore, the achievement level of the adults is 13.33%.

Table 8. Summary of the arithmetic mean, standard deviation, t-test and critical values of the achievement test by the students and adults

Respondents	Mean	SD	Size	DF	Standard Error	t-Cal	t-Critical
Students	13.37	6.20	150				
				298	0.05	1.860	1.960
Adults	12.20	4.60	150				

From table 8 above, there is a little difference between the students mean score of 13.37 and adults mean score of 12.20. Standard Deviation for students was 6.20 and standard deviation of adults was 4.60. This indicates the level of achievement of students and adults on environmental concept.

4.2. Achievement Levels of Students and Adults and Their Demographic Status (Economic Level, Area, School Type, Age, Sex, Civil Status, Household, Occupation)

The second sub-objective of this study is "How is the achievement levels of students and adults differ according to their demographic status (economic level, school location, school type, gender, age, family system, and occupation). This sub – objective was determined based on the grades obtained on ECAT as shown in tables 9, 10 and 11.

According to the table 9 and 10 below, on economic level as a demographic factor, out of the 150 students sampled, 146 are from the low income class while 4 of them from the lower middle income class, none from the high income class level. From the ECAT conducted 76 (50.66) passed while 70 (46, 66% failed. Out of the 4 students that sat for the ECAT from the lower middle class, 3 passed and only 1 failed.

On achievement of the 150 sampled students on school location factor, 128 of the students are from rural area, the remaining 22 of the students are from schools from urban area. 60 (40%) of the students from the rural area got credit while 68 (45.33%) failed. Out of the 22 students from the urban area, 2(1.33) of them got distinction, 18(12%) got credit while 2 (1.33%) failed.

On achievement based on school type, 90 of the students are from public schools while 60 of them are from private schools. In the public school, 40(26.66%) of the students passed the ECAT while 50 (33.33%) of them failed. 6(4%) students in the private schools got distinction, 37(24.66) got credit and 17(11.33%) failed.

Table 9. Achievement level of students with respect to economic level, gender, school type, school location, family system

	ECAT GRADES			
	Distinction	**Credit**	**Fail**	**Total**
Economic Level				
Low Income <1.025 $	0	76 (50.66%)	70 (46.66%)	146
Lower middle income 1,026-	0	3 (2%)	1 (0.66%)	4
3,995	0	0	0	0
High income > 3,995				
School Location				
Urban	2(1.33%)	18 (12%)	2 (1.33%)	22
Rural	0	60 (40%)	68 (45.33)	128
School Type				
Public	0	40 (26.66%)	50 (33.33%)	90
Private	6 (4%)	37 (24.66%)	17 (11.33%)	60
Gender				
Male	4 (2.66%)	40 (26.66)	51 (34%)	95
Female	3 (2%)	20 (13.33%)	32(21.33)	55
Age				
10 - 17	3 (2%)	65 (43.33%)	82 (54.66)	150
18 – 30	0	0	0	0
Family System				
Monogamy	4 (2.66%)	40(26.66%)	46(30.66%)	90
Polygamy	0	25(16.66%)	35(23.33%)	60
Polyandry	0	0	0	0
Occupation				
Student	3 (2%)	51 (34%)	67 (44.66)	121
Farming	0	3 (2%)	6 (4%)	9
Business	0	8 (5.33%)	12 (8%)	20

On gender, 95 are males while the remaining 55 are females. Their achievement on ECAT of males students revealed that 4(2.66%) got distinction, 40(26.66) got credit, 51(34%) failed while that of females students revealed that 3(2%) got distinction, 20 (13.33%) got credit and 32(21.33%) failed.

On age, the study is on students of ages below 18 years and adults of above 18 years, so all students (150) were given ECAT. 3(2%) got distinction, 65 (43.33%) got credit while 82 (54.66) failed.

On achievement of students under the family system, 90 of them came from monogamous family and the remaining 60 came from polygamous family, none from polyandrous or single parenting family. Out of the 90 that came from monogamous homes, 4 (2.66%) got distinction, 40 (26.66%) got credit while 46 (30.66%) failed. Out of 60 students from polygamous homes, none had distinction, 25(16.66%) got credit while 35 (23.33) failed.

On occupation as one of the demographic determinant of achievement, 121 of the respondents are students, they don't engage in any form of labour after school. Out of this number (121), 3(2%) got distinction, 51 (34%) got credit, and 67 (44.66 %) failed. 9 students out of the population of the 150 students engage in farming after school, their ECAT revealed that none had distinction, 3(2%) had credit while 6(4%) failed. 20 of the 150 students engage in businesses and their performance revealed none with distinction, 8 (5.33%) had credit and 12 (8%) failed.

The economic level of adults revealed that, 146 of them are from low income class while only 4 are from lower middle income. From the lower income class 72 (48%) had credits, 74 (49.33) failed and none with distinctions. From the lower middle income level, 2 (1.33%) had credits while 2(1.33%) failed. There is no adult student from high income level.

Results from school location revealed that 124 attend rural schools while 26 indicated that their schools are located in the urban area. The achievement of adults in the urban area revealed that 2(1.33%) had distinctions, 20 (13.33%) had credits and 4 (2.66%) failed. The data of adults that school in rural area revealed that none had distinction, 60 (40%) had credits while 62 (41.33%) failed.

Demographic data on school type revealed that 91 adults attended public school while 59 attended private schools. On those that attended public schools, none had distinction, 38 (25.33) had credits and 53 (35.33) failed. The statistics of those that attended private schools indicated that 3 (2%) had distinctions, 30 (20%) had credits, 26 (17.33%) failed.

Data on gender revealed that 92 of the adults are male while the remaining 58 are female. The male adult had 1 (0.66%) with distinctions, 43 (28.66%) had credits,

48 (32%) failed. The female adult had none with distinction, 23 (15.33%) had credits while 35 (23.33%) failed.

On age as a demographic factor on achievement, all the adults ages ranges from 19 – 30 years. On the basis of the age, 3 (2%) had distinctions on the ECAT, 65 (43.33%) had credits and 82 (54.66) failed the ECAT.

Table 10. Achievement level of adults with respect to demographic status (economic level, gender, school type, school location, family system)

	ECAT GRADES			
	Distinction	**Credit**	**Fail**	**Total**
Economic Level				
Low Income <1.025 $	0	72 (48%)	74 (49.33%)	146
Lower middle income 1,026-	0	2 (1.33%)	2 (1.33%)	4
3,995	0	0	0	0
High income > 3,995				
School Location				
Urban	2(1.33%)	20 (13.33%)	4 (2.66%)	26
Rural	0	60 (40%)	62 (41.33%)	124
School Type				
Public	0	38 (25.33%)	53 (35.33%)	91
Private	3 (2%)	30 (20%)	26 (17.33%)	59
Gender				
Male	1 (0.66%)	43 (28.66%)	48 (32%)	92
Female	0	23 (15.33%)	35 (23.33)	58
Age				
10 - 18	0	0	0	0
19 – 30	3 (2%)	65 (43.33%)	82 (54.66)	150
Family System				
Monogamy	3 (2%)	41 (27.33%)	46(30.66%)	90
Polygamy	0	24(16%)	36(24%)	60
Polyandry	0	0	0	0
Occupation				
Student	5 (3.33%)	33 (22%)	74 (49.33%)	112
Farming	0	5 (3.33%)	4 (2.66%)	9
Business	0	10 (6.66%)	19 (12.66%)	29

Data on the family system revealed that 90 of them are from monogamous family, 60 are from polygamous family and none from polyandrous family. From the monogamous side, 3 (2%) had distinctions, 21 (27.33%) had credits, 46 (30.66%) failed. Polygamous families had none with distinction, 24 (16%) had credits, 36 (24%) failed the ECAT.

On occupation as a demographic determinant in adult achievement, 112 of the adults do not engage in any form of labour after school, 9 engaged in farming after school and 29 engaged in businesses after school hours. Of 112 of the adults that do not engage in any form of activities after school, 5 (3.33%) had distinctions, 33 (22%) had credits, 74 (49.33%) failed. Those that engaged in farming activities, none had distinction, 5 (3.33%) had credits, 4(2.66%) failed. Of the 29 that engaged in businesses after school hours, none had distinction, 10 (6.66%) had credits while 19 (12.66%) failed.

From tables 9 and 10, students and adults are from the lower income of <1.025 $ and lower middle income 1,026-3,995$, none is from the high income levels > 3,995$ per annum. According to World Bank Blogs (2019), this threshold is grossly inadequate to take care of individuals, and this has devastating effect on the educational and economic development of a nation.

School location revealed that 22 students are from urban areas, 128 from rural area while their adult counter parts have 26 from urban while 128 from rural areas. Majority of the students and adults are from rural areas. According to Obande, (2006), most schools situated in rural areas lack basic facilities such as libraries and laboratories and these have significant effect on the academic achievement of students.

Data on the school type revealed that 90 students are from public schools while 60 are from private schools. The adults have 91 from public schools while 59 are from private schools. From result of public schools, no student or adult got distinction in the ECAT conducted. This goes to confirm what Fagbunmi, (2005), Akinmade (2008) said on achievement of public and private schools that private schools tend to perform better in school because they are readily being provided with instructional materials.

On gender, students had 95 males and 55 females while adults had 92 males and 58 females. Male students had 4 (2.66%) distinctions than their female counter part that had 3 (2%) distinctions. I (0.66%) male adult had distinction while none female adult had distinction. They difference in the achievement level is not significant. O'gandy (2014) posited the difference in the achievement levels between males and females has decreased considerably.

On age as demographic variable, the study is on students between the ages of 10 – 17 and adults between the ages of 19 – 30. The achievement level of students

and adults correspond with 3(2%) distinction, 65 (43.33%) credit and 82 (54.66%) failed.

On family system as a demographic variable, 90 of students are from monogamous (one wife one husband) homes, 60 are from polygamous (one husband, two or more wives) homes. The achievement level of monogamous family, are higher than that of polygamous family with values of 40 (26.66%) credit and 25 (23.33%) for monogamy and polygamy respectively. The adults had 41 (27.33%) for monogamy family and 24 (16%) for polygamy families achievement level.

On occupation, 121 are students without undertaking any form of business, 9 are students but they engage in farming activities after school, 20 are students but they engage in one form of business or the other. 3 (2%) had distinctions, 51 (34 %) had credits, 67 (44.66%) failed. 112 of the adult are students, no any form of activity after school. 9 engage in farming after school, 29 engage in business after school. 5 (3.33%) had distinction, 33 (22%) that are student had credit and 74 (49.33%) failed. Those that engage in farming and business after school none had distinction.

4.3. Understanding Levels of Environmental Concepts of Students and Adults

The third sub-objective of this study is “What are the understanding levels of environmental concepts of students and adults” This sub-objective was determined using frequencies, percentages, mean and standard deviation. Questionnaires were administered to students and adults, as presented in tables 11, 12, 13 and 14 below and the results computed.

From table 11 only 38.22% of the total respondents indicated that they understood the concept, while 61.83% of them showed lack of understanding. Out of the 38.22% that indicated that they understood the concepts only 12.98% gave Acceptable Scientific Response (ASR), while 26.45% gave unacceptable Scientific Responses (USR) and 60.57% could not give any response that is, No Response (NR). This shows that most of the students could not explain some of the concepts they claimed to have understood.

Table 11. Frequency and percentage of understanding of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by both students and adults

CONCEPTS	SAMP SIZE (N)	YES FRE(Q)	%	NO FREQ (F)	%	ASR	%	USR	%	NR	%
1	300	258	86.00	42	14.00	41	13.67	217	72.33	42	14.00
2	300	69	23.00	231	77.00	37	12.33	38	12.67	225	75.00
3	300	171	57.00	129	43,00	63	21.00	109	36.33	128	42.00
4	300	153	51.00	147	49.00	45	15.00	108	36.00	147	49.00
5	300	162	54.00	138	46.00	41	13.67	121	40.33	138	46.00
6	300	183	61.00	117	39.00	94	31.33	105	35.00	101	33.67
7	300	172	57.33	128	42.67	96	32.00	79	26.33	125	41.67
8	300	130	43.33	170	56.67	20	6.67	99	33.00	181	60.33
9	300	68	22.67	232	77.33	14	4.67	53	17.67	233	77.69
10	300	69	23.00	231	77.00	29	9.67	144	48.00	127	42.33
11	300	186	63.00	114	38.00	43	14.33	133	44.33	124	41.33
12	300	113	37.67	187	62.33	53	17.67	60	20.00	187	62.33
13	300	44	14.67	256	85.33	10	3.33	34	11.33	256	85.33
14	300	156	52.00	144	48.00	66	22.00	90	30.00	144	48.00
15	300	110	36.67	190	63.33	26	8.67	93	31.00	181	60.00
16	300	70	23.33	230	76.67	33	11.00	39	13.00	228	76.00
17	300	129	43.00	171	57.00	25	8.33	106	35.33	169	56.33
18	300	135	45.00	165	55.00	73	24.33	67	22.33	160	53.33
19	300	137	45.67	163	54.33	34	11.33	104	34.67	162	54.00
20	300	60	20.00	240	80.00	15	5.00	31	10.33	254	84.67
21	300	44	14.67	256	85.33	4	1.33	40	13.33	256	85.33
22	300	177	59.00	123	41.00	71	23.67	106	35.33	123	41.00
23	300	154	51.33	146	48.67	47	15.67	107	35.67	146	48.67
24	300	157	52.33	143	47.67	64	21.33	93	31.00	143	47.67
25	300	148	49.33	152	50.67	77	25.67	73	24.33	150	50.00
26	300	84	28.00	216	72.00	35	11.67	49	16.33	216	72.00
27	300	27	9.00	273	91.00	2	0.67	25	8.33	273	91.00
28	300	33	11	267	89.00	14	4.67	19	6.33	267	89.00

Table 11. Frequency and percentage of understanding of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by both students and adults (Continue)

CONCEPTS	SAMP SIZE (N)	YES FRE(Q)	%	NO FREQ (F)	%	ASR	%	USR	%	NR	%
29	300	61	20.33	239	79.67	13	4.33	48	16.00	239	79.67
30	300	27	9.00	273	91.00	2	0.67	25	8.33	273	91.00
31	300	108	36.00	192	64.00	29	9.67	79	26.33	192	64.00
32	300	229	67.33	71	23.67	70	23.33	156	52.00	74	24.67
33	300	129	43.00	171	57.00	43	14.33	86	28.67	171	57.00
34	300	147	49.00	153	51.00	22	7.33	125	41.67	153	51.00
35	300	66	22.00	234	78.22	9	3.00	57	19.00	234	79.00
36	300	63	21.00	237	79.00	25	8.33	38	12.67	237	79.00
37	300	64	21.33	236	78.67	11	3.67	53	17.67	236	79.33
38	300	140	46.67	160	53.33	42	14.00	98	32.67	160	53.33
39	300	21	7.00	279	93.00	10	3.33	11	3.67	279	93.00
40	300	166	55.33	134	44.67	109	36.33	57	19.00	134	44.67
TOT AL	300	4640	1528.66	7290	2471.34	1549	519	3184	1057.98	7280	2422.66
%		38.22		61.83		12.98		26.45		60.57	
mean($\bar{X}$)		%		%		%		%		%	

Table 12. Frequencies and percentages of understanding of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by the students

		Brief Explanation									
CONCEPTS	**SAMPLE SIZE N**	**YES FREQ**	**%**	**NO FREQ**	**(%)**	**ASR**	**%**	**USR**	**%**	**NR**	**%**
1	150	129	86.00	21	14.00	22	14.67	107	71.33	21	14.00
2	150	41	27.33	109	72.67	20	13.33	27	18.00	103	68.67
3	150	79	52.67	71	47.33	30	20.00	50	33.33	70	46.67
4	150	68	45.33	82	54.67	22	14.67	46	30.67	82	54.67
5	150	78	52.00	72	48.00	22	14.67	56	37.33	72	48.00
6	150	83	55.33	67	44.67	55	36.67	44	29.33	51	34.00
7	150	85	56.67	65	43.33	48	32.00	37	24.67	65	43.33
8	150	57	38.00	93	62.00	10	6.67	47	31.33	93	62.00
9	150	35	23.33	115	76.67	9	6.00	25	16.62	116	77.53
10	150	32	21.33	118	78.67	18	12.00	118	78.67	14	9.33
11	150	81	54.00	69	46.00	19	12.67	63	42.00	68	45.33
12	150	58	38.67	92	61.33	28	18.67	30	20.00	92	61.33
13	150	22	14.67	128	85.33	4	2.67	18	12.00	128	85.33
14	150	84	56.00	66	44.00	36	24.00	48	32.00	66	44.00
15	150	57	38.00	93	62.00	11	7.33	46	30.67	93	62.00
16	150	26	17.33	124	82.67	16	10.67	12	8.00	122	81.33
17	150	60	40.00	90	60.00	14	9.33	48	32.00	88	58.67
18	150	53	35.00	97	64.67	32	21.33	26	17.33	92	61.33
19	150	71	47.33	79	52.67	20	13.33	52	34.67	78	52.00
20	150	28	18.67	122	81.33	9	6.00	19	12.67	122	81.33
21	150	9	6.00	141	94.00	1	0.67	8	5.33	141	94.00

Table 12. Frequencies and percentages of understanding of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by the students (continued)

Brief Explanation

CONCEPTS	SAMPL SIZE N	YES FREQ(F)	%	NO FREQ (F)	(%)	ASR	%	USR	%	NR	%
22	150	84	56.00	66	44.00	36	24.00	48	32.00	66	44.00
23	150	77	51.33	73	48.67	30	20.00	47	31.33	73	48.67
24	150	78	52.00	72	48.00	37	24.67	41	27.33	72	48.00
25	150	72	48.00	78	52.00	39	26.00	34	22.67	77	51.33
26	150	42	28.00	108	72.00	17	11.33	25	16.67	108	72.00
27	150	18	12.00	132	88.00	1	0.67	17	11.33	132	88.00
28	150	20	13.33	130	86.67	7	4.67	13	8.67	130	86.67
29	150	29	19.33	121	80.67	2	1.33	27	18.00	121	80.67
30	150	16	10.67	134	89.33	0	0.00	16	10.67	134	89.33
31	150	52	34.67	98	65.33	13	8.67	39	26.00	98	65.33
32	150	105	70.00	45	30.00	38	25.33	64	42.67	48	32.00
33	150	66	44.00	84	56.00	22	14.67	44	29.33	84	56.00
34	150	73	48.67	77	51.33	9	6.00	64	42.67	77	51.33
35	150	32	21.33	118	78.67	7	4.67	25	16.67	118	78.67
36	150	28	18.67	122	81.33	14	9.33	14	9.33	122	81.33
37	150	28	19.33	121	80.67	7	4.67	22	14.67	121	80.67
38	150	65	43.33	85	56.67	21	14.00	44	29.33	85	56.67
39	150	13	8.67	137	91.33	7	4.67	6	4.00	137	91.33
40	150	85	56.67	65	43.33	54	36.00	31	20.67	65	43.33
Total		**2230**	**1510**	**3780**	**2520**	**807**	**524.7**	**1568**	**1062**	**3655**	**2496.31**
%		**37.75**		**63**		**13.1**		**26.60**		**62.40**	
MEAN($\bar{X}$)		**%**		**%**		**2 %**		**%**		**0 %**	

From table 12 above only 37.75 of the students indicated that they understood the concept, while 63% did not understand, 13.12% gave acceptable Scientific Responses while 26.60% gave unacceptable Scientific Responses. This shows that only few of the students truly understand the concepts they claimed to have understood.

Table 13: Frequencies and percentages of understanding of acceptable scientific response (ASR), unacceptable scientific response (USR) and no response (NR) by the adult Students

	Brief explanation										
CONCEPTS	**SAMPLE SIZE (N)**	**YES FREQ**	**PERCENTAGES (%)**	**NO FREQ(F)**	**(%)**	**ASR**	**%**	**USR**	**%**	**NR**	**%**
1	150	129	86.00	21	14.00	19	12.67	110	73.33	21	14.00
2	150	28	18.67	122	18.33	17	11.33	11	7.33	122	18.33
3	150	92	61.33	58	38.67	33	22.00	59	39.33	58	38.67
4	150	85	56.67	65	43.33	23	15.33	62	41.33	65	43.33
5	150	84	56.00	66	44.00	19	12.60	65	43.33	66	44.00
6	150	100	66.67	50	33.33	39	26.00	61	40.67	50	33.33
7	150	87	58.00	63	42.00	48	32.00	42	28.00	60	40.00
8	150	73	48.67	77	51.33	10	6.67	52	34.67	88	58.67
9	150	33	22.00	117	78.00	5	3.33	28	18.67	117	78.00
10	150	37	24.67	113	75.33	11	7.33	26	17.33	113	75.33
11	150	105	70.00	45	30.33	24	16.00	70	46.67	56	37.33
12	150	55	36.67	95	63.33	25	16.67	30	20.00	95	63.33
13	150	22	14.67	128	85.33	6	4.00	16	10.67	128	85.33
14	150	72	48.00	78	52.00	30	20.00	42	28.00	78	52.00
15	150	53	35.00	97	64.67	15	10.00	47	31.33	88	58.67
16	150	44	29.33	106	70.67	17	11.33	27	18.00	106	70.67
17	150	69	46.00	81	54.00	11	7.33	58	38.67	81	54.00
18	150	82	45.60	68	45.33	41	27.33	41	27.33	68	45.33
19	150	66	44.00	84	56.00	14	9.33	52	26.67	84	56.00

Table 13: Frequencies and percentages of understanding of acceptable scientific response (ASR), unacceptable scientific response (USR) and no response (NR) by the adult Students (continued)

Brief explanation

CONCEPTS	SAMP SIZE (N)	YES FREQ (F)	PERCENTAGES (%)	NO FREQ(F)	(%)	ASR	%	USR	%	NR	%
20	150	32	21.33	118	78.67	6	4.00	12	8.00	132	88.00
21	150	35	23.33	115	76.67	3	2.00	32	21.33	115	76.67
22	150	93	62.00	57	38.00	35	23.33	58	38.67	57	38.00
23	150	77	51.33	73	48.67	17	11.33	60	40.00	73	48.67
24	150	79	52.67	71	47.33	27	18.00	52	34.67	71	47.33
25	150	76	50.67	74	49.33	38	25.33	39	26.00	73	48.67
26	150	42	28.00	108	72.00	18	12.00	24	16.00	108	72.00
27	150	9	6.00	141	94.00	1	0.67	8	5.33	141	94.00
28	150	13	8.67	137	91.33	7	4.67	6	4.00	137	91.33
29	150	32	21.33	118	78.67	11	7.33	21	14.00	118	78.67
30	150	11	7.33	139	92.67	2	1.33	9	6.00	139	92.67
31	150	56	37.33	94	62.67	16	10.67	40	26.67	94	62.67
32	150	124	82.67	26	17.33	32	21.33	92	61.33	26	17.33
33	150	63	42.00	87	58.00	21	14.00	42	28.00	87	58.00
34	150	74	49.33	76	50.67	13	8.67	61	40.67	76	50.67
35	150	34	22.67	116	77.33	2	1.33	32	21.33	116	77.33
36	150	35	23.33	115	76.67	11	7.33	24	16.00	115	76.67
37	150	35	23.33	115	76.67	4	2.67	31	20.67	115	76.67
38	150	75	50.00	75	50.00	21	14.33	54	36.00	75	50.00
39	150	8	5.33	142	94.64	3	2.00	5	3.33	142	94.67
40	150	81	54.00	69	46.00	55	36.67	26	17.33	69	46.00
Total		2410	1600	3510	2399	742	500.31	1616	1084.33	3625	2415.34
% Mean($\bar{X}$)		40%		59.96%		12.51%		27.10%		60.38%	

From table 13, only 40% of the adult students responded that they understood the environmental concepts while 59.96% showed lack of understanding. However, out of the forty 40% that claimed to have understood the concept, only 12.51% of them gave Acceptable Scientific Response (ASR), while 27.10% of them gave unacceptable Scientific Response. This indicated that though most of the adults that claimed understanding of most of the concept, yet, they cannot give acceptable scientific explanation to them.

The frequencies and percentages of Acceptable Scientific Responses (ASR), Unacceptable Scientific Responses (USR) and No Response (NR) mean index of understanding and the standard deviation of both male and female respondent are as shown on table 14 below:

Table 14. Summary of frequencies and percentages of understanding of acceptable scientific response (ASR) unacceptable scientific response (USR), no response (NR), mean (x) index of understanding and standard deviation of respondent's responses.

Brief Explanation													
No	Sample size	Yes F	%	NO F	%	ASR F	%	USR F	%	NR F	%	$\bar{X}$ of SD	SD
40	300	4640	38.2	7290	61.8	1549	12.9	31.84	26.4	7280	60.5	1.52	0.30

From table 14 above, it is clear that students had only 38.2% Yes Responses and 61.8% No Responses. A further look at the table revealed only 12.9% Acceptable Scientific Responses (ASR), 26.4% Unacceptable Scientific Responses (USR) and 60.5%No Response (NR) on the selected concepts. The result obtained from this table indicated that the student and adult understanding of the environmental concept was generally low.

However to further ascertain the level of students' and adults' understanding of the environmental concepts in the curriculum, the Acceptable Scientific Responses (ASR), Unacceptable Scientific Responses and No Responses were scored 3, 2 and 1 respectively. And the understanding index for the forty concepts and the standard

deviation were found to be 1.52 and 0.30 as seen on table 12 above. The indices for the understanding of each concept by the students and adult respondents were also presented on table 15 below.

Table 15. Concepts and their understanding index by the Students and adults

S/No	Concepts	Understanding index	Remark
1	Pollution	1.99	Understood
2	Global warming	1.57	Understood
3	Climate Change	1.48	Not Understood
4	Adaptation	1.66	Understood
5	Biosphere	1.68	Understood
6	Desert	1.98	Understood
7	Overcrowding	1.90	Understood
8	Xerophyte	1.32	Not understood
9	Biome	1.27	Not understood
10	Climax vegetation	1.47	Not understood
11	Ecology	1.73	Understood
12	Tropic rainforest	1.55	Understood
13	Wilting	1.18	Not understood
14	Primary producer	1.44	Not Understood
15	Savanna	1.48	Not understood
16	Edaphic factor	1.35	Not understood
17	Energy Transfer	1.52	Understood
18	Biotic factor	1.71	Understood
19	Food Chain	1.47	Not Understood
20	Ecological Niche	1.20	Not understood
21	Biomass	1.16	Not Understood
22	Bush Fallowing	1.83	Understood
23	Overgrazing	1.67	Understood
24	Vegetation	1.75	Understood
25	Pollutants	1.89	Understood
26	Aquatic Habitat	1.39	Not understood
27	Photic Zone	1.10	Not understood
28	Aestivation	1.16	Not understood

Table 15. Concepts and their understanding index by the Students and adults

S/No	Concepts	Understanding index	Remark
29	Mangrove swamp	1.27	Not Understood
30	Endangered species	1.09	Not understood
31	Conservation	1.43	Not Understood
32	Population	2.00	Understood
33	Competition	1.47	Understood
34	Ecosystem	1.56	Understood
35	Turbidity	1.25	Not understood
36	Hydrophyte	1.43	Not understood
37	Succession	1.25	Not understood
38	Terrestrial Habitat	1.61	Understood
39	Poikilothermy	1.10	Not understood
40	Nuclear Energy	1.92	Understood

Table 15 shows that the concepts Pollution, Global warming, Adaptation, Biosphere, Desert, Overcrowding, Ecology, Tropical Forest, Energy Transfer, Biotic Factor, Bush Fallowing, Overgrazing, Vegetation, Pollutants, Population, Competition, Ecosystem, Terrestrial Habitat and Nuclear Energy were understood by the students as all these concepts had understanding indices at or above 1.52 Which is the mean index for understanding the forty concepts A total of 19 concepts were considered understood by the student. The remaining 21 concepts had understanding indices below 1.52 hence they were considered not understood by the student. Based on this therefore it could be said that the Students and Adults understanding level of the environmental concepts was not good.

4.4. Difference in Understanding of Environmental Concepts in Students and Adults

The fourth sub-objective of this study is “How the understanding levels of environmental concepts of students are differ?” This sub-objective was determined using mean, variance and standard deviation. Questionnaires were administered by the researcher to students and adults as presented in table 14. Details of the responses are also presented in tables 16, 17, 18, 19, 20 and 21. The tables below showed how students and adults differ in understanding of environmental concepts.

Table 16. Raw score and indices for concept understanding by students and adults

Concepts	**ASR 3**	**USR 2**	**UR 1**	**TOTAL**	**Sample Size**	**Mean**	**Remark**
1	123	434	42	599	300	1.99	Understood
2	123	434	42	599	300	1.99	Understood
3	111	76	225	412	300	1.37	Not Understood
4	189	218	128	535	300	1.78	Understood
5	135	216	147	498	300	1.66	Understood
6	123	242	138	503	300	1.68	Understood
7	282	210	101	593	300	1.98	Understood
8	288	158	125	571	300	1.90	Understood
9	60	198	181	395	300	1.32	Not understood
10	42	106	233	381	300	1.27	Not understood
11	87	288	127	442	300	1.73	Understood
12	129	266	124	519	300	1.47	Not Understood
13	159	120	187	466	300	1.55	Understood
14	30	68	256	354	300	1.18	Not understood
15	198	180	144	522	300	174	Not understood
16	78	186	181	445	300	1.48	Not understood
17	78	186	181	445	300	1.48	Not understood
18	75	212	169	456	300	1.52	Understood
19	219	134	160	513	300	1.71	Understood
20	102	208	162	472	300	1.57	Understood
21	44	62	254	360	300	1.20	Not understood
22	12	80	256	348	300	1.16	Not understood
23	213	212	123	548	300	1.83	Understood
24	141	214	146	501	300	1.67	Understood
25	192	186	143	525	300	1.75	Understood
26	231	185	150	566	300	1.89	Understood

Table 16. Raw score and indices for concept understanding by students and adults (continued)

Concepts	**ASR 3**	**USR 2**	**UR 1**	**TOTAL**	**Sample Size**	**Mean**	**Remark**
27	105	98	216	419	300	1.39	Not understood
28	6	50	275	331	300	1.10	Not understood
29	42	38	257	347	300	1.16	Not understood
30	39	104	239	382	300	1.27	Not understood
31	6	50	273	329	300	1.09	Not understood
32	87	158	192	437	300	1.45	Not understood
33	210	312	74	596	300	2.00	Understood
34	129	172	171	472	300	1.57	Understood
35	66	250	153	469	300	1.56	Understood
36	27	114	234	374	300	1.25	Not understood
37	75	76	277	428	300	1.43	Not understood
38	126	196	160	482	300	1.61	understood
39	30	22	279	331	300	1.10	Not Understood
40	327	114	134	575	300	1.92	understood

Total mean index of understanding = 60.67

$\overline{X}$ = 1.52

Table above 16 showed the indices for understanding of each concept by Students and Adults. The sum of the indices was 60.67 with a mean index of understanding for both students and Adults as 1.52, all concepts with the understanding index above 1.52 indicated that the student understood them while concepts with the understanding indices below 1.52 where considered not understood. From this table concept with serial numbers 1,2,4,5,6,7,8,11,12,13,18,20,23,24,25,26,34, 38 and 40 where considered understood by the students and adults as these concepts had mean indices of understanding above 1.52.

Table 17. Raw Score and indices for concepts understanding by students

Concepts	ASR 3	USR 2	NR 1	Total	Sample size	Mean	Remark
1	66	214	21	301	150	2.00	Understood
2	60	54	103	217	150	1.45	Not understood
3	90	100	70	260	150	1.73	Understood
4	66	92	82	240	150	1.60	Understood
5	66	112	72	250	150	1.67	Understood
6	165	88	51	304	150	2.03	Understood
7	144	74	65	283	150	1.89	Understood
8	30	94	93	217	150	1.45	Not understood
9	27	50	116	193	150	1.27	Not understood
10	54	236	14	304	150	2.03	Understood
11	57	126	68	251	150	1.67	Understood
12	84	60	92	236	150	1.57	Understood
13	12	36	128	176	150	1.73	Understood
14	108	96	66	270	150	1.80	Understood
15	33	92	93	218	150	1.45	Not understood
16	48	24	122	194	150	1.29	Not understood
17	42	96	88	226	150	1.51	Not understood
18	96	52	92	240	150	1.60	Understood
19	60	104	78	242	150	1.41	Not understood
20	27	38	122	187	150	1.25	Not understood
21	3	16	141	160	150	1.07	Not understood
22	108	96	66	2.70	150	1.80	Understood
23	90	94	73	257	150	1.71	Understood

Table 17. Raw Score and indices for concepts understanding by students (continued)

Concepts	**ASR 3**	**USR 2**	**NR 1**	**Total**	**Sample Size**	**Mean**	**Remark**
24	111	82	72	265	150	1.77	Understood
25	117	68	77	262	150	1.75	Understood
26	51	50	108	209	150	1.39	Not understood
27	3	34	132	169	150	1.13	Not understood
28	21	26	130	177	150	1.18	Not understood
29	6	54	121	181	150	1.21	Not understood
30	0	32	134	166	150	1.11	Not understood
31	39	78	98	215	150	1.43	Not understood
32	114	128	48	290	150	1.93	Understood
33	66	88	84	238	150	1.49	Not understood
34	27	128	77	232	150	1.55	Understood
35	21	50	118	164	150	1.09	Not understood
36	42	28	122	192	150	1.28	Not understood
37	21	44	121	186	150	1.24	Not understood
38	63	88	85	236	150	1.57	Understood
39	21	12	137	170	150	1.13	Not understood
40	162	62	65	289	150	1.93	Understood

Total Mean($\overline{X}$) Index Understanding 61.47

Mean ($\overline{X}$)1.54

Table 17 shows a total of 61.47 or an average mean index of understanding of 1.54 for the students only. Concepts with the understanding index of 1.54 and above were considered understood by the students. From this table concepts with serial numbers: 1,3,4,5,6,7,10,11,12,13,14,18,,22,23,24,25,32,,34,38 and 40 had index of understanding as or above 1.54, hence they considered understood by the students.

Table 18. Raw score and indices for concepts understanding by the adult students

Concepts	**ASR 3**	**USR 2**	**NR 1**	**Total**	**Sample Size**	**Mean**	**Remark**
1.	57	220	21	298	150	1.99	Understood
2.	51	22	122	195	150	1.30	Not understood
3.	99	118	58	275	150	1.83	Understood
4.	66	124	65	255	150	1.70	Understood
5.	57	130	66	253	150	1.67	Understood
6.	177	122	50	289	150	1.92	Understood
7.	144	84	60	288	150	1.92	Understood
8.	30	104	88	223	150	1.49	Not understood
9.	15	56	117	188	150	1.25	Not understood
10.	33	52	113	198	150	1.32	Not understood
11.	72	140	56	268	150	1.79	Understood
12.	75	60	95	230	150	1.53	Understood
13.	18	32	128	178	150	1.19	Not understood
14.	90	84	78	252	150	1.68	Understood
15.	45	94	88	275	150	1.51	Not understood
16.	51	54	106	209	150	1.39	Not understood
17.	33	116	81	230	150	1.53	Understood
18.	123	82	68	273	150	1.82	Understood
19.	42	104	84	230	150	1.43	Not understood
20.	18	24	132	174	150	1.16	Not understood
21.	9	64	115	188	150	1.25	Not understood
22.	105	116	57	278	150	1.90	Understood
23.	51	120	73	244	150	1.63	Understood
24.	81	104	71	256	150	1.71	Understood
25.	114	117	73	304	150	2.03	Understood
26.	54	48	108	210	150	1.40	Not understood
27.	3	16	141	160	150	1.07	Not understood
28.	21	12	137	179	150	1.19	Not understood
29.	33	50	118	201	150	1.39	Not understood
30.	6	18	139	163	150	1.09	Not understood
31	48	80	94	222	150	1.50	Not understood
32.	96	184	26	306	150	2.04	Understood
33.	63	84	87	234	150	1.46	Not understood
34	39	122	76	237	150	1.58	Understood
35.	6	64	116	186	150	1.24	Not understood
36.	33	48	115	196	150	1.31	Not understood
37.	12	62	115	189	150	1.26	Not understood
38.	63	108	75	246	150	1.64	Understood
39.	9	10	142	161	150	1.07	Not understood
40.	165	52	69	286	150	1.91	Understood
Total Mean Index of Understanding=61.24							
Mean ($\bar{X}$)**=1.53**							

Table 18 above shows a total of 61.24 (or an average mean of 1.53) for concepts understanding by the adult students only. Concepts with the understanding index of 1.53 and above were considered understood by the adult students. Table 18 shows that the concepts with serial numbers 1, 3, 4, 5, 6, 7, 11, 12, 14,17, 18, 22, 23, 24, 25, 32, 34, 38 and 40 were understood by adult students. Furthermore on how is the understanding levels of environmental concepts of Students and Adults differ. Mean, variance and standard deviation were further used to answer this sub objective as shown in the tables 19, 20 and 21 below.

Table 19. Concepts and their understanding index by the students

Serial Number of Concepts	**Understanding Index**
1	2.01
2	1.45
3	1.73
4	1.60
5	1.67
6	2.03
7	1.89
8	1.45
9	1.27
10	2.03
11	1.67
12	1.57
13	1.73
14	1.80
15	1.45
16	1.29
17	1.51

Table 19. Concepts and their understanding index by the students (continued)

Serial Number of Concepts	**Understanding Index**
18	1.60
19	1.61
20	1.25
21	1.07
22	1.80
23	1.71
24	1.77
25	1.75
26	1.39
27	1.13
28	1.18
29	1.21
30	1.11
31	1.43
32	1.93
33	1.59
34	1.55
35	1.09
36	1.28
37	1.24
38	1.57
39	1.13
40	1.93
TOTAL	**61.47**
MEAN ($\overline{X}$)	**1.54**

The Mean score for understanding for students is 1.54

Table 20. Concepts and their understanding index by the adult student

Serial Number Concepts	**Understanding Index**
1	1.99
2	1.30
3	1.83
4	1.70
5	1.97
6	1.92
7	1.92
8	1.49
9	1.49
10	1.32
11	1.79
12	1.53
13	1.19
14	1.68
15	1.51
16	1.39
17	1.53
18	1.82
19	1.53
20	1.16
21	1.25
22	1.90
23	1.63
24	1.71
25	2.03
26	1.40
27	1.07
28	1.19
29	1.09
30	1.09
31	1.50
32	2.04
33	1.56
34	1.58
35	1.24
36	1.31
37	1.26
38	1.64
39	1.07
40	1.97
Total	61.24
Mean ($\overline{X}$)	1.53

The understanding mean score for the adults is 1.53.

Table 21. Summary of the extent to which students and adults differ in their understanding of the environmental concepts

Respondent	Size	Mean($\bar{X}$)	Variance	Standard Deviation
Students	150	1.54	0.080	0.28
Adults	150	1.53	0.082	0.29

Table 21 above showed students had a higher mean of 1.54 and standard deviation of 0.28 on their level of understanding of some environmental concepts than their adult counterpart who had a mean ($\bar{X}$) of 1.53 and also a standard deviation of 0.29 on the environmental concepts. The result on table 21 shows the variance for the students to be 0.080 and 0.082 for the adult student. Students and Adult differ slightly by their mean, variance and standard deviation in their understanding of environmental concepts.

4.5. Difference in Understanding Level of Students and Adults According To Their Demographic Status

The fifth sub-objective of this study is "How is the understanding level of students and adults differing according to their demographic status?" This sub-objective was determined based on Pearson Product Correlation Coefficient.

Table 22. Summary of Correlation coefficient between students and their demographic status.

S/N	Demographic factor	N = 150	r	Significance
1	Economic Level	150	0.986	0.000
2	School Location	150	0.953	0.000
3	School Type	150	0.969	0.000
4	Gender	150	-1.118	0.000
5	Age	150	1.319	0.000
6	Family System	150	0.982	0.000
7	Occupation	150	0.969	0.000

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, economic level has a correlation of r = 0.986, approximately 1 indicating positive linear relationship between students and their economic level.

Furthermore, it can be reported that, the basis to which students understand environmental concepts is greatly associated or related to their economic level.

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.953, approximately 1 indicating positive linear relationship between students and their school location. Therefore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their school location.

School type, r = 0.969, approximately 1 indicating positive linear relationship between students and their school type. Therefore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their school type.

Gender, r = -1.118, approximately -1 indicating negative relationship between students and their gender. Furthermore, it can be reported that, the basis to which students understand environmental concepts is not associated or related to their gender.

Age, r = 1.319, approximately 1 indicating positive linear relationship between students and their school age. Therefore, it can be said that, the basis to which students understand environmental concepts is slightly associated or related to their age.

On family system, r = 0.982, approximately 1 indicating positive linear relationship between students and their family system. Furthermore, it can be reported that, the basis to which students understand environmental concepts is related to their family system.

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.969, approximately 1 indicating positive linear relationship between students and their occupational status. Furthermore, it can be reported that, the basis to which students understand environmental concepts is related to their occupational status.

Table 23. Summary of correlation coefficient between adults and their demographic status.

S/N	Demographic status	N = 150	r	Significance
1	Economic Level	150	0.969	0.000
2	School Location	150	0.959	0.000
3	School Type	150	0.959	0.000
4	Gender	150	-0.931	0.000
5	Age	150	0.403	0.000
6	Family System	150	0.982	0.000
7	Occupation	150	0.953	0.000

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.0969, approximately 1 indicating positive linear relationship between students and their school location. Furthermore, it can be reported that, the basis to which adults understand environmental concepts is greatly associated or related to their economic level.

School location, r = 0.959, approximately 1 indicating positive linear relationship between students and their school location. Therefore, it can be said that, the basis to which adults understand environmental concepts is greatly associated or related to their school location.

For school type, r = 0.959, approximately 1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their school type.

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = -0.931, approximately -1 indicating negative relationship between students and gender. Furthermore, it can be reported that, the basis to which adults understand environmental concepts is not associated or related to their gender.

For age, r = 0.403, approximately 0 indicating no relationship between adults and their ages. Furthermore, it can be said that, the basis to which students understand environmental concepts is has no influence to their ages.

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.982, approximately 1 indicating positive linear relationship between students and their school location. Therefore, it can be said that,

the basis to which adults understand environmental concepts is greatly associated or related to their family system.

For occupation, r = 0.953, approximately 1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which adults understand environmental concepts is greatly associated or related to their occupation.

Table 24. Summary of correlation coefficient between students and adults and their demographic status

S/N	Demographic status	N = 150	Students r =	Adults r =	Significance
1	Economic Level	150	0.986	0.969	0.000
2	School Location	150	0.953	0.959	0.000
3	School Type	150	0.969	0.959	0.000
4	Gender	150	-1.118	-0.931	0.000
5	Age	150	1.319	0.403	0.000
6	Family System	150	0.982	0.982	0.000
7	Occupation	150	0.969	0.953	0.000

Table 24 above revealed that students and adults understanding of environmental concepts is closely related to their economic level as they have a positive correlation values of 0.986 and 0.969 respectively.

Students and adults understanding of environmental concepts is also related to their school location whether in the urban or rural area. They have values of 0.953 and 0.959 respectively indicating a positive correlation of their understandings.

Students and adults understanding of environmental concepts is also dependent on their school type whether private or public. Students have a positive value of 0.969 and adults also have a positive value of 959.

Gender has negative correlation in understanding environmental concepts for both students and adult. Students have a negative value of – 1.118 and adults have a negative value of – 0.931. This signifies that gender has no role in enhancing understanding of environmental concepts.

The table also revealed that students age influences understanding of environmental concepts with the value of 1.319 while their adults counterpart are indifferent about role of age in influencing understanding of environmental concepts, their correlation value is 0.403.

Family system (Monogamy/Polygamy/Polyandry has a positive correlation with both students and adults understanding of environmental concepts. They have same values of 0.982.

On occupation as a demographic factor influencing the understanding of environmental concepts on students and adults, there is a positive correlation that occupation is one of the dominant factors to be considered with students' correlation value of 0.969 and adults correlation value of 0.953.

4.6. Reasons for Misconception about Environmental Concepts

The sixth sub-objective of this study is, "what are the reasons for misconception about environmental concept"? This sub-objective was determined based on frequencies and percentages. Interviews were conducted on students and adults by the researcher as revealed in table 25 below. The table showed students and adults' reasons for misconception about environmental concepts.

Table 25. Frequencies and percentages of respondents' responses from the result of the interview as reasons for misconception on some environmental concepts

S/N	Reasons for misconception adopted from Mang (2009)	Number of respondents	Frequencies (F)	Percentages %
1	Over simplification of concepts (OSC)	100	00	00
2	Language problem (LP)	100	52	52
3	Teachers pedagogical problem (TPP)	100	79	79
4	Misconception from family members (MFM)	100	00	00
5	Students attitude to biology (SAB)	100	63	63
6	Topic not taught (TNT)	100	55	55
7	Abstractness of concept (AC)	100	81	81
8	Distance from school (DFS)	100	16	16
9	Forgetfulness (F)	100	3	3

The reasons for misconception shown in table 25 were adapted from Mang (2009), as reasons for misconception on genetic concepts. Following the result of the interview conducted on students using these factors by Mang (2009), the frequencies and percentages of students responses on each factor as reason for misconception on the selected environmental concepts were presented in this table 23. 81% of the respondents showed that abstractness of concepts (AS) was the major reasons for their misconception, 79% indicated that the reason for their misconception was teachers' pedagogical problem (TPP), 63% was due to students attitude to biology, 55% said most topics were not taught (TNT) and 52% gave their reasons for misconception as Language problem (LP). Other minor reasons not given by Mang (2009) but in students responses included Distance from school 16% and Forgetfulness 3%.

The result of this finding supported the observation made by Scoon (1995) in Duguryil, Duguryil and Mutkirest (2014) that many misconceptions originate in the class room and that many pre-service teachers of elementary education have many of the same misconceptions that their future students would have. Duguryil and Duguryil (2002) seems to support the idea that student's attitude to biology would result to misconception as they opined that students do come into the class with some ideas about some science concepts which are scientifically not accepted and that these students find it difficult to change their misconception even after instruction. In another view, Damar, (2005) opines that lack of understanding a concept would result to misconception and hence present problems for understanding the conceptual links of such concepts. It is therefore evident that reasons for misconception can arise from students.

4.7. Students' and Adults' Thoughts on How to Solve or Overcome the Problem of Environmental Misconception

The seventh sub-objective of this study was "How can these reasons be solved or overcome"? This sub-objective was determined by using frequencies and percentages based on the outcome of the interview conducted on students and adults as presented in table 26. The table summarizes students' and adults' reasons for misconception about environmental concepts and what can be done to solve or overcome it.

Table 26. Frequencies and percentages of respondents' responses from the result of the interview on how to solve or overcome the misconception problems on some environmental concepts

S/N	Solution	Number of respondents	Frequencies (F)	Percentages %
1	More practical (MP)	100	78	78
2	Simple and clear English (SCE)	100	76	76
3	Use of teaching aids (UTA)	100	73	73
4	More time for questioning (MTQ)	100	68	68
5	Prompt evaluation	100	78	78

Table 26 above shows the solution for their misconception to include more practical's in ecological/environmental courses, 78% of the students indicates this, 76% were of the opinion that simple and clear English should be used in the teaching of ecological/environmental topics, 73% said teaching aid should be used, 68% suggested that more time should be made available during ecological/environmental lessons ,and lastly 78% also said prompt evaluation of ecological/environmental assignments and work should be ensured.

Furthermore, Hersback (1995) suggested that to overcome misconception, science teaching should spend more time on exploration and artistic excursion that promote deep-level thinking and less students fear of failure. Duguryil et. al (2004) had also noted that teachers need to identify the misconceptions commonly held by students in certain areas of individual science subject in order to select relevant learning materials and organized them in such a way that would challenge the misconception thereby helping the students. This is to say that to overcome misconception of concepts by students the teachers should sit up to their responsibilities in planning instruction and the learning environment. The student should also be ready to learn by developing the right attitude to help them overcome the misconceptions they are holding.

CHAPTER V
DISCUSSION OF RESULTS

The findings of the result of the first sub-objective were presented in tables 6, 7, and 8. Table 6 revealed that only 25 students got 20 marks and above which is 16.67% of the students (respondents). 125 of them, representing 83.33% failed the test. Therefore, from the table 6, it can be said that the achievement test level of students was 16.67 %. On the other hand, finding of the result on achievement test on adults in table 5 revealed that Only 9 adult students scored 20 and above which is 13.33% while 141 of the adult respondents representing 94% failed the achievement test. Therefore, the achievement level of the adults was 13.33 %. Consequent upon this as revealed in table 6 there is a little difference between the students mean score of 13.37 and adults mean score of 12.20. Standard Deviation for students was 6.20 and standard deviation for adults was 4.60. This indicates the level of achievement of students and adults on environmental concept.

The findings of the second sub-objective are presented in tables 9, 10 and 11. Table 9 revealed the achievement level of students according to demographic variable. The first demographic variable is economic level. Under the economic level, it was discovered that out of the 150 sampled students, 146 are from the low income class and the remaining 4 students are from the lower middle income class, no student from the high income class. Out of the 146 that came from the low income class, none had distinction on ECAT, 76 (50.66%) had credits and 70 (46.66%) failed. This result is not encouraging. 4 students that came from lower middle income class, 3 (2%) had credits and only 1 (0.66%) failed. It can be said that economic level plays vital role in academic achievement of students as about 70 (46.66%) from the low income class failed and only 1 (0.66%) from the lower middle income class failed.

The result on school location revealed that out of the 150 sample students, 22 indicated that their school is located at the urban area and they equally lived in urban area. 128 indicated that they are from rural area and their schools are located in rural areas. Of the school that is located in the urban area, 2 (1.33%) students had distinctions, 18 (12%) had credits and 2 (1.33%) failed. No student with distinction from schools situated in the rural areas, 60 (40%) had credits and 68 (45.33%). From this result, greater percentage of the students 68(45.33%) from schools in rural area

failed the ECAT. It can therefore say that students failed the ECAT because most of the schools are from rural area and lack basic instructional facility. Mang, (2009) stated that lack of instructional facility will affect students' academic achievement.

The result on school type revealed that 90 of the 150 students attend public school while the remaining 60 attend private schools. No student had distinction amongst those that attended public school, 40 (26.66%) had credits, 50 (33.33%) failed. 6 (4%) students that attended private schools had distinction, 37 (24.66%) had credits while 17 (11.33) failed. The combined percentages of those that failed from public and private school is high, therefore, school type as a demographic factor influences academic achievement of students.

On gender, 95 of the students are males and the remaining 55 are females. 4(2.66) of the males had distinction, 40 (26.66%) had credits and 51 (34%) failed. 3(2%) of the females had distinction, 20 (13.33%) had credits and 32 (21.33%) failed. The difference in percentages between those that had distinctions is .66, which is insignificant. This goes to confirm what Okebukola (2004) said that difference between the academic achievements of males has reduced considerably. The study considered the ages of students from 10 -17 years. 3 (2%) had distinctions, 65 (43.33%) had credits and 82 (54.66%) failed. The percentage of those that failed, 54.66% is greater than the combined percentage of those that passed (distinction/credit).

The result on the family system as a demographic variable revealed that 90 of 150 students are from monogamous homes while 60 of 150 students are from polygamous home. No student is from polyandrous home. 4 (2.66%) students from monogamous home had distinctions, 40 (26.66%) had credits, 46 (30.66%) failed. No student from polyandrous home had distinction, 25 (16.66%) had credits, 35 (23.33%) failed. Those from monogamous homes had distinctions and perform better than those in polyandrous homes.

On occupation as a demographic variable in students' achievement, 121 out of 150 are students, they do not engage in any form of labor after school. 9 engaged in farming after school and 20 engaged in business after school hours. 3 (2%) of the student that do not engage in any form of activity had distinctions, 51 (34%) had credits, 67 (44.66%) failed. No student had distinction amongst those that goes to farm after school hours, 3(2%) had credits and 6 (4%) failed. No student with distinction amongst those that engaged in business after school, 8 (5.33%) had

credits and 12 (8%) failed. This shows that those students that only study without engaging in any form of activity perform better than the students that engaged in other forms of activity after school hours.

Table 10 revealed achievement level of adults with respect to demographic status. Economic level of adults revealed that 146 of the adults are from low income class, 4 are from lower middle class and none from high income class. No adult from the low income class had distinction, 72 (48%) had credits, 74 (49.33%) failed. From the lower middle income class, none had distinction, 2 (1.33%) had credits and 2 (1.33%) failed. No adult from the high income class. More adults from the low income class failed compare to those in the lower middle income class. From these results, students in low income class that comes from the rural area have difficulty in assessing educational materials thereby impacting negatively on their academic achievement (Ango, 2003).

Data from the school location for adults revealed that 22 of the 150 adults sampled indicated that 22 of the school of the adults' schools are from the urban area, and the 128 are from the rural area. 2 (1.33%) of the students in urban area had distinction, 18 (12%) had credits and 2 (1.33) failed. No adult from the rural area had distinction, 60 (40%) had credits, 68 (45.33%) failed. This data indicates that schools in urban areas had adults with distinction while no adult with distinction in rural area.

Results from school type revealed that 90 of the 150 adults attended public schools while the remaining 60 of the 150 adults attended private schools. No student in public school had distinction, 40 (26.66%) had credits and 50 (33.33%) failed. 6 (4%) of the adults in private schools had distinction, 37 (24.66%) had credits while 17 (11.33%) failed. The data shows the performance of adults in private school is better than those in public schools.

On gender, 92 of the adults are males and the remaining 58 are females. 1(0.66%) of the males had distinction, 43 (28.66%) had credits, 48 (32%) failed. No female adult had distinction. 23 (15.33) had credits, 35 (23.33%) failed. The age of adults ranges from 19 – 30 years. 3 (2%) had distinctions, 65 (43.33%) had credits while 82 (54.66) failed. Greater percentage (54.66%) of the adults failed the ECAT.

Results from the family system revealed that 90 of the 150 adults are from monogamous homes, 60 of 150 adults are from polygamous homes and none from polyandrous home. 3 (2%) of adults from monogamous home had distinction, 41 (27.3%) had credits, 46 (30.66%) failed. No adult from polygamous home had

distinction, 24 (16%) had credits, 36 (24%) failed. Results indicate that adults from monogamous home achieved higher grades than those in polygamous homes.

The results on occupation revealed that 112 of 150 are students, they do not engage in any form of activity apart from their studies. 9 engaged in farming after school hours and 29 engaged in business after school hours. Of the 112 that concentrate on their studies/books after school hours, 5 (3.33%) had distinction, 33 (22%) had credits, 74 (49.33) failed. On those that goes to farm after school hours, none had credit, 5 (3.33%) had credits and 4 (2.66%) failed. Those adults that engaged in business after school hours, none had distinction, 10 (6.66%) had credits, 19 (12.66%) failed. Despite the fact that 112 of the 150 students concentrate on their studies, yet their result on the ECAT is not encouraging as 49% failed,

Table 11 summarizes the result of the achievement of students and adults as it relates to their demographic status. Obande, (2006) opined that demographic factors influences academic achievement of students. Adi, (2019) argued that school location had tremendous effect on students achievement. This was supported by Ango, (2003). 128 of students indicated that their school is from the rural area, 124 adults also indicated that their school is from the rural area. Akinmade (2008) posited that schools located in the urban areas tend to achieve higher grades in school than schools located in the rural area, this was demonstrated in this study as 68% failure for students that sat for ECAT and their schools are located in rural as against 2 % of the students that their schools were located in the urban area. 62% failure for adults that their school was located in the rural area as against 4% failure for schools located in urban area, this is a confirmation of what Akinmade (2008) posited. Demola and femi (2004) posited that family system affect achievement of students, this was demonstrated in the marks score for students and adults that came from monogamous and polygamous homes, those from monogamous homes had 40 (26.66%) credit while those in polygamous homes had 25 (16.66%) credit.

The third sub-objective was determined and treated in tables 11, 12, 13 and 14. Tables 11, 12, 13 and 14, revealed that most students did not understand some of the concept found in their curriculum. These concepts were Climate change, Xerophyte, Biome, Climax vegetation, Wilting, Savanna, Edaphic factor, Ecological Niche, Photic Zone, Aestivation, Endangered species, Conservation, Turbidity, Hydrophytes, Succession and Poikitothermy. Table 11 shows that the students understanding and explanation on the selected environmental concept was low as

indicated by their percentage YES Responses and the Acceptable Scientific Responses (ASR). Table 11 indicates that the respondent had only 38.22% YES responses, 61.83% NO Reponses. However, considering the percentage Acceptable Scientific Responses (ASR), Unacceptable Scientific Response (USR) and NO Response (NR) only 12.98 of the student on this table gave Acceptable Scientific Response, 26.45% gave Unacceptable Scientific Response (USR) and 60.57% NO response (NR). This low level of understanding the concepts by the students was made evident in failure of most of the student to understand the achievement questions correctly**.** More so, table 14 shows that the students (both students and adults) had a mean understanding index for understanding the concepts as 1.52 and a standard deviation of 0.30. This low performance goes to confirm the chief examiners report, WAEC (2002) that student had poor understanding of questions related to ecology/environment and the nervous system. More so, Okeke and Ochuba (1986) opined in a research finding that students poor performance over the years in biology was particularly related to the fact that student do not fare well in environmental question items.

The fourth sub-objectives was determined based on respondents' responses as presented in tables 16, 17, 18, 19, 20 and 21. It shows the extent to which the students and adults differ in their understanding of environmental concepts. The tables 16, 17 and 18 showed that the total of 19 concepts out of the 40 were understood by students; since these concepts had indices of understanding at or above the mean index of 1.54 for the students and 1.53 for the adults with a standard deviation of 0.28 and 0.29 respectively as summarized in table 21. Concepts Pollution, Global warming, Adaptation, Biosphere, Desert, Overcrowding, Ecology, Tropical Forest, Energy Transfer, Biotic Factor, Food Chain, Bush Fallowing, Overgrazing, Vegetation, Pollutants, Population, Competition, Ecosystem, Terrestrial Habitat and Nuclear were understood by both categories of students. The concept understood by the student respondents which the adults' respondents failed to understand where the concepts climax vegetation and wilting. While the only concepts understood by the adult respondents which the student respondents failed to understand was Energy transfer. This shows that the students and adults differ in some way in their understanding of the selected environmental concepts. This difference is further revealed by their percentage scientific responses of Acceptable Scientific Response (ASR) of 13.12% for the students and 12.51% for the adults.

This goes to a large extent to show that though a difference exist in the understanding of students' and adults' respondents on the selected concepts as shown on table21, yet, the difference is not significant this is supported by the work of Braimoh and Benjamin (1997), that age and gender differences in educational achievement have decline considerably. Insignificant difference in the understanding of environmental concepts by students and adults goes to confirm the fact that students and adults understanding of environmental concepts is not encouraging.

The fifth sub-objective is been discussed in table 22. It is students' correlation coefficient of understanding according to demographic status, the table showed the calculated "r" of 0.988 at 0.000 level of significance. This indicates that there is positive correlation between students' understanding and their demographic factors. This shows that understanding environmental concepts has a positive relationship with their demographic status. The extent to which students will perform academically is dependent on their demographic credentials. Students from schools situated in urban areas with the school stock with instructional facilities like libraries and laboratories tend to perform better academically than students that do not get access to these facilities (Ango, 2003).

Table 23 is adults' correlation coefficient of understanding according to demographic status the table showed the calculated "r" of 0.904 at 5% level of significance. This indicates that there is a positive correlation between adults understanding and their demographic factors. This goes further to show that understanding of environment concepts has a positive relationship with their demographic status. The extent to which adults will perform academically is also dependent on their demographic credentials. Ango, (2003) posited that, Students from schools situated in urban areas with the school stock with instructional facilities like libraries and laboratories tend to perform better academically than students that do not get access to these facilities.

Table 24 is a summary of students and adults demographic variables as it relates to their academic achievement. The summary table revealed that economic level, school location, school type, family system and occupation demographic variables had positive linear relationship to academic achievement meaning students and adults' academic achievement correlates with their demographic status. Gender for students ($r = -0.931$) and adults ($r = -1.118$) had negative correlations with academic achievement meaning academic achievement is not dependent on gender.

Age for students (r = 1.319) and adults (r = 0.403) indicating no relationship meaning age contribution to academic achievement is neither positive nor negative, it is indifferent.

The sixth sub-objective was determined based on the outcome of respondents' result as shown in table 25. It presented reasons for misconception by the students and adults. From the findings on these, factors that account for misconception by the students and adults were abstractness of concepts (AC) 81%, Teacher pedagogical problems (TPP) 79%, students attitude to biology (SAB) 63% language problems (LP) 52%, distance from school (DFS) and forgetfulness (F) account for 16% and 3% respectively.

The seventh sub-objective was determined based on the respondents' responses as shown in table 26. It presented solutions on how to solve or overcome such misconceptions. Ways suggested by students and adults as solutions were more practical and prompt evaluation (MP) 78%, (PE) 78%, simple and clear English (SCE) 76%, use of teaching aid (UTA) 73% and more time for questioning 68%. Supporting these suggestions given by the students, Cohen et al (2001) and Hersback (1995) opined that teachers can ask student open ended and probing question and also spend more time on exploration and artistic excursion that provoke critical thinking.

Educational achievement has reliably been considered as a significant result of students exercises. Despite the fact that there is overwhelming examination on the connection between the two, the outcomes so far have been conflicting. There are two significant points of view on this relationship. For instance, Zhu (2010) uncovered that there was a noteworthy and moderately solid connection between's understudy exercises and scholarly accomplishment, and King (2015) set that scholastic accomplishment was emphatically corresponded with social and passionate commitment. Pietarinen, Soini, and Pyhältö (2014) found a positive relationship between's psychological exercises/projects and scholastic accomplishment. The proposed instrument fundamental these connections is that understudy exercises advances scholastic achievement (Crossan, Field, Gallacher, and Merrill, 2003), which in this way advances students' accomplishment with the ideal learning exercises, subsequently framing "a righteous cycle of learning" (Lei, Xu, Shao, and Sang, 2015; Wäschle, Allgaier, Lachner, Fink, and Nückles, 2014). A few specialists have opined that the positive relationship among's understanding and

scholastic accomplishment is increasingly self-evident (Furrer and Skinner, 2003). Taken together, the discoveries in these investigations demonstrated that various parts of students and adults comprehension have contrasting associations with scholastic accomplishment.

Be that as it may, different researchers didn't arrive at comparative resolutions, and in certain investigations scientists have not by any means discovered any noteworthy connection among's understanding and scholarly accomplishment. For instance, Shernoff and Schmidt (2008) found that students understanding didn't foresee grade point normal among African-Americans. Chen, Yang, Bear, and Zhen (2013) additionally saw that no critical relationship between students understanding and academic achievement. Shernoff (2010) called attention to that there was no critical connection between students dynamic passionate commitment and their arithmetic and English accomplishment scores. Appleton et al. (2006) found that the relationship between subjective understanding and scholarly accomplishment was feeble. A potential clarification for these outcomes may be that understudies who accomplish passing marks ace the aptitudes expected to learn content rapidly, in this manner dedicating less time to contemplating. Conversely, understudies who get less than stellar scores don't have an excellent establishment of aptitudes that help them adapt, so they experience issues getting passing marks in any event, when they endeavor to connect more.

Achievement in adults and students' examination has given an intricate confirmation of the accomplishment objective structure (Elliot, 2005). Hulleman, Schrager, Bodmann and Harackiewicz (2010) noticed that in the past 25 years there had been more than 1,000 examinations explicitly worried about achievement hypothesis. In any case, a genuine restriction of this investigation is that it has been done with tests involving understudies between the ages of 12 - 17 years and grown-ups between the ages of 17 - 30 years. The generalizability of findings from achievement and understanding exploration requests an investigation of different classifications of understudies to encourage confidence that the consistency of research findings is in reality appropriate to the more extensive populace of understudies going to auxiliary schools. In the couple of concentrates utilizing more seasoned grown-up populaces to inspect accomplishment objectives, key parts of accomplishment objectives have been discarded. For instance, Eppler and Harju (1997) thought about customary (more youthful) and non-conventional (more

seasoned) understudies in their reception of dominance and execution objectives. They found that non-customary understudies got higher scores than conventional understudies on accomplishment, yet the two gatherings didn't vary in their appropriation of execution objectives. Sadly, the stock utilized in this investigation didn't quantify dominance shirking or execution evasion objectives, and the members included just 50 grown-up students. Sachs (2001) further placed that dominance objectives appeared to encourage inherent inspiration however not scholastic fulfilment among low maintenance understudies matured somewhere in the range of 30 and 40 at the University of Hong Kong. Be that as it may, Sachs opined that exhibition objectives were frequently unessential for grown-up students, thus he didn't quantify the selection of execution objectives in his example.

Most investigations on achievement have included both male and female members. In any event, when significant contrasts have been found (Elliot and Thrash, 2002) in any case, scientists have decided not to remark on these findings, apparently in light of the fact that sexual orientation was an accidental variable instead of the focal point of request. Hyde and Durik (2005) looked into past investigations that had inspected sexual orientation contrasts in accomplishment. They specifically featured the absence of announcing of results and noticed that 'sexual orientation was seldom the focal point of these investigations' (p. 385). When significant contrasts were later discovered, young ladies and ladies had commonly detailed more elevated levels of achievement than young men and men in spaces, for example, language, expressions, and brain research yet not in science or arithmetic. All things considered, the general picture currently is that sexual orientation doesn't assume a significant job in achievement. An intriguing factors with regards to the present research was segment factors, for example, age, sex, monetary level, region, occupation. To think about accomplishment in optional training, scientists have commonly utilized the Patterns of Adaptive Learning Styles (Midgley et al., 2000). The distinctions in instrumentation and their suggestions for hypothesis improvement were plot by Hulleman et al. (2010), however strangely, the issue of age as a variable has not been satisfactorily tended to. In an investigation of grown-ups beyond 50 2006 years old, (2006) opined that 'develop understudies are a differing and heterogeneous gathering, with the 'truth' of their experience(s) being excessively mind boggling, excessively separately arranged, for significant portrayal generally' (p. 120). It along these lines follows that regarding grown-up students as a solitary

populace would be hazardous. In the present examination, grown-ups were contemplated alongside understudies. Interestingly, the grown-ups in this examination were in a study hall circumstance, the analyst had satisfactory power over them not as placed by Waller (2006).

In looking at adults and students, Elliot and McGregor's (2001) placed in their presentation approach study that grown-up students are similarly as likely as more youthful understudies to embrace authority approach and execution evasion objectives. Though Eppler and Harju (1997) found no distinction among conventional and non-customary understudies in their appropriation of execution objectives, be that as it may, this investigation understudies were considerably less likely than Elliot and McGregor's (2001) members to show execution approach objectives. This is more in accordance with Sachs' (2001) recommendation that accomplishment is frequently superfluous for grown-up students. On its substance, at that point, accomplishment may not be as significant for grown-up students as they are for more youthful students. All things considered, a key distinction between this investigation and that of Eppler and Harju (1997) is that this examination is directed in a study hall circumstance and not on a separation learning circumstance. The present investigations tried to know the understanding degree of understudies and grown-up on natural issues and how this issues impacts their scholastic accomplishment in assessment/application circumstance. In a few past investigations, analysts have, without a doubt, thought about that the connection among understudy and grown-up understanding and scholastic accomplishment may be affected by different factors, for example, (a) the technique for detailing understudy exercises (chiefly for social and enthusiastic commitment), (b) social worth, and (c) sexual orientation. Dweck and Elliott (1983; Dweck, 1986) recommended that accomplishment included two wide kinds of objectives: learning objectives (trying to build one's skill, comprehension, or dominance) and execution objectives (looking for good decisions or maintaining a strategic distance from negative decisions of one's capability from others). The two kinds of objectives could advance dominance situated conduct. Their outcomes recommended that the relationship between understudies' accomplishment and comprehension was interceded by their ingenuity, exertion, and association in their investigations.

There have not yet been any deliberate investigations of how the technique for revealing students and adults segment status may impact the outcomes recorded

on the connection among understudy and grown-ups understanding and scholastic achievement In any case, in some experimental investigations the outcomes have demonstrated that the connection between's segment variables and scholastic achievement changes significantly between self-revealed or other-announced proportions of study, with the slight contrasts watched for segment effect on scholarly accomplishment. For instance, Fall and Roberts (2012) found that the Pearson connection coefficient between educator revealed social commitment and scholarly accomplishment was .48, though that for understudy self-announced conduct commitment was just 0.27. Also, Furrer and Skinner (2003) found that the Pearson connection coefficients of educator revealed conduct and enthusiastic commitment with scholarly achievement were 0.57 and 0.53, individually, while those for understudy detailed commitment were 0.33 and 0.19. Generally speaking, at that point, the strategy for revealing students and adults' comprehension might be a key variable impacting the connection between understudy action and scholastic accomplishment.

As to factors, the researcher concentrated on economic level, school type, region, sex, age and occupation. In a few examinations the outcomes have indicated that understudy and grown-ups contrasts generously with a person's social foundation, with discoveries showing this effects affects the relationship among students and adults understanding and scholastic accomplishment (Shernoff and Schmidt, 2008).

At present, there have been moderately barely any examinations led in which the discoveries have shown that sex is a key variable impacting the relationship amongst students and adults understanding and scholarly accomplishment. In any case, in one Chinese examination the scientists found that, contrasted and young men, young ladies' understanding was all the more firmly related with scholarly accomplishment (Wen, Zhang, Yu, and Dai, 2010). Then again, this examination discovered relationship amongst students and adults understanding and their educational achievement.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

This research work sets out to analyse environmental concept understanding and achievement and determining the misconception according to students' and adults' opinions. This chapter however, deals with the conclusion, implication of the findings, recommendation and suggestion for further research.

6.1 Conclusion

This study revealed that demographic factors such as low income earners and schools situated in rural area where there is no access to educational materials like library, laboratory contributes negatively towards making students and adults to achieve low grades in their examinations. Though students and adults differ in their understanding of the selected environmental concepts, yet the difference was not significant. It was revealed that the understanding of both categories of students and adults on the selected concepts was low as most of the concepts presented in their curriculum were not understood by them, majority of the students show wrong explanations on the concepts they claimed to have understood as follows:

Biomass	-	Community of living organism of same species
Photic zone	-	Method of survival during dry period
Endangered species	-	Harmful to their habitat
Succession	-	Have victory
Pollutants	-	Transfer of pollen from the stamen
Competition	-	In sport or field event
Climax vegetation	-	Temperate agricultural region
Gills	-	Wings of fish
Edaphic factor	-	plants found in the soil.

This however shows that teachers need to tidy their belt in selecting and organizing learning instruction that will yield the desired outcome couple with student right attitude to learn. This poor performance of students in environmental concepts can also be translated that people are not adequately informed about the dangers of not conservation our natural resources.

The findings in this research work has established the fact that the understanding and achievement levels of students and adults on environmental concepts is discouraging, thus posing a significant threat on how to effectively manage resources in the environment and also how to work towards overcoming these challenges in their examinations. Concepts not understood by students and adults are Climate change, Xerophyte, Biome, Climax vegetation, Wilting, Savannah, Edaphic factor, Ecological Niche, Photic Zone, Aestivation, Endangered species, Conservation, Turbidity, Hydrophytes, Succession and Poikilothemy.

However, another important finding established in this research work is the fact the difference that exist between Students and Adults in their understanding of the environmental concepts was not significant, this was because the students had a mean index of 1.54 while adults had 1.53 with a standard deviation of 0.28 and 0.29 respectively.

The calculated "r" of 0.988 at 5% level of significance shows a positive correlation between students understanding of environmental concepts and their demographic factors. In the same vein, the calculated "r" of 0.904 at 5% level of significance shows a relationship that depicts positive association between adults and demographic. This goes to show that demographic factors greatly influence adults understanding of environmental concepts.

Another findings of this research was that factors that account for misconception by the students were abstractness of concepts 81 per cent, Teacher pedagogical problems 79 per cent, student's attitude to biology 63 per cent, topics not taught 55 per cent, language problems 52 per cent, distance from school (DFS) and forgetfulness (F) account for 16 per cent and 3 per cent respectively.

To overcome such misconceptions, ways suggested by students and adults as solutions were more practical's in environmental and ecological concepts, 78% of the students indicates this, 76 per cent were of the opinion that simple and clear English should be used in the teaching of ecology, 73 per cent said teaching aid should be used, 68 per cent suggested that more time should be made available during ecology lesson and lastly 78 per cent also said prompt evaluation of ecology assignments and work should be ensured.

The major implication of this findings is that curriculum planners and classroom teachers should plan and organize learning material orderly in order to move from simple to abstract and this concur with Olaadeniyi (1985) where he noted

that concept learning should be hierarchical, he said, complex and abstract are learned by coordinating successive perception and basic concepts.

6.2. Recommendation

An enriching environment for meaningful study of science particularly ecology should be provided; laboratory activities and field work can be of paramount importance. This agrees with Miller (2004) where he pointed out that practical work particularly in the teaching and learning of environmental concepts and ecology is to help students make links between the domain of real objects, that is observable things and the domain of ideas.

The researcher also recommends that science teaching and learning should be made relevant to the child immediate environment and home, that is to say that teaching should emanates from what the child already knows from home, as observed by Kujawa and Huske (1995) that prior knowledge acts as lens for viewing and absorption of new knowledge or formation. This implies that local examples should be used to concretized difficult concepts. Environmentalist, Scientist, Educationist, Psychologist, Sociologist, believed that the relationship between teachers and learners are complementary to the development, progression and building of human intellectual capacity of each other, this bond of relationship should not be allowed to wane.

Furthermore, the present stipulated age limits for schooling should be upheld by parents and teachers so that students are not subjected to learning that is too high above their cognitive competence as this will lead to frustration and discouragement. The level of the learner should be taken into account Adeyegbe (2003). More also, curriculum experts, ministries of education, examination bodies and classroom teachers should try to identify the crucial issue affecting students thought processes and concepts development in science and offer aid appropriately. As Hogan (2000) posited that students must be helped to acquire the fundamental principles of a subject in line with the thinking or cognitive level of children. Novak (1990) has also noted that it is the duty of the curriculum specialist to develop programs and activities that would enhance the formation of concepts, principles and generalization.

Indigenous authors should be encouraged to write textbooks using local examples, where principles and concepts could be more related to the student's immediate environment and investigation oriented to provoke high level thinking in students. The present non-professional personnel in the teaching profession courses at the various levels should be made to undertake orientation courses to make them qualify to teach and more also those that are professionals should not be dormant and should be encouraged to attend workshops, seminars and in service courses to further enrich them and to remain in touch with the ever changing curriculum.

Location of schools close to student's residential areas will curtail the risks of travelling long distances by our so-called day students that are at the very beginning of a lesson already tired for any meaningful learning.

These recommendations when carefully and seriously taken will go a long way in improving our students and the adults in the learning process and make them conscious of the environment.

This research work had only dwelt on Analysis of Environmental Concepts Understanding and Achievement and determining the misconception according to the students' and adults' opinion in Plateau Central, Nigeria. The study however, established the fact that students' and adults 'level of understanding environmental concept was very low. Hence more effort is required to actually help them.

In line with the above, further researchers should therefore be carried in the following suggested areas:

- Effect of poor knowledge on the understanding of science concepts
- The role of instructional aids and their effect on students' concept formation and achievement in science.
- Reasons for students misconception in science generally and how to change these misconceptions.
- Research should also be conducted to cover similar concepts in Biology particularly on topics like Photosynthesis, genetics and evolution.

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APPENDIX 1

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

01.04.2019

Dear Toma Maina Antip

Your application titled "**Analysis of environmental concepts for Plateau State Central, Nigeria for determining the misconceptions among students**" with the application number YDÜ/EB/2019/312 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Direnç Kanol

Assoc. Prof. Dr. Direnç Kanol
Rapporteur of the Scientific Research Ethics Committee

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document

APPENDIX II

Participant Information Sheet and Informed Consent Form

Dear Students,

This research aims to analyze Environmental Concept Understanding and Achievement and Determining the Misconception according to Students' and adults' Opinion: A case study of Plateau State Central, Nigeria**.**

This questionare was prepared in four sections:

A. Background Information
B. Students and Adults Achievement Questionaire
C. Students and Adults Concept Understanding
D. Interview Schedule

Please write your opinions clearly on the spaces below. In the questionnaire, you are to tick the response that most apply to you. The interview section will be handle by the researcher. Your contribution towards this study is greatly appreciated, as it will add significantly to the value of this research. Your responses will be kept secure and will remain confidential. Thank you for your contributing.

SECTION A: BACKGROUND INFORMATION

This section is intended to get some background information about you. Fill in the necessary information in the space provided or tick as appropriate

i. Economic Level (Low, Middle, High) ……
ii. School Location (Urban, Rural)…… …….
iii. School Type (public, Private) ……
iv. Gender (M/F) ……
v. Age (10-17) (18-30)……
vi. Family System (Monogamy/Polygamy/Polyandry/ Single Parent)……
vii. Occupation (Student/Farming/ Petty Business……

In case you have any questions or concerns, please contact me using the information below.

Toma Maina ANTIP
PhD Student
Environmental Education and Management Department

SECTION B

SECONDARY SCHOOL ENVIRONMENTAL STUDENTS ECOLOGICAL CONCEPTS ACHIEVEMENT TEST (ECAT)

This section consist of 40 questions on selected concepts from past West African School Certificate (2012 – 2017). You are to identify the option from the list of options provided by a single tick. This section will last for 40 minutes.

1. Puddles ponds, rivers, lakes and oceans are group together as (a) Ecosystem (b) Biosphere (c) Terrestrial Habitat (d) aquatic habitat
2. Plants that are found in extreme dry condition are called (a) Epiphyte (b) Hydrophyte (c) Mesophyte (d) Thallophytes (e) Xerophyte
3. All the available space on earth which support life constitute the (a) Lithosphere (b) Atmosphere (c) Biosphere (c) Hydrosphere (e) Thermocline.
4. The process by which plant and animals are modified in structure, physiology and behavior in order to survive is known as (a) Evolution (b) Adaptation (c) Succession (d) Aggression (e) Hibernation
5. Which of the following is the correct food chain for the organisms found in aquatic community?

a. Paramecium –Phytoplankton – Prawn – Water flea – Tilapia – Shark
b. Water flea – Paramecium – Phytoplankton – Prawn - Tilapia – Shark
c. Phytoplankton – Water flea – Paramecium – Prawn – Shark - Tilapia
d. Phytoplankton – Paramecium - Water flea - Prawn – Shark – Tilapia

6. Very law annual rainfall, sparse vegetation, high day temperature and cold night are characteristics of the biome known as (a) Swamp (b) Tropical Forest (c) Southern Guinea savanna (d) desert
7. Which of the following is not a characteristics of overcrowding in plant and animal community (a) Population outstripping available space (b) population exceeding available food (c) competition within the population (d) increase in primary production
8. The number of individuals in a habitat in relation to the unit space available to each organism is referred to as (a) Birth rate (b) density (c) Mortality (d) frequency € dispersion
9. Which of the following biome is found in Nigeria (a) Sahel Savannah (b) Tundra (c) desert (d) Afro – alpine vegetation (e) temperate deciduous forest
10. Which of the following statement is not true about climax vegetation? (a) is a stable succession (b) eliminates competition (c) is an environmental phenomenon (d) result from succession € involves colonization of habitat
11. The study of living organism in relation to their environment is called (a) cytology (b) ecology (c) hematology (d) mycology (e) paleontology.
12. The following apply to the tropical except (a) abundant water supply (b) loose and moist soil (c) short trees growing beneath tall trees (d) scanty trees with small leaves (e) presence of many animals
13. The following will cause wilting in plants (a) Humidity (b) Coldness (adequate soil water (e) excesses transpiration.
14. Which of the following will be a primary producer in a food chain? (a) saprophyte (b) Herbivore (c) carnivore (d) green plant (e) parasite
15. Fewer number of trees is a characteristics of the savannah zone in Nigeria because (a) There is too much sunlight (b) there is limited amount of rainfall (c) they are usually expose to grazing animals (d) they are covered with mountains (e) the farmers usually engage in bush burning.
16. Soil factor in a ecosystem are referred to as (abiotic factor (b) climatic factor (c) edaphic factor (d) physiography factor (e) topographic factor.
17. The correct sequence of energy transfer among living organisms in an ecosystem is (a) Consumer – decomposer – Producer (b) Consumer – producer – decomposer (c) Decomposer – Producer – consumer (d) Producer – consumer – decomposer (e) Producer – decomposer – consumer.
18. The activity of organism which affect the survival of another organism in a habitat can be describe as (a) biotic factor, (b) climatic (c) physiographic (d) edaphic factor (e) Abiotic factor.
19. Which of the following best describe a marine habitat? (a) Loose and moist soil with high concentration of salt (b) Large water supply with high concentration of salt (c) large water supply with suspended materials (d) large water supply with distinctive color of test (e) large water supply which sustain normal life

20. The entire habitat and habitat of an organism can be described as its (a) Ecological community (b) Ecological Niche (c) Habitat factor (d) biotic factor (e) Abiotic factors.
21. Which of the following organism will have the highest biomass? (a) Small fish (b) Tadpole (c) Hawk (d) phytoplankton (e) Big fish.
22. The farming practice in which an exhausted farmland is left for a number of years before cultivation is known as (a) Crop Rotation (b) continues cropping (c) mono cropping (d) bush fallowing (e) mixed cropping.
23. The following are effect of overgrazing except (a0 depletion of useful fodder crops (b) soil and wind erosion of pasture lands (c) epidemics of cattle diseases (d) migration of herdsmen (e) scarcity of good pasture lands.
24. The factor which determine the type of vegetation a particular habitat will support are related to the following except? (a) nature of the soil particles (b) amount of rainfall (c) mineral content of the soil (d) farming activities (e) depth of the water table
25. Which of the following substances is not a pollutant of water (a) fertilizer (b) sewage (c) pesticide (d) smoke
26. Which of the following is a characteristics of a swamp? (a) Vegetation with stratified arrangement (b) mesophytes with broad leaves (c) the ground is flooded most of the time (d) predominance of climbing plant (e) many plants with pre – resistant structure.
27. What is critical limiting factor for plants below the photic zone in an ecosystem? (a) Availability of nutrients (b) availability of water (c) intensity of light (d) carbon dioxide concentration.
28. Which of the following statements best explain the term aestivation? (a) a device for survival during a period of extreme food and water shortage (b) a method of revival adopted by animals during dry season (c) a device of rapid multiplication during abundance of food (d) method of survival adopted by animals during favorable condition.
29. The possession of breathing roots is a characteristics of (a) Mangrove swamp (b) coastal savannah (c) guinea savannah (d) Shrub biome
30. Some species of plants and animals are considered as endangered because (a) they are found in large number in most habitats (b) they are harmful to their natural habitat (c) the population have become so small that they will soon die out (d) they should be killed or kept in cage.
31. Forrest conservation include the following except (a) prevention of bush fire (b) extensive failing of trees (c) replacing of harvested trees by seeding (d) selective exploitation of forest trees.
32. Which of the following is not true of a population (a) members of the population may be of the same species but do not interbreed (b) members of the same species and can interbreed (c) size of a population may be limited by a space (d) some species can formed another population elsewhere
33. Competition among individuals as a population increase () number of organism (b) survival of the fittest (c) availability of nutrient supplied (d) enlargement of the territory
34. The term ecosystem refers to the (a) different groups of green plants in a habitat (b) living members of a habitat (c) living organism interacting with the physical environment (d) members of a particular plant and animals living in a habitat.
35. The abiotic factors which determine the depth to which light penetrates in a pond is (a) current (b) turbidity (c) wind (d) salinity
36. Plants found in an aquatic environment are generally refer to as (a) epiphytes (b) halophytes (c) xerophytes (d) hydrophytes
37. If a piece of abandoned farmland went through a series of floral and fauna changes and becomes established with a permanent plant and animal population, it could be said to have undergone (a) transformation (b) succession (c) competition (d) evolution issues among living and nonliving things
38. Which of these can be responsible for poor grades in school (a) Low income earners with school situated in rural area where there are no instructional facilities (b) presence of trained personnel (c) An equipped library and laboratories. (d) none of the above.
39. What physiological term can be used to describe the regulation of body temperature of the lizard (a) homoeostasis (b) homoithermy (c) poikilothermic (d) osmoregulation
40. Which of the following organs is specially adapted for gaseous exchange in aquatic organism? (a) Lungs (b) Trachea (c) Gills (d) Tracheoles (e) alveoli

Grading; 1-19 Fail; 20-30 Pass/Credit; 31-40 Distinction

SECTION C

STUDENTS AND ADULTS ENVIRONMENTAL CONCEPT UNDERSTANDING (ECU)

This section consist of forty (40) questions on some environmental concepts from past West African Examination Council (2010-2016). You are to identify the right option that most appeal to you, whether strongly Disagree, Disagree, Neutral, Agree or Strongly Disagree

S/N	Statements	Strongly Disagree	Disagreed	Neutral	Agree	Strongly Agree
1	Environmental pollution is a thread to mankind					
2	Global warming affects both Plants and animals					
3	There is no side effect of global warming					
4	Plants and animals do not have to modified themselves in structure and behavior in order to survive					
5	Organisms cannot survive Independently					
6	.Desert are characterise by low rainfall, sparse vegetation and high day temperature					
7	Overcrowding in plants and animals leads to increase in primary production					
8	Xerophytes are not found in extreme dry conditions					
9	Accumulation of solid and liquid wastes on land does not lead to water pollution.					
10	Climax vegetation eliminates Competition					
11	Ecology is the study of Living organism in relation To their environment					
12	Increase in population of living organisms constitute health risk.					

Students and Adults environmental concept understanding (ECU). Continued.

S/N	Statement	Strongly Agreed	Disagreed	Neutral	Agreed	Strongly Agreed
13	Good soil water will not cause wilting in plants					
14	Green plants are known as Primary producers in food chain					
15	There is limited rainfall in Savannah regions of Nigeria					
16	16.Soil factor in an ecosystem Is referred to as edaphic					
17	Produce-consumer-decomposer Is the correct sequence of energy transfer among living organism in An ecosystem					
18	Climatic factor can affect the Survival of another organism in A habitat					
19	A marine habitat has large water supply with suspended materials					
20	Ecological niche is often describe as the entire habits and habitat of an organism					
21	Biomass can be used to generate Electricity					
22	Bush fallowing does not encourage Farming practice in which an Exhausted farmland is left for a Number of years					
23	Economic level influence choice of schools for students and adults					
24	Environmental education does not lead to environmental awareness					
25	No environmental teachers specialist in secondary schools					
26	The education system in Nigeria Is tailored towards self-sufficiency					
27	Technology has brought more harm than good.					
28	Money is needed to manage environmental problems.					
29	Environmental protection is the duty of government, non-Governmental organisations and individuals					

Students and Adults environmental concept understanding (ECU). Continued.

S/N	Statements	Strongly Disagreed	Disagreed	Neutral	Agreed	Strongly Agreed
30	it is too late to undo the damage cause by industrialisation to the environment					
31	Genetically modified food is good for the ever increasing world population					
32	Global warming is good for aquatic animals					
33	Afforestation can reduce air pollution					
34	Competition among members of a population increases survival of the fittest.					
35	Environmental Education can help students to be real world Problem solvers					
36	Environmental attitudes need to inculcated to pupils right from Primary school					
37	Constant review of environmental topics in the syllabus is necessary to reflect the global reality					
38	Some animals have gone extinct as a result of poaching and climate change.					
39	Poor grades in school is associated to demographic factors					
40	40. Building of Nuclear stations should be Discouraged because of its potential Dangers to plants and animals					

STUDENTS AND ADULTS ENVIRONMENTAL CONCEPT UNDERSTANDING (continued)

The section below is a list of some environmental concepts in the Senior Secondary Students curriculum. In front of each concept are two columns. One under “yes” and another under “No”. You are to indicate with a thick in front of each concept to show whether or not you understand a concept. If a thick is yes, a brief explanation should then be given in the column provided in front of each concept. This section will last for 40 minutes.

ENVIRONMENTAL CONCEPTS UNDERSTANDING (ECU).

S/N	CONCEPTS	LEVEL OF CONCEPT UNDERSTANDING		
		Yes	No	Brief Explanation
1	Pollution			
2	Global Warming			
3	Climate Change			
4	Adaptation			
5	Biosphere			
6	Desert			
7	Overcrowding			
8	Xerophyte			
9	Biome			
10	Climax Vegetation			
11	Ecology			
12	Tropical rainforest			
13	Wilting			
14	Primary producer			
15	Savannah			
16	Edaphic factor			
17	Energy transfer			
18	Biotic factor			
19	Food Chain			
20	Ecological niche			
21	Biomass			
22	Bush fallowing			
23	Pollutants			
24	Environmental Awareness			
25	Aquatic Habitat			
26	Photic Zone			
27	Gills			

Environmental Concepts Understanding (ECU) continued

S/N	Concepts	Level of Concept Understanding		
		Yes	No	Brief Explanation
28	Xerophyte			
29	Environmental Protection			
30	Industrialization			
31	Modified food			
32	Aestivation			
33	Afforestation			
34	Competition			
35	Environmental Problems			
36	Attitude			
37	Environmental Syllabi			
38	Endangered Species			
39	Pokilothermy			
40	Nuclear Energy			

SECTION D

INTERVIEW SCHEDULE ON THE REASONS AND SOLUTIONS FOR MISCONCEPTION ON THE SELECTED ENVIRONMENTAL CONCEPTS

INTERVIEW QUESTIONS **60 minutes**

1. What was the reason (s) for misconception on concept(s) you do not understand?
2. What can be done to help you understand these concepts better?

REASONS FOR MISCONCEPTION ON THE SELECTED ENVIRONMENTAL CONCEPTS.

The following reasons can serve as a guide for the researcher

1 Over simplification of concepts (OSC)

2 Language problem (LP)

3 Teachers pedagogical problem (TPP)

4 Misconception from family members (MFM)

5 Students attitude to biology (SAB)

6 Topic not taught (TNT)

7 Abstractness of concept (AC)

OTHER REASONS OBSERVED IN RESPONDENT'S RESPONSES

8 Distance from school (DFS)

9 Forgetfulness (F)

SOLUTION FOR MISCONCEPTION ON THE SELECTED ENVIRONMENTAL CONCEPTS.

The following can serve as a guide for the researcher to proffer solutions to the misconception mentioned above.

1 More practical (MP)

2 Simple and clear English (SCE)

3 Use of teaching aids (UTA)

4 More time for Questioning (MTQ)

5 Prompt Evaluation

APPENDIX III

Computation of Variance and Standard Deviation for concept understanding for students and adults respondents using the mean indices for understanding the concepts

Serial Number of Concepts	**X**	**F**	**FX**	**$X - \bar{X}$**	**$(X - \bar{X})^2$**	**$F(X - \bar{X})^2$**
32	2.00	1	2.00	0.48	0.2304	0.2304
1	1.99	1	1.99	0.47	0.2209	0.2209
6	1.98	1	1.98	0.46	0.2116	0.2116
40	1.92	1	1.92	0.40	0.1600	0.1600
7	1.90	1	1.90	0.38	0.1444	0.1444
25	1.89	1	1.89	0.37	0.1369	0.1369
22	1.83	1	1.83	0.31	0.0961	0.0961
3	1.78	1	1.78	0.26	0.0676	0.0676
24	1.75	1	1.75	0.23	0.0529	0.0529
14	1.74	1	1.74	0.22	0.0484	0.0484
11	1.73	1	1.73	0.21	0.0441	0.0441
18	1.71	1	1.71	0.19	0.0361	0.0361
5	1.68	1	1.68	0.16	0.0256	0.0256
23	1.67	1	1.67	0.15	0.225	0.225
4	1.65	1	1.65	0.13	0.0169	0.0169
38	1.61	1	1.61	0.09	0.0081	0.0081
19 & 33	1.57	2	3.14	0.05	0.0025	0.0050
34	1.56	1	1.56	0.04	0.0016	0.0016
12	1.55	1	1.55	0.03	0.0009	0.0009
17	1.52	1	1.52	0.00	0.0000	0.0000
15	1.48	1	1.48	-0.04	0.0016	0.0016
10	1.47	1	1.47	-0.05	0.0025	0.0025
31	1.45	1	1.45	-0.07	0.0049	0.0049
36	1.43	1	1.43	-0.009	0.0081	0.0081
26	1.39	1	1.39	-0.13	0.0169	0.0169
2	1.37	1	1.37	-0.15	0.0225	0.0225
16	1.35	1	1.35	-0.17	0.0289	0.0289
8	1.32	1	1.32	-0.20	0.0400	0.0400
29	1.30	1	1.30	-0.22	0.0484	0.0484
9	1.27	1	1.27	-0.25	0.0625	0.0625
35 & 37	1.25	2	2.50	-0.27	0.0729	0.01458
20	1.20	1	1.20	-0.32	0.1024	0.1024
13	1.18	1	1.18	-0.34	0.1156	0.1156
21 & 28	1.16	2	2.32	-0.36	0.1296	0.2592
27 & 39	1.10	2	2.20	-0.42	0.1764	0.3528
27 & 39	1.10	2	2.20	-0.42	0.1764	0.3528
30	1.09	1	1.09	-0.43	0.1849	0.1849

ΣX	ΣXY	
40	60.92	$\sum Fx\ (X - X)^2$

$\bar{X} = \sum \underline{Fx} =$

$$s = \sqrt{\frac{\sum F(X-X)^2}{n-1}}$$

$\bar{X} = \frac{60.92}{40-1}$ $S^2 = \frac{36262}{40-1}$

1.523 = 1.52

$S^2 = 0.093$

Standard Deviation is given by the square root of the variance thus

$$s = \sqrt{\frac{\sum F(X-X)^2}{n-1}}$$

$S = \sqrt{0.093}$

S = <u>0.30</u>

APPENDIX IV

Computation of Variance and Standard Deviation for concept understanding by the students' respondents using the mean indices for understanding the concepts

Serial No of Concepts	**X**	**F**	**FX**	**$X - \bar{X}$**	**$(X - \bar{X})^2$**	**$F(X - \bar{X})^2$**
10	2.03	2	4.06	0.49	0.2401	0.4804
1	2.01	1	2.01	0.47	0.2209	0.2209
32 & 40	1.93	2	3.86	0.39	0.1521	0.3042
7	1.89	1	1.89	0.35	0.1225	0.1225
14 & 22	1.80	2	3.60	0.26	0.0676	0.1352
24	1.77	1	1.77	0.23	0.0529	0.0529
25	1.75	1	1.75	0.21	0.0441	0.0441
3 & 13	1.73	2	1.73	0.19	0.0361	0.0722
23	1.71	1	1.71	0.17	0.0289	0.0289
5 & 11	1.61	2	3.34	0.13	0.0169	0.0338
19	1.61	1	1.61	0.07	0.0049	0.0049
4 & 18	1.60	2	1.60	0.06	0.0036	0.0072
33	1.59	1	1.59	0.05	0.0025	0.0025
38	1.57	2	3.60	0.26	0.0676	0.1352
34	1.55	1	1.55	0.01	0.0001	0.0001
17	1.51	1	1.51	-0.03	0.0009	0.0009
2, 8 & 15	1.45	3	4.35	0.09	0.0081	0.0243
31	1.43	1	1.43	-0.11	0.00121	0.00121
26	1.39	1	1.39	-0.15	0.00225	0.00225
16	1.29	1	1.29	-0.25	0.0625	0.0625
36	1.28	1	1.28	-0.26	0.0676	0.0676
9	1.27	1	1.27	-0.27	0.0729	0.0729
37	1.24	1	1.24	-0.30	0.0900	0.0900
29	1.21	1	1.21	-0.33	0.1089	0.1089

Computation of Variance and Standard Deviation for concept understanding by the students' respondents using the mean indices for understanding the concepts (continued)

Serial No of Concepts	**X**	**F**	**FX**	**X – $\bar{X}$**	**(X - $\bar{X}$)²**	**F(X - $\bar{X}$)²**
28	1.18	1	1.18	-0.36	0.1296	0.1296
27&39	1.13	2	2.26	-0.41	0.1618	0.3362
30	1.11	1	1.11	-0.43	0.1849	0.1849
35	1.0	1	1.09	-0.45	0.2025	0.2025
6,21	1.07	1	1.07	-0.47	0.2209	0.2209

$\Sigma F = 40$ $\Sigma FX = 61.47$

$\bar{X} = \frac{\Sigma FX}{}$ $\Sigma F(X - \bar{X})^2 = 3.1313$

$\frac{\Sigma F(X - \bar{X})^2}{n-1} = 3.1313$

$\frac{\Sigma FX}{1-40}$ $S^2 = \frac{\Sigma F(X - \bar{X})^2}{40-1}$

$\bar{X} = 61.47$ $S^2 = \frac{\Sigma F(X - \bar{X})^2}{39}$

$\bar{X} = 1.54$

$S^2 = \frac{1.313}{39}$

$S^2 = 0.080$

$= S^2 = 0.08$

Standard deviation is equal to

$$s^2 = \frac{\sqrt{\sum F(X - X)^2}}{n - 1}$$

$S = \sqrt{0.080}$ $S = 0.28$

APPENDIX V

Computation of Variance and Standard Deviation for concept understanding for the adults' respondent using the mean indices for understanding the concepts

S/N of Concepts	X	F	FX	$X - \bar{X}$	$(X - \bar{X})2$	$F(X - \bar{X})^2$
39	2.04	1	2.04	0.51	0.2601	0.2601
25	2.03	1	2.03	0.50	0.2500	0.2500
1	1.99	1	1.99	0.46	0.2116	0.2116
6 & 7	1.92	2	3.84	0.39	0.1521	0.3042
40	1.91	1	1.91	0.38	0.1444	0.1444
22	1.90	1	1.90	0.37	0.1369	0.1369
3	1.83	1	1.83	0.30	0.0933	0.0900
18	1.82	1	1.82	0.29	0.0841	0.0841
11	1.79	1	1.79	0.26	0.0676	0.0676
24	1.71	1	1.71	0.18	0.0324	0.0324
4	1.70	1	1.70	0.17	0.0289	0.0289
14	1.68	1	1.68	0.15	0.0225	0.0225
5	1.67	1	1.67	0.16	0.0256	0.0256
38	1.64	1	1.64	0.11	0.0121	0.0121
23	1.63	1	1.63	0.10	0.0100	0.0100
31	1.58	1	1.58	0.03	0.0025	0.0025
30	1.56	1	1.56	0.05	0.0009	0.0009
12,17&19	1.53	3	4.59	0.00	0.0000	0.0000
15	1.51	1	1.51	-0.02	0.0004	0.0004
31	1.50	1	1.50	-0.03	0.0009	0.0009
8	1.49	1	1.49	-0.04	0.0016	0.0016
26	1.40	1	1.40	-0.13	0.0169	0.0169
16&29	1.39	2	2.78	-0.14	0.0196	0.0169
10	1.32	1	1.32	-0.21	0.0441	0.0441
36	1.31	1	1.31	-0.22	0.0484	0.0484

Computation of variance and standard deviation for concept understanding for the adults' respondent using the mean indices for understanding the concepts. (Continued)

S/N of Concepts	X	F	FX	$X - \bar{X}$	$(X - \bar{X})2$	$F(X - \bar{X})^2$
2	1.30	1	1.30	-0.23	0.0529	0.0529
37	1.26	1	1.26	-0.27	0.0729	0.0729
9&21	1.25	2	2.50	-0.28	0.784	0.1568
35	1.24	1	1.24	-0.29	0.0841	0.0841
13&28	1.19	2	2.38	-0.34	0.1156	0.2312
20	1.16	1	1.16	-0.37	0.1369	0.1369
30	1.09	1	1.09	-0.44	0.1936	0.1936
27&39	1.07	2	2.14	-0.46	0.2116	0.4232

$\Sigma F = 40$ $\Sigma FX = 61.29$

$\Sigma X = 40$ $\Sigma FX = 61.24$

$\bar{X} = \frac{\Sigma FX}{\Sigma X}$ $\Sigma F(X-X)^2 = 3.2034$

$S^2 \frac{\Sigma F(X-X)2}{n-1}$

$\bar{X} = \frac{61.29}{n-40}$ 61.29 $\bar{X} = 1.53$ $S^2 = \frac{3.2034}{40-1}$ $S^2 = \frac{32034}{39}$ $S^2 = 0.082$

$$s = \frac{\sqrt{\sum F(X-X)^2}}{n-1}$$

$S = \sqrt{0.082}$ $S = 0.2$

APPENDIX VI

Correct and brief explanation to the forty concepts

S/N	Concepts	Explanation
1.	Pollution	It is the introduction of contaminants into natural environment that cause adverse effect
2.	Global warming	The earth's rising surface temperature
3.	Climate Change	Includes warming and the side effects like melting glaciers, heavy rainstorms and drought
4.	Adaptation	Extent of change in structure and function that enhance survival in a particular place.
5.	Biosphere	The life zone of the earth
6.	Desert	Extremely dry area with little rain throughout the year.
7.	Overcrowding	Increase in population beyond the carrying capacity of a particular area.
8.	Xerophytes	Plant growing in condition of water shortage.
9.	Biome	Large ecological habitat for organisms
10.	Climax vegetation	Stable stage of a community after series of succession
11.	Ecology	Study of the relationship of organism to one another and their environment
12.	Tropical rainforest	A biome of high rainfall throughout the year
13.	Wilting	Plant (cell) shrinkage as a result of excessive water loss.
14.	Primary producer	Are the plant trap sunlight energy to produce food?
15.	Savanna	Vegetation zone (biome) of lower rain fall, tall grasses and few number of trees.
16.	Edaphic factor	Physical and chemical nature of the soil. (soil factors)
17	Energy transfer	Transfer of nutrient from one organisms to another through feeding relationships.
18	Biotic factor	Environment influences arising from the activities of plants and animals
19	Food Chain	Linear feeding relationship among few organisms.
20	Ecological niche	Position or role specially adapted to an organisms in an ecosystem.
21	Biomass	Total weight or volume of an organism in an area/per unit area
22	Bush fallowing	Allowing a particular farmland for some time after some year of farming to regain fertility
23	Overgrazing	When grazing animals overfeed themselves on a pasture land.
24	Vegetation	Plants that are found in a particular area
25	Pollutant	Materials or substances that contaminates the environment.
26	Aquatic Habitat	Water environment for water dwelling plants
27	Photic zone	Depth in which sunlight can penetrate in water
28	Aestivation	Period of inactivity in animals during prolong heat or drought.
29	Environmental Protection	It is a process whereby the natural environment is being protected by individuals and all and sundry
30	Endangered species	Species of organisms that are almost going extinct in an environment.

Correct and brief explanation to the forty concepts (continued)

S/N	Concepts	Explanation
31	Conservation	Act of protecting the natural and manmade resource from been lost.
32	Population	Group of living organism of the same species living in a geographical area at a particular time.
33	Competition	Struggling for a limited environmental resource
34	Ecosystem	A natural community (biotic and abiotic) living in a geographical area at a particular time.
35	Turbidity	Presence of suspended particles (mud) in water that prevent easy viewing
36	Hydrophytes	Aquatic plants
37	Succession	Progressive series of change involving the colonization of an area by living organisms
38	Terrestrial habitat	Land dwelling place for organisms
39	Poikilothermy	Temperature regulation in cool blood animals
40	Nuclear Energy	Nuclear energy is the energy held in the nucleus of an atom; It can be used to manufacture explosive

Concepts and their Understanding index by the Students is 1.54 and Concepts and their Understanding index by the Adult Student is 1.53 as presented in tables 11 and 12 above.

APPENDIX VII

RIGHT ANSWERS TO THE TEST QUESTIONS

S/N	Correct Response
1	E
2	E
3	C
4	B
5	D
6	E
7	D
8	B
9	A
10	B
11	B
12	D
13	D
14	D
15	B
16	C
17	D
18	B
19	B
20	B
21	D
22	D
23	C
24	E
25	D
26	C
27	C
28	A
29	A
30	C
31	B
32	B
33	B
34	C
35	B
36	D
37	B
38	A
39	C
40	C

APPENDIX VIII

Achievement of Candidates (students and adults) in senior certificate examination May/June (SSCE 2011 -2016**)**

Year	Subject	Total Entry	No Sat for Exams	No of Credit	% Passed at Credit	No Fail	% Failure
2012	Biology	639020	620, 291	119769	19. 30	315919	50.93
	Chemistry	201369	195810	62442	31.88	81065	41.39
	Physic	193052	188312	56604	30.05	59237	31.45
2013	Biology	1029962	995345	231475	23.25	468216	47.04
	Chemistry	311606	301740	109397	36.26	110664	36.67
	Physics	295963	287993	9964	3.46	78487	27.25
2014	Biology	917041	882119	278122	31.52	333696	37.82
	Chemistry	271371	262824	90488	34.42	94856	36.09
	Physics	261687	254188	120768	47.51	51606	20.30
2015	Biology	911219	909101	392249	43.14	251858	27.70
	Chemistry	288324	282120	143839	50.98	61619	21.84
	Physics	280818	275369	130982	47.56	53079	19.27
2016	Biology	838945	821966	253483	30.83	291.581	35.47
	Chemistry	275078	269774	105133	38.97	92.237	34.19
	Physics	270028	265262	135359	51.02	52.313	19.72

Source: Usman 2006

APPENDIX IX

Students' demographic correlation coefficient of understanding according to economic level

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	8	25	46	71	
Average	0	2	5	9	14	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	2	5	9	14	30
xy	0	4	15	36	30	125
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	4	25	81	196	306

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(125) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times306) - (30)^2}} = \frac{625 - 450}{\sqrt{(275 - 225)}\sqrt{(1530 - 900)}}$$

$$r = \frac{175}{\sqrt{(50\times630)}} = \frac{175}{\sqrt{31500}}$$

$$r = \frac{175}{177.48} \quad r = 0.986.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.986, approximately +1 indicating positive linear relationship between students and their demographic status. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their economic level.

APPENDIX X

Computation of Students' demographic correlation coefficient of understanding according to school location

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	7	24	47	72	
Average	0	1	5	9	14	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	5	9	14	29
xy	0	2	15	36	70	123
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	25	81	196	303

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(123) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times303) - (29)^2}} = \frac{615 - 450}{\sqrt{(275 - 225)}\sqrt{(1515 - 841)}}$$

$$r = \frac{165}{\sqrt{(50\times674)}} = \frac{165}{\sqrt{33700}}$$

$$r = \frac{175}{183.58} \quad r = 0.953.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.953, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their school location.

APPENDIX XI

Computation of Students' demographic correlation coefficient of understanding according to school type (Private/Public)

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	3	20	51	76	
Average	0	1	4	10	15	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	4	10	15	30
xy	0	2	12	40	75	129
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	16	100	225	342

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(129) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times342) - (30)^2}} = \frac{645 - 450}{\sqrt{(275 - 225)}\sqrt{(1710 - 900)}}$$

$$r = \frac{195}{\sqrt{(50\times810)}} = \frac{195}{\sqrt{40500}}$$

$$r = \frac{195}{201.25} \quad r = 0.969.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.969, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their school type.

AAPENDIX XII

Students' demographic correlation coefficient of understanding according to gender

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	75	50	19	6	0	
Average	15	10	4	1	0	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	15	10	4	1	0	30
xy	15	20	12	4	0	51
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	225	100	16	1	0	342

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(51) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times342) - (30)^2}} = \frac{225 - 450}{\sqrt{(275 - 225)}\sqrt{(1710 - 900)}}$$

$$r = \frac{-225}{\sqrt{(50\times810)}} = \frac{-225}{\sqrt{40500}}$$

$$r = \frac{-225}{201.25} \quad r = -1.118.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = -1.118, approximately -1 indicating negative relationship between students and gender. Furthermore, it can be said that, the basis to which students understand environmental concepts is not associated or related to their gender.

APPENDIX XIII

Computation of students' demographic correlation coefficient of understanding according to their ages

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	19	80	45	6	
Average	0	4	16	9	1	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	4	16	9	1	30
xy	0	8	48	36	5	145
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	16	256	81	1	354

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(145) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times354) - (30)^2}} = \frac{725-450}{\sqrt{(275-225)}\sqrt{(1770-900)}}$$

$$r = \frac{275}{\sqrt{(50\times870)}} = \frac{275}{\sqrt{43500}}$$

$$r = \frac{275}{208.56} \quad r = 1.319.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 1.319, approximately +1 indicating positive linear relationship between students and their ages. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their ages.

APPENDIX XIV

Computation of students' demographic correlation coefficient of understanding according to family system

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	6	23	50	71	
Average	0	1	5	10	14	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	5	10	14	30
xy	0	2	15	40	70	127
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	25	100	196	322

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(127) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times322) - (30)^2}} = \frac{635 - 450}{\sqrt{(275 - 225)}\sqrt{(1610 - 900)}}$$

$$r = \frac{185}{\sqrt{(50\times710)}} = \frac{185}{\sqrt{35500}}$$

$$r = \frac{185}{188.41} \quad r = 0.982.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.982, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their family system.

APPENDIX XV

Computation of students' demographic correlation coefficient of understanding according to occupation

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	4	21	50	75	
Average	0	1	4	10	15	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	4	10	15	30
xy	0	2	12	40	75	129
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	16	100	225	342

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(129) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times342) - (30)^2}} = \frac{645 - 450}{\sqrt{(275 - 225)}\sqrt{(1710 - 900)}}$$

$$r = \frac{195}{\sqrt{(50\times810)}} = \frac{195}{\sqrt{40500}}$$

$$r = \frac{195}{201.25} \quad r = 0.969$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.969, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their occupation.

APPENDIX XVI

Adults' demographic correlation coefficient of understanding according to economic level

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	3	20	51	76	
Average	0	1	4	10	15	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	4	10	15	30
xy	0	2	12	40	75	129
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	16	100	225	342

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(129) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times342) - (30)^2}} = \frac{645 - 450}{\sqrt{(275 - 225)}\sqrt{(1710 - 900)}}$$

$$r = \frac{195}{\sqrt{(50\times810)}} = \frac{195}{\sqrt{40500}}$$

$$r = \frac{195}{201.25} \quad r = 0.969$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.0969, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which adult understand environmental concepts is greatly associated or related to their economic level.

APPENDIX XVII

Computation of adults' demographic correlation coefficient of understanding according to school location

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	6	20	45	79	
Average	0	1	4	9	16	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	4	9	16	30
xy	0	2	12	36	80	130
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	16	81	256	354

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(130) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times354) - (30)^2}} = \frac{650 - 450}{\sqrt{(275 - 225)}\sqrt{(1770 - 900)}}$$

$$r = \frac{200}{\sqrt{(50\times870)}} = \frac{200}{\sqrt{43500}}$$

$$r = \frac{200}{208.57} \quad r = 0.959.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.959, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which adults understand environmental concepts is greatly associated or related to their school location.

APPENDIX XVIII

Adults' demographic correlation coefficient of understanding according to school type (Private/Public)

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	2	19	50	79	
Average	0	0	4	10	16	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	0	4	10	16	30
xy	0	0	12	40	80	132
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	0	16	100	256	372

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(132) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times372) - (30)^2}} = \frac{660 - 450}{\sqrt{(275 - 225)}\sqrt{(1860 - 900)}}$$

$$r = \frac{210}{\sqrt{(50\times960)}} = \frac{210}{\sqrt{48000}}$$

$$r = \frac{210}{219.09} \quad r = 0.959.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.959, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which students understand environmental concepts is greatly associated or related to their school type.

APPENDIX XIX

Adults' demographic correlation coefficient of understanding according to gender

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	70	58	12	10	0	
Average	14	12	2	2	0	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	14	12	2	2	0	30
xy	14	24	6	8	0	52
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	196	144	4	4	0	348

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(52) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times348) - (30)^2}} = \frac{260 - 450}{\sqrt{(275 - 225)}\sqrt{(1740 - 900)}}$$

$$r = \frac{-190}{\sqrt{(50\times840)}} = \frac{-190}{\sqrt{42000}}$$

$$r = \frac{-190}{204.94} \quad r = -0.931$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = -0.931, approximately -1 indicating negative relationship between students and gender. Furthermore, it can be said that, the basis to which adults understand environmental concepts is not associated or related to their gender.

APPENDIX XX

Computation of adults' demographic correlation coefficient of understanding according to their ages

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	15	50	75	10	
Average	0	3	10	15	2	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	3	10	15	2	30
xy	0	6	30	60	10	106
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	9	100	225	4	338

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(106) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times338) - (30)^2}} = \frac{530 - 450}{\sqrt{(275 - 225)}\sqrt{(1690 - 900)}}$$

$$r = \frac{80}{\sqrt{(50\times790)}} = \frac{80}{\sqrt{39500}}$$

$$r = \frac{80}{198.75} \quad r = 0.403.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 1.319, approximately 0 indicating no relationship between adults and their ages. Furthermore, it can be said that, the basis to which students understand environmental concepts is has no influence to their ages.

APPENDIX XXI

Computation of adults' demographic correlation coefficient of understanding according to family system

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	5	24	51	70	
Average	0	1	5	10	14	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	5	10	14	30
xy	0	2	15	40	70	127
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	25	100	196	322

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(127) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times322) - (30)^2}} = \frac{635 - 450}{\sqrt{(275 - 225)}\sqrt{(1610 - 900)}}$$

$$r = \frac{185}{\sqrt{(50\times710)}} = \frac{185}{\sqrt{35500}}$$

$$r = \frac{185}{188.41}, \quad r = 0.982.$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.982, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which adults understand environmental concepts is greatly associated or related to their family system.

APPENDIX XXII

Adults' demographic correlation coefficient of understanding according to occupation

	Strongly Disagreed (SD)	Disagreed (DA)	Undecided (U)	Agreed (A)	Strongly Agreed (SA)	
Total Response	0	3	15	56	76	
Average	0	1	3	11	15	
						∑
Point (x)	1	2	3	4	5	15
Response (y)	0	1	3	11	15	30
xy	0	2	9	44	75	130
$\mathbf{x^2}$	1	4	9	16	25	55
$\mathbf{y^2}$	0	1	9	121	225	356

Source: Field work, 2019

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (x)^2}\sqrt{N\sum y^2 - (y)^2}}$$

$$r = \frac{5(130) - (15)(30)}{\sqrt{(5\times55) - (15)^2}\sqrt{(5\times356) - (30)^2}} = \frac{650 - 450}{\sqrt{(275 - 225)}\sqrt{(1780 - 900)}}$$

$$r = \frac{200}{\sqrt{(50\times880)}} = \frac{200}{\sqrt{44000}}$$

$$r = \frac{200}{209.76} \quad r = 0.953$$

Pearson product correlation coefficient describes the strength and direction of association between variables with values ranging from -1 (negative) to +1 (positive). On this note, r = 0.953, approximately +1 indicating positive linear relationship between students and their school location. Furthermore, it can be said that, the basis to which adults understand environmental concepts is greatly associated or related to their occupation.

Table 1

Misconceptions in Ecology

Misconceptions	Author
Misconceptions relating to food webs and food chains	
Food webs are interpreted as a simple food chain	Brumby (1982), Griffiths and Grant (1985), Munson (1994)
Organisms higher in a food web eat everything that is lower in the web	Griffiths and Grant (1985)
The top of a food chain has the most energy because it accumulates up the chain	Ola Adeniyi (1985)
Populations higher on a food web increase in numbers, because they deplete those lower in the web	Munson (1994)
Varying the population of an organism will only affect the others that are directly connected through a food chain	Munson (1994), Griffiths and Grant (1985)
In a food web, a change in size in one population will only affect another population if the two populations are directly related as predator and prey	Gallegos, Jerezano, and Flores (1994)
Food chains involve predator and prey, but not producers	Gallegos, Jerezano, and Flores (1994)
Chemical pollutants undergo no change in form as they move through food chains	Hogan (2000)
Misconceptions relating to ecological niches	
The needs and roles of a species are general and typical of species	Munson (1994)
Species coexist in an ecological system because of their compatible needs and behaviors: they 'get along'	Munson (1994)
Misconceptions relating to ecosystems	
Some ecosystems have limitless resources and provide an opportunity for limitless growth of a population	Munson (1994), Brody and Koch (1990)
Populations will increase indefinitely due to limitless resources or will increase until the limits are reached, at which point the population will crash and the organisms become extinct	Brody and Koch (1990)
Varying the population of an organism will affect all other organisms to the same degree	Griffiths and Grant (1985)
Varying the population of an organism may not affect an ecosystem, because some organisms are not important	Munson (1994)
Ecosystems are not a functioning whole, but simply a collection of organisms	Brehm, Anderson, and DuBay (1986)
Imbalance of species within its local environment or community is always bad	Krebs (1999)
An organism cannot change trophic levels	Lavoie (1997)
Misconceptions relating to energy flow	
Energy is not conserved	Hogan (2000)
Decomposers release some energy that is cycled back to plants	Lavoie (1997)
The nitrogen cycle is used to provide energy for the carbon cycle	Lavoie (1997)
Energy is not lost in trophic transfer	D'Avanzo (2003)
Carnivores have more energy or power than herbivores do	Ola Adeniyi (1985)
Plants are dependent on humans, not vice versa	Eisen and Stavy (1992)
Carbon dioxide is a source of energy for plants	Lavoie (1997)
Total biomass for a trophic level is greatest at the top of the food web because the organisms are larger	Brehm, Anderson, and DuBay (1986)

Misconceptions	Author
Misconceptions relating to plant–herbivore interactions	
Plants cannot defend themselves against herbivores	Stamp (2004)
Species don't have any particular function in plants	Stamp (2004)
Plants cannot defend themselves against pathogens	Stamp (2004)
Most insect herbivores will eat a variety of plant species	Stamp (2004)
Except for plant toxins, the quality of food for herbivores is the same as that for carnivores	Stamp (2004)
Plants get their food from the soil via their roots	Scaife and Abdullah (1997)
Misconceptions relating to carrying capacity	
Populations exist in states of either constant growth or decline depending on their position in a food chain	Munson (1994)
Density-dependent factors are biotic, and density-independent factors are abiotic	Lavoie (1997)
Populations increase until limits are reached, then they crash and go extinct	McComas (2002)
More herbivores exist than carnivores because people keep and breed herbivores	Leach et al. (1996)
Some ecosystems are limitless resources and provide an opportunity for limitless growth of a population	Munson (1994)
The relative sizes of prey and predator populations have no bearing on the size of the other	Gallegos, Jerezano, and Flores (1994)
Misconceptions relating to limiting factor	
All factors are limiting except the most abundant one	Eyster and Tashiro (1997)
The most limiting factor is the least abundant one	Eyster and Tashiro (1997)
Misconceptions relating to succession	
Carnivores have more energy or power than herbivores do	Ola Adeniyi (1985)
Without human intervention, old fields either remain largely barren or in a perpetual state of weedy growth	Brehm, Anderson, and DuBay (1986)
Soil decreases in fertility over time	Brehm, Anderson, and DuBay (1986)
Soil is fertile only if humans intervene	Brehm, Anderson, and DuBay (1986)
The climax community is usually the final stage, long-lasting and self-perpetuating	Gibson (1996)
As succession progresses, a community is characterized by bigger plants and bigger animals	Brehm, Anderson, and DuBay (1986)
Succession involves separate stages leading ultimately to a deterministic climax	Lavoie (1997)
Communities change little over time	D'Avanzo (2003)
Misconceptions relating to predator–prey interactions	
The number of producers is high to satisfy consumers	Leach et al. (1996)
'Balance of Nature' refers to populations of predators and prey being similar in size	Brehm, Anderson, and DuBay (1986)
Carnivores are big and/or ferocious. Herbivores are passive and/or smaller	Gallegos, Jerezano, and Flores (1994)
The relative sizes of prey and predator populations have no bearing on the size of the other	Gallegos, Jerezano, and Flores (1994)

Table 2

Environmental/ecological themes in biology textbook

i. Organization of life
ii. The organism at work
iii. The organism and its environment
iv. Continuity of life

Major Topics		Content
Classification of plants	1.	Botanical classification
	2.	Agricultural Classification
	3.	Plants classified on the span of their Life cycles: Annual, Biennials and Perennials
Transport System	1.	Define Diffusion and Osmosis
	2.	Materials for Transportation
Nutrient Cycle in Nature	1.	Carbon and Oxygen Cycles
	2.	Water cycle
	3.	Nitrogen cycle
	4.	Decomposition in nature
Ecological Management	1.	Types of Association: Symbiosis-
1. Symbiosis		Mutual benefits;
2. Parasitism-		Harmful to host
3. Mutualism		Beneficial to both
		Features of Biological importance
4. Tolerance	1.	Concepts of min and max range of tolerance
5. Adaptation	1.	Adaptation in form and function of Living organisms due to environmental conditions
	2.	Effects of availability of water on adaptive Modifications. (i) Structural adaptation of Tadpoles and fish to life in water (ii)Structural adaptation of birds
6. Pollution	1	Pollution of the atmosphere (i)Nature, names and sources of air pollutants (ii)Effects of air pollutants (iii)Effects of noise Pollution
	2	Pollution of Water and Soil (i)Types and composition of pollutants (ii)Side effects
Regulation of Internal Environment	1	Homeostatic organs; substances Involved In homeostatic- the kidney, liver.
Ecology of population	1.	Causes and effects of food shortages on the size of a population
	2	factors affecting population
	3.	Dynamic equilibrium or balance in nature
	4	Family planning

Table 3

Names of schools and sample sizes

S/N	Name of School	Type	No of Students (S)	No of Adults(A)	Sample Size S	A	Total
1	Good Shepherd College Pankshin	V.A.School	49	93	9	18	27
2	G.S.S.Pankshin	Govt. School	69	92	11	18	29
3	M.S.S. Mangu	V.A. School	76	81	34	22	56
4	G.S.S. Mangu	Govt. School	172	146	23	23	46
5	All Nation Academy Bokkos	V.A. School	31	13	6	3	9
6	G. S.S. Bokkos	Govt. School	67	76	13	15	28
7	G.M.C. Kabwir	V.A. School	43	73	8	15	23
8	G.S.S. Kabwir	Govt. School	138	76	19	15	34
9	International College of Languages Kanam	V.A. School	56	37	11	7	18
10	G.S.S. Gar Kanam	Govt.School	86	72	16	14	30
	Total	10	787	759	150	150	300

V.A. School = Voluntary Agency School; G.M.C. = Gonerit Memorial College; A=Adults
G.S.S. = Government Secondary School; M.S.S. = Mangu Secondary School; S=Students

Table 4

Students mark (scores) on the environmental concepts achievement test (ECAT)

Marks (scores) X	**Frequency**	**FX**
32	1	32
28	1	28
27	2	54
26	1	26
25	1	25
24	4	96
23	2	46
22	3	66
21	2	42
20	8	160
19	10	190
18	9	162
17	9	153
16	3	48
15	4	60
14	12	168
13	7	91
12	9	108
11	5	55
10	13	130
9	7	63
8	9	72
7	7	63
6	5	30
5	6	30
4	3	12
3	1	3

Students mark (scores) on the environmental Concepts achievement test (ECAT) (continued)

Marks (scores) X	**Frequency**	**FX**
2	2	4
1	2	2
0	2	0
Total=Σx **150;** ΣFx= 2005 **Mean=13.37**		

Table 5.
Adult mark (scores) on the environmental concepts achievement test (ECAT) continued

Mark (scores)	**Frequencies**
26	1
25	0
24	2
23	0
22	0
21	1
20	5
19	8
18	8
17	3
16	2
15	16
14	7
13	11
12	12
11	10
10	9
9	11
8	7
7	13
6	8
5	3
4	3
2	1
Total Σf=150; Σfx= 1830 **Mean**=12.20	

Table 6

Summary of the arithmetic mean, standard deviation, t-test and critical values of the achievement test by the students and adults

Respondents	Mean	SD	Size	DF	Standard Error	t-Cal	t-Critical
Students	13.37	6.20	150	298	0.05	1.860	1.960
Adults	12.20	4.60	150				

Table 7

Achievement level of students with respect to economic level, gender, school type, school location, family system

	ECAT GRADES			
	Distinction	**Credit**	**Fail**	**Total**
Economic Level				
Low Income <1.025 $	0	76 (50.66%)	70 (46.66%)	146
Lower middle income 1,026-3,995	0	3 (2%)	1 (0.66%)	4
High income > 3,995	0	0	0	0
School Location				
Urban	2(1.33%)	18 (12%)	2 (1.33%)	22
Rural	0	60 (40%)	68 (45.33)	128
School Type				
Public	0	40 (26.66%)	50 (33.33%)	90
Private	6 (4%)	37 (24.66%)	17 (11.33%)	60
Gender				
Male	4 (2.66%)	40 (26.66)	51 (34%)	95
Female	3 (2%)	20 (13.33%)	32(21.33)	55
Age				
10 - 17	3 (2%)	65 (43.33%)	82 (54.66)	150
18 - 30	0	0	0	0
Family System				
Monogamy	4 (2.66%)	40(26.66%)	46(30.66%)	90
Polygamy	0	25(16.66%)	35(23.33%)	60
Polyandry	0	0	0	0
Occupation				
Student	3 (2%)	51 (34%)	67 (44.66)	121
Farming	0	3 (2%)	6 (4%)	9
Business	0	8 (5.33%)	12 (8%)	20

Table 8

Achievement level of adults with respect to demographic status (economic level, gender, school type, school location, family system**)**

	ECAT GRADES			
	Distinction	**Credit**	**Fail**	**Total**
Economic Level				
Low Income <1.025 $	0	72 (48%)	74 (49.33%)	146
Lower middle income 1,026-	0	2 (1.33%)	2 (1.33%)	4
3,995	0	0	0	0
High income > 3,995				
School Location				
Urban	2(1.33%)	20 (13.33%)	4 (2.66%)	26
Rural	0	60 (40%)	62 (41.33%)	124
School Type				
Public	0	38 (25.33%)	53 (35.33%)	91
Private	3 (2%)	30 (20%)	26 (17.33%)	59
Gender				
Male	1 (0.66%)	43 (28.66%)	48 (32%)	92
Female	0	23 (15.33%)	35 (23.33)	58
Age				
10 - 17	3 (2%)	65 (43.33%)	82 (54.66)	150
18 - 30	0	0	0	0
Family System				
Monogamy	3 (2%)	41 (27.33%)	46(30.66%)	90
Polygamy	0	24(16%)	36(24%)	60
Polyandry	0	0	0	0
Occupation				
Student	5 (3.33%)	33 (22%)	74 (49.33%)	112
Farming	0	5 (3.33%)	4 (2.66%)	9
Business	0	10 (6.66%)	19 (12.66%)	29

Table 9

Frequencies and percentage of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by both students and adults

CONCEPTS	SAMP SIZE (N)	YES FRE(Q)	%	NO FREQ (F)	%	ASR	%	USR	%	NR	%
1	300	258	86.00	42	14.00	41	13.67	217	72.33	42	14.00
2	300	69	23.00	231	77.00	37	12.33	38	12.67	225	75.00
3	300	171	57.00	129	43,00	63	21.00	109	36.33	128	42.00
4	300	153	51.00	147	49.00	45	15.00	108	36.00	147	49.00
5	300	162	54.00	138	46.00	41	13.67	121	40.33	138	46.00
6	300	183	61.00	117	39.00	94	31.33	105	35.00	101	33.67
7	300	172	57.33	128	42.67	96	32.00	79	26.33	125	41.67
8	300	130	43.33	170	56.67	20	6.67	99	33.00	181	60.33
9	300	68	22.67	232	77.33	14	4.67	53	17.67	233	77.69
10	300	69	23.00	231	77.00	29	9.67	144	48.00	127	42.33
11	300	186	63.00	114	38.00	43	14.33	133	44.33	124	41.33
12	300	113	37.67	187	62.33	53	17.67	60	20.00	187	62.33
13	300	44	14.67	256	85.33	10	3.33	34	11.33	256	85.33
14	300	156	52.00	144	48.00	66	22.00	90	30.00	144	48.00
15	300	110	36.67	190	63.33	26	8.67	93	31.00	181	60.00
16	300	70	23.33	230	76.67	33	11.00	39	13.00	228	76.00
17	300	129	43.00	171	57.00	25	8.33	106	35.33	169	56.33
18	300	135	45.00	165	55.00	73	24.33	67	22.33	160	53.33
19	300	137	45.67	163	54.33	34	11.33	104	34.67	162	54.00
20	300	60	20.00	240	80.00	15	5.00	31	10.33	254	84.67
21	300	44	14.67	256	85.33	4	1.33	40	13.33	256	85.33
22	300	177	59.00	123	41.00	71	23.67	106	35.33	123	41.00
23	300	154	51.33	146	48.67	47	15.67	107	35.67	146	48.67
24	300	157	52.33	143	47.67	64	21.33	93	31.00	143	47.67

Table 9.Frequencies and percentage of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by both students and adults (Continued)

CONCEPTS	SAMP SIZE (N)	YES Fre(q)	%	NO Freq (F)	%	ASR	%	USR	%	NR	%
25	300	148	49.33	152	50.67	77	25.67	73	24.33	150	50.00
26	300	84	28.00	216	72.00	35	11.67	49	16.33	216	72.00
27	300	27	9.00	273	91.00	2	0.67	25	8.33	273	91.00
28	300	33	11	267	89.00	14	4.67	19	6.33	267	89.00
29	300	61	20.33	239	79.67	13	4.33	48	16.00	239	79.67
30	300	27	9.00	273	91.00	2	0.67	25	8.33	273	91.00
31	300	108	36.00	192	64.00	29	9.67	79	26.33	192	64.00
32	300	229	67.33	71	23.67	70	23.33	156	52.00	74	24.67
33	300	129	43.00	171	57.00	43	14.33	86	28.67	171	57.00
34	300	147	49.00	153	51.00	22	7.33	125	41.67	153	51.00
35	300	66	22.00	234	78.22	9	3.00	57	19.00	234	79.00
36	300	63	21.00	237	79.00	25	8.33	38	12.67	237	79.00
37	300	64	21.33	236	78.67	11	3.67	53	17.67	236	79.33
38	300	140	46.67	160	53.33	42	14.00	98	32.67	160	53.33
39	300	21	7.00	279	93.00	10	3.33	11	3.67	279	93.00
40	300	166	55.33	134	44.67	109	36.33	57	19.00	134	44.67
TOTAL	300	4640	1528.66	7290	2471.34	1549	519	3184	1057.98	7280	2422.66
% mean($\overline{X}$)		38.22 %		61.83 %		12.98 %		26.45 %		60.57 %	

Table 10
Frequencies and percentages of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (nr) by the students

Brief Explanation											
CONCEPTS	**SAMPLE SIZE N**	**YES FREQ(F)**	**%**	**NO FREQ (F)**	**(%)**	**ASR**	**%**	**USR**	**%**	**NR**	**%**
1	150	129	86.00	21	14.00	22	14.67	107	71.33	21	14.00
2	150	41	27.33	109	72.67	20	13.33	27	18.00	103	68.67
3	150	79	52.67	71	47.33	30	20.00	50	33.33	70	46.67
4	150	68	45.33	82	54.67	22	14.67	46	30.67	82	54.67
5	150	78	52.00	72	48.00	22	14.67	56	37.33	72	48.00
6	150	83	55.33	67	44.67	55	36.67	44	29.33	51	34.00
7	150	85	56.67	65	43.33	48	32.00	37	24.67	65	43.33
8	150	57	38.00	93	62.00	10	6.67	47	31.33	93	62.00
9	150	35	23.33	115	76.67	9	6.00	25	16.62	116	77.53
10	150	32	21.33	118	78.67	18	12.00	118	78.67	14	9.33
11	150	81	54.00	69	46.00	19	12.67	63	42.00	68	45.33
12	150	58	38.67	92	61.33	28	18.67	30	20.00	92	61.33
13	150	22	14.67	128	85.33	4	2.67	18	12.00	128	85.33
14	150	84	56.00	66	44.00	36	24.00	48	32.00	66	44.00
15	150	57	38.00	93	62.00	11	7.33	46	30.67	93	62.00
16	150	26	17.33	124	82.67	16	10.67	12	8.00	122	81.33
17	150	60	40.00	90	60.00	14	9.33	48	32.00	88	58.67
18	150	53	35.00	97	64.67	32	21.33	26	17.33	92	61.33
19	150	71	47.33	79	52.67	20	13.33	52	34.67	78	52.00
20	150	28	18.67	122	81.33	9	6.00	19	12.67	122	81.33
21	150	9	6.00	141	94.00	1	0.67	8	5.33	141	94.00

Table 10. Frequencies and percentages of acceptable scientific response (ASR) unacceptable scientific response (USR) and no response (NR) by the students (continued)

Brief Explanation											
CONCEPTS	**SAMPL SIZE N**	**YES FREQ(F)**	**%**	**NO FREQ (F)**	**(%)**	**ASR**	**%**	**USR**	**%**	**NR**	**%**
22	150	84	56.00	66	44.00	36	24.00	48	32.00	66	44.00
23	150	77	51.33	73	48.67	30	20.00	47	31.33	73	48.67
24	150	78	52.00	72	48.00	37	24.67	41	27.33	72	48.00
25	150	72	48.00	78	52.00	39	26.00	34	22.67	77	51.33
26	150	42	28.00	108	72.00	17	11.33	25	16.67	108	72.00
27	150	18	12.00	132	88.00	1	0.67	17	11.33	132	88.00
28	150	20	13.33	130	86.67	7	4.67	13	8.67	130	86.67
29	150	29	19.33	121	80.67	2	1.33	27	18.00	121	80.67
30	150	16	10.67	134	89.33	0	0.00	16	10.67	134	89.33
31	150	52	34.67	98	65.33	13	8.67	39	26.00	98	65.33
32	150	105	70.00	45	30.00	38	25.33	64	42.67	48	32.00
33	150	66	44.00	84	56.00	22	14.67	44	29.33	84	56.00
34	150	73	48.67	77	51.33	9	6.00	64	42.67	77	51.33
35	150	32	21.33	118	78.67	7	4.67	25	16.67	118	78.67
36	150	28	18.67	122	81.33	14	9.33	14	9.33	122	81.33
37	150	28	19.33	121	80.67	7	4.67	22	14.67	121	80.67
38	150	65	43.33	85	56.67	21	14.00	44	29.33	85	56.67
39	150	13	8.67	137	91.33	7	4.67	6	4.00	137	91.33
40	150	85	56.67	65	43.33	54	36.00	31	20.67	65	43.33
TOTL		**2230**	**1510**	**3780**	**2520**	**807**	**524.7**	**1568**	**1062**	**3655**	**2496.31**
% MEAN($\overline{X}$)		**37.75 %**		**63 %**		**13.12 %**		**26.60 %**		**62.40 %**	

Table 11

Frequencies and percentages of acceptable scientific response (ASR), unacceptable scientific response (USR) and no response (nr) by the adult students

Brief explanation											
CONCEPTS	**SAMPLE SIZE (N)**	**YES FREQ (F)**	**PERCENTAGES (%)**	**NO FREQ(F)**	**(%)**	**ASR**	**%**	**USR**	**%**	**NR**	**%**
1	150	129	86.00	21	14.00	19	12.67	110	73.33	21	14.00
2	150	28	18.67	122	18.33	17	11.33	11	7.33	122	18.33
3	150	92	61.33	58	38.67	33	22.00	59	39.33	58	38.67
4	150	85	56.67	65	43.33	23	15.33	62	41.33	65	43.33
5	150	84	56.00	66	44.00	19	12.60	65	43.33	66	44.00
6	150	100	66.67	50	33.33	39	26.00	61	40.67	50	33.33
7	150	87	58.00	63	42.00	48	32.00	42	28.00	60	40.00
8	150	73	48.67	77	51.33	10	6.67	52	34.67	88	58.67
9	150	33	22.00	117	78.00	5	3.33	28	18.67	117	78.00
10	150	37	24.67	113	75.33	11	7.33	26	17.33	113	75.33
11	150	105	70.00	45	30.33	24	16.00	70	46.67	56	37.33
12	150	55	36.67	95	63.33	25	16.67	30	20.00	95	63.33
13	150	22	14.67	128	85.33	6	4.00	16	10.67	128	85.33
14	150	72	48.00	78	52.00	30	20.00	42	28.00	78	52.00
15	150	53	35.00	97	64.67	15	10.00	47	31.33	88	58.67
16	150	44	29.33	106	70.67	17	11.33	27	18.00	106	70.67
17	150	69	46.00	81	54.00	11	7.33	58	38.67	81	54.00
18	150	82	45.60	68	45.33	41	27.33	41	27.33	68	45.33
19	150	66	44.00	84	56.00	14	9.33	52	26.67	84	56.00

Table 11. Frequencies and percentages of acceptable scientific response (ASR), unacceptable scientific response (USR) and no response (NR) by the adult students (Continued)

CONCEPTS	SAMP SIZE (N)	YES FREQ (F)	PERCENTAGES (%)	NO FREQ(F)	(%)	ASR	%	USR	%	NR	%
20	150	32	21.33	118	78.67	6	4.00	12	8.00	132	88.00
21	150	35	23.33	115	76.67	3	2.00	32	21.33	115	76.67
22	150	93	62.00	57	38.00	35	23.33	58	38.67	57	38.00
23	150	77	51.33	73	48.67	17	11.33	60	40.00	73	48.67
24	150	79	52.67	71	47.33	27	18.00	52	34.67	71	47.33
25	150	76	50.67	74	49.33	38	25.33	39	26.00	73	48.67
26	150	42	28.00	108	72.00	18	12.00	24	16.00	108	72.00
27	150	9	6.00	141	94.00	1	0.67	8	5.33	141	94.00
28	150	13	8.67	137	91.33	7	4.67	6	4.00	137	91.33
29	150	32	21.33	118	78.67	11	7.33	21	14.00	118	78.67
30	150	11	7.33	139	92.67	2	1.33	9	6.00	139	92.67
31	150	56	37.33	94	62.67	16	10.67	40	26.67	94	62.67
32	150	124	82.67	26	17.33	32	21.33	92	61.33	26	17.33
33	150	63	42.00	87	58.00	21	14.00	42	28.00	87	58.00
34	150	74	49.33	76	50.67	13	8.67	61	40.67	76	50.67
35	150	34	22.67	116	77.33	2	1.33	32	21.33	116	77.33
36	150	35	23.33	115	76.67	11	7.33	24	16.00	115	76.67
37	150	35	23.33	115	76.67	4	2.67	31	20.67	115	76.67
38	150	75	50.00	75	50.00	21	14.33	54	36.00	75	50.00
39	150	8	5.33	142	94.64	3	2.00	5	3.33	142	94.67
40	150	81	54.00	69	46.00	55	36.67	26	17.33	69	46.00
Total		2410	1600	3510	2399	742	500.31	1616	1084.33	3625	2415.34
% Mean($\overline{X}$)		40%		59.96%		12.51 %		27.10 %		60.38 %	

From table 11 only 40% of the adult students responded that they understood the environmental concepts while 59.96% showed lack of understanding. However, out of the forty 40% that claimed to have understood the concept, only 12.51% of them gave Acceptable Scientific Response (ASR), while 27.10% of them gave unacceptable Scientific Response. This indicated that though most of the adults that claimed understanding of most of the concept, yet, they cannot give acceptable scientific explanation to them.

Table 12

Summary of frequencies and percentages of understanding of acceptable scientific response, unacceptable scientific response, no response, mean (x) index of understanding and standard deviation of respondent's responses

Brief Explanation													
No	Sample size	Yes F	%	NO F	%	ASR F	%	USR F	%	NR F	%	Mean of SD	SD
40	300	4640	38.2	7290	61.8	1549	12.9	31.84	26.4	7280	60.5	1.52	0.30

Table 13

Concepts and their understanding index by the students and adults

S/N	**Concepts**	**Understanding index**	**Remark**
1	Pollution	1.99	Understood
2	Global warming	1.57	Understood
3	Climate Change	1.48	Not Understood
4	Adaptation	1.66	Understood
5	Biosphere	1.68	Understood
6	Desert	1.98	Understood
7	Overcrowding	1.90	Understood
8	Xerophyte	1.32	Not understood
9	Biome	1.27	Not understood
10	Climax vegetation	1.47	Not understood
11	Ecology	1.73	Understood
12	Tropic rainforest	1.55	Understood
13	Wilting	1.18	Not understood
14	Primary producer	1.44	Not Understood
15	Savanna	1.48	Not understood
16	Edaphic factor	1.35	Not understood
17	Energy transfer	1.52	Understood
18	Biotic factor	1.71	Understood
19	Food Chain	1.47	Not Understood
20	Ecological niche	1.20	Not understood

Table 13.
Concepts and their understanding index by the students and adults (continued)

S/No	Concepts	Understanding index	Remark
21	Biomass	1.16	Not understood
22	Bush fallowing	1.83	Understood
23	Overgrazing	1.67	Understood
24	Vegetation	1.75	Understood
25	Pollutants	1.89	Understood
26	Aquatic Habitat	1.39	Not understood
27	Photic zone	1.10	Not understood
28	Aestivation	1.16	Not understood
29	Mangrove swamp	1.27	Not understood
30	Endangered specie	1.09	Not understood
31	Conservation	1.45	Not understood
32	Population	2.00	Understood
33	Competition	1.47	Understood
34	Ecosystem	1.56	Understood
35	Turbidity	1.25	Not understood
36	Hydrophyte	1.43	Not understood
37	Succession	1.25	Not understood
38	Terrestrial habitat	1.61	Understood
39	Poikilothermy	1.10	Not understood
40	Nuclear Energy	1.92	Understood

Table 14

Raw score and indices for concept understanding by students and adults

Concepts	ASR 3	USR 2	UR 1	Total	Sample Size	Mean	Remark
1	123	434	42	599	300	1.99	Understood
2	123	434	42	599	300	1.99	Understood
3	111	76	225	412	300	1.37	Not Understood
4	189	218	128	535	300	1.78	Understood
5	135	216	147	498	300	1.66	Understood
6	123	242	138	503	300	1.68	Understood
7	282	210	101	593	300	1.98	Understood
8	288	158	125	571	300	1.90	Understood
9	60	198	181	395	300	1.32	Not understood
10	42	106	233	381	300	1.27	Not understood
11	87	288	127	442	300	1.73	Understood
12	129	266	124	519	300	1.47	Not Understood
13	159	120	187	466	300	1.55	Understood
14	30	68	256	354	300	1.18	Not understood
15	198	180	144	522	300	174	Not understood
16	78	186	181	445	300	1.48	Not understood
17	99	78	228	405	300	1.35	Not understood
18	75	212	169	456	300	1.52	Understood
19	219	134	160	513	300	1.71	Understood
20	102	208	162	472	300	1.57	Understood
21	44	62	254	360	300	1.20	Not understood
22	12	80	256	348	300	1.16	Not understood
23	213	212	123	548	300	1.83	Understood
24	141	214	146	501	300	1.67	Understood
25	192	186	143	525	300	1.75	Understood
26	231	185	150	566	300	1.89	Understood
27	105	98	216	419	300	1.39	Not understood
28	6	50	275	331	300	1.10	Not understood
29	42	38	257	347	300	1.16	Not understood
30	39	104	239	382	300	1.27	Not understood
31	6	50	273	329	300	1.09	Not understood
32	87	158	192	437	300	1.45	Not understood
33	210	312	74	596	300	2.00	Understood
34	129	172	171	472	300	1.57	Understood
35	66	250	153	469	300	1.56	Understood
36	27	114	234	374	300	1.25	Not understood
37	75	76	277	428	300	1.43	Not understood
38	126	196	160	482	300	1.61	Understood
39	30	22	279	331	300	1.10	Not Understood
40	327	114	134	575	300	1.92	Understood
Total mean index of understanding = 60.67 $\overline{X}$ = 1.52							

Table 15
Raw score and indices for concepts understanding by students

Concepts	ASR 3	USR 2	NR 1	Total	Sample Size	Mean	Remark
1	66	214	21	301	150	2.00	Understood
2	60	54	103	217	150	1.45	Not understood
3	90	100	70	260	150	1.73	Understood
4	66	92	82	240	150	1.60	Understood
5	66	112	72	250	150	1.67	Understood
6	165	88	51	304	150	2.03	Understood
7	144	74	65	283	150	1.89	Understood
8	30	94	93	217	150	1.45	Not understood
9	27	50	116	193	150	1.27	Not understood
10	54	236	14	304	150	2.03	Understood
11	57	126	68	251	150	1.67	Understood
12	84	60	92	236	150	1.57	Understood
13	12	36	128	176	150	1.73	Understood
14	108	96	66	270	150	1.80	Understood
15	33	92	93	218	150	1.45	Not understood
16	48	24	122	194	150	1.29	Not understood
17	42	96	88	226	150	1.51	Not understood
18	96	52	92	240	150	1.60	Understood
19	60	104	78	242	150	1.41	Not understood
20	27	38	122	187	150	1.25	Not understood
21	3	16	141	160	150	1.07	Not understood
22	108	96	66	2.70	150	1.80	Understood
23	90	94	73	257	150	1.71	Understood
24	111	82	72	265	150	1.77	Understood
25	117	68	77	262	150	1.75	Understood
26	51	50	108	209	150	1.39	Not understood
27	3	34	132	169	150	1.13	Not understood
28	21	26	130	177	150	1.18	Not understood

Table 15. Raw score and indices for concepts understanding by students (continued)

Concept	**ASR 3**	**USR 2**	**NR 1**	**Total**	**Sample Size**	**Mean**	**Remark**
29	6	54	121	181	150	1.21	Not understood
30	0	32	134	166	150	1.11	Not understood
31	39	78	98	215	150	1.43	Not understood
32	114	128	48	290	150	1.93	Understood
33	66	88	84	238	150	1.49	Not understood
34	27	128	77	232	150	1.55	Understood
35	21	50	118	164	150	1.09	Not understood
36	42	28	122	192	150	1.28	Not understood
37	21	44	121	186	150	1.24	Not understood
38	63	88	85	236	150	1.57	Understood
39	21	12	137	170	150	1.13	Not understood
40	162	62	65	289	150	1.93	Understood
Total Mean($\overline{X}$) Index Understanding					61.47		
Mean ($\overline{X}$)					1.54		

Table 16

Raw score and indices for concepts understanding by the adult students

Concept	ASR 3	USR 2	NR 1	Total	Sample Size	Mean	Remark
1.	57	220	21	298	150	1.99	Understood
2.	51	22	122	195	150	1.30	Not understood
3.	99	118	58	275	150	1.83	Understood
4.	66	124	65	255	150	1.70	Understood
5.	57	130	66	253	150	1.67	Understood
6.	177	122	50	289	150	1.92	Understood
7.	144	84	60	288	150	1.92	Understood
8.	30	104	88	223	150	1.49	Not understood
9.	15	56	117	188	150	1.25	Not understood
10.	33	52	113	198	150	1.32	Not understood
11.	72	140	56	268	150	1.79	Understood
12.	75	60	95	230	150	1.53	Understood
13.	18	32	128	178	150	1.19	Not understood
14.	90	84	78	252	150	1.68	Understood
15.	45	94	88	275	150	1.51	Not understood
16.	51	54	106	209	150	1.39	Not understood
17.	33	116	81	230	150	1.53	Understood
18.	123	82	68	273	150	1.82	Understood
19.	42	104	84	230	150	1.43	Not understood
20.	18	24	132	174	150	1.16	Not understood
21.	9	64	115	188	150	1.25	Not understood
22.	105	116	57	278	150	1.90	Understood
23.	51	120	73	244	150	1.63	Understood
24.	81	104	71	256	150	1.71	Understood
25.	114	117	73	304	150	2.03	Understood
26.	54	48	108	210	150	1.40	Not understood
27.	3	16	141	160	150	1.07	Not understood

Table 16
Raw score and indices for concepts understanding by the adult students (continued)

Concept	**ASR 3**	**USR 2**	**NR 1**	**Total**	**Sample Size**	**Mean**	**Remark**
28.	21	12	137	179	150	1.19	Not understood
29.	33	50	118	201	150	1.39	Not understood
30.	6	18	139	163	150	1.09	Not understood
31.	48	80	94	222	150	1.50	Not understood
32.	96	184	26	306	150	2.04	Understood
33.	63	84	87	234	150	1.46	Not understood
34	39	122	76	237	150	1.58	Understood
35.	6	64	116	186	150	1.24	Not understood
36.	33	48	115	196	150	1.31	Not understood
37.	12	62	115	189	150	1.26	Not understood
38.	63	108	75	246	150	1.64	Understood
39.	9	10	142	161	150	1.07	Not understood
40.	165	52	69	286	150	1.91	Understood
Total Mean Index of Understanding =61.24 Mean ($\bar{X}$) **=1.53**							

Table 17

Concepts and their understanding index by the students

Serial Number of Concept	**Understanding Index**
1	2.01
2	1.45
3	1.73
4	1.60
5	1.67
6	2.03
7	1.89
8	1.45
9	1.27
10	2.03
11	1.67
12	1.57
13	1.73
14	1.80
15	1.45
16	1.29
17	1.51
18	1.60
19	1.61
20	1.25
21	1.07
22	1.80
23	1.71
24	1.77
25	1.75
26	1.39
27	1.13

Table 17

Concepts and their understanding index by the students (Continued)

Serial Number of Concept	**Understanding Index**
28	1.18
29	1.21
30	1.11
31	1.43
32	1.93
33	1.59
34	1.55
35	1.09
36	1.28
37	1.24
38	1.57
39	1.13
40	1.93
Total	**61.47**
Mean ($\overline{X}$)	**1.54**

Table 18

Concepts and their understanding index by the adult student

Serial Number Concepts	**Understanding Index**
1	1.99
2	1.30
3	1.83
4	1.70
5	1.97
6	1.92
7	1.92
8	1.49
9	1.49
10	1.32
11	1.79
12	1.53
13	1.19
14	1.68
15	1.51
16	1.39
17	1.53
18	1.82
19	1.53
20	1.16
21	1.25
22	1.90
23	1.63
24	1.71
25	2.03
26	1.40
27	1.07
28	1.19
29	1.39
30	1.09
31	1.50
32	2.04
33	1.56
34	1.58
35	1.24
36	1.31
37	1.26
38	1.64
39	1.07
40	1.97
Total 61.24 Mean 1.53	

Table 19

Summary of the extent to which students and adults differ in their understanding of the environmental concepts

Respondent	Size	Mean($\bar{X}$)	Variance	Standard Deviation
Students	150	1.54	0.080	0.28
Adults	150	1.53	0.082	0.29

Table 20

Summary of Correlation coefficient between students and their demographic status

S/N	**Demographic factor**	**N = 150**	**r**	**Significance**
1	Economic Level	150	0.986	0.000
2	School Location	150	0.953	0.000
3	School Type	150	0.969	0.000
4	Gender	150	-1.118	0.000
5	Age	150	1.319	0.000
6	Family System	150	0.982	0.000
7	Occupation	150	0.969	0.000

Table 21

Summary of Correlation coefficient between Adults and their demographic status.

S/N	**Demographic status**	**N = 150**	**r**	**Significance**
1	Economic Level	150	0.969	0.000
2	School Location	150	0.959	0.000
3	School Type	150	0.959	0.000
4	Gender	150	-0.931	0.000
5	Age	150	0.403	0.000
6	Family System	150	0.982	0.000
7	Occupation	150	0.953	0.000

Table 22

Summary of Correlation coefficient between students and adults and their demographic status

S/N	Demographic status	N = 150	Students r =	Adults r =	Significance
1	Economic Level	150	0.986	0.969	0.000
2	School Location	150	0.953	0.959	0.000
3	School Type	150	0.969	0.959	0.000
4	Gender	150	-1.118	-0.931	0.000
5	Age	150	1.319	0.403	0.000
6	Family System	150	0.982	0.982	0.000
7	Occupation	150	0.969	0.953	0.000

Table 23

Frequencies and percentages of respondents' responses from the result of the interview as reasons for misconception on some environmental concepts

S/N	**Reasons for misconception adopted from Mang (2009)**	**Number of respondents**	**Frequencies (F)**	**Percentages %**
1	Over simplification of concepts (OSC)	100	00	00
2	Language problem (LP)	100	52	52
3	Teachers pedagogical problem (TPP)	100	79	79
4	Misconception from family members (MFM)	100	00	00
5	Students attitude to biology (SAB)	100	63	63
6	Topic not taught (TNT)	100	55	55
7	Abstractness of concept (AC)	100	81	81

Other Reasons observed in respondents' responses

Table 23. Frequencies and percentages of respondents' responses from the result of the interview as reasons for misconception on some environmental concepts (continued)

S/N	**Reasons for misconception adopted from Mang (2009)**	**Number of respondents**	**Frequencies (F)**	**Percentage (%)**
8	Distance from school (DFS)	100	16	16
9	Forgetfulness (F)	100	3	3

Table 24

Frequencies and percentages of respondents' responses from the result of the interview on how to solve or overcome the misconception problems on some environmental concepts

S/N	Solution	Number of respondents	Frequencies (F)	Percentages %
1	More practical (MP)	100	78	78
2	Simple and clear English (SCE)	100	76	76
3	Use of teaching aids (UTA)	100	73	73
4	More time for questioning (MTQ)	100	68	68
5	Prompt evaluation	100	78	78

CURRICULUM VITAE

TOMA MAINA ANTIP

General Information

Name: Toma Maina Antip

Sex: Male

Birth Date: 20 January 1972

Marital Status: Married

Nationality: Nigerian

Telephone: Mobile -05488745166; +234 806 5393934

E-mail: tomamaina@yahoo.com

Languages: English, French, Hausa, Kadung

Personal Profile

I am an articulate, intelligent, analytical and enthusiastic professional, with adequate training, experience and exposure in Biology education, Environmental Education and Management and communication technology. With my academic background, complementary formations, experience and exposure, I am able to effectively teach and facilitate continuous professional development sessions. I am a self-motivated team player interested in positively contributions to the development of organizations and presently lecturing in Biology Department of Federal College of Education Pankshin, Plateau State, Nigeria.

Academic Development

In Nigeria: 2002 – 2005 University of Jos, Plateau/Nigeria, Master of Science (M.Sc.) Biology Education.

In Nigeria: 1992 – 1997 University of Jos, Plateau. Bachelor of Science (B.Sc.) Integrated Science Education.

In Nigeria: 1987 – 1990 Federal College of Education, Pankshin, Plateau. Nigeria Certificate in Education (N.C.E).

In Nigeria: 2008-2013 Church of Christ in Nations Theological Education by Extension, National Diploma in Christian Theology. Awaiting Result

In Nigeria: 2009 Federal College of Education, Pankshin, Plateau, Nigeria. Certificate in Computer Application (C.C.A).

In Nigeria: 1982 – 1987 Mangu Secondary School. General Certificate in Education (G.C.E).

Complementary Development

In Nigeria 2008 Facilitator: Youths and Education: The Way Forward.

In Nigeria 2009 Facilitator: Youths and the Challenge of Peace and Security.

Main Professional Skills

Teaching and Motivating Students to Learn

- Expert knowledge and skilled in using contemporary teaching strategies.
- Expert knowledge and skilled in using technology to assist teaching and learning.
- Training students and youth groups in discipleship and Bible study

People Engagement Skills

- Capacity Building
- Facilitating workshops and Conferences
- Public speaking at educational and technology fora.

Use of Computer Technologies

- Windows Microsoft Programs: Word processing, E-mailing, E-research, Power point.

Other Attributes and Skills

- Scientifically literate and able to work and relate well with people from different ethnic background and social status.
- Dynamic, resourceful, willing and able to learn within a limited time frame as well as effective under pressure.
- Experience in capacity building and training skills.
- Demonstrate research and analytical and writing skills
- Demonstrable ability to work independently and think innovatively
- Fluency in written and spoken English.

Current Job Title and Description

- Senior Lecturer, Biology Department
- Currently my job requires me to lecture courses in Biology
- Assess students' performance
- Research work and
- Publications

Papers and Publications

Presented over 20 papers in and served as resource person at national and international workshops and conferences. Some of these include:

- Littering and its possible effect on water quality: A case study of Jos Bukuru Area. A paper presented on the 2nd International Conference on Water Problems in the Mediterranean Countries (WPMC 2019) from 6 – 10 May, 2019
- Achieving Water Pollution Control through the use of selected instructional Strategies. . A paper presented on the 2nd International Conference on Water Problems in the Mediterranean Countries (WPMC 2019) from 6 – 10 May, 2019
- An assessment of the Biology curriculum of the Senior Secondary Two (SS II) in Relations to Piagetian Levels of Cognitive Development in Plateau State, Nigeria. A paper presented at GLOBETS conference in Girne, North Cyprus from 11th-14th April, 2018.
- Municipal Solid wastes and their effects on Plants. A review of the cases of Nicosia and Nigeria. Journal of Educational Studies, 2018. Volume 18, No.2
- Developing scientific skills in Biology Students: A Panacea for a better Society. Journal ff Science, Mathematics and Technology Education. Vol. 1, No. 1, April, 2019
- Re – Directing Tertiary Education Towards Entrepreneurship Education as a Panacea for Unemployment in Nigeria. Journal of Educational Thoughts and Processes (JETP). Maiden Edition, September, 2018.
- Improving Health Habits of Nigerians through the teaching of hygiene in Primary Schools. International Journal of Social Science Education (IJSSE). Vol. 1. No.1, November,2018
- Trends in Environmental Education: Implication for Science Teachers. International Journal of Chemistry Research. www.chemrj.org.vol 3(6) p.93-105, 2018.
- Bioremediation in Ponds: A case study of Panyam Fish Farm, Platreau State. A paper presented at the 8th European Pond Conservation Network, from 21st-25th May, 2018 in Torroella de Montgrí, Girona, Spain.
- Improving Health Habits of Nigerians through the teaching of Hygiene in Primary Schools. International Journal of Social Science Education (IJSSC) 1(1) p. 350-360

- Effect of Controlled Lactic Acid and Bacteria Fermentation on the Micro Biological and Chemical of Red Belly Tilapia (Tilapia zilli). Publication in Journal of Research in Bioscience, 2016
- The need to reposition Vocational and Technical Education towards economic Revitalization. Nigerian Journal of Educational Issues Vol. 1 Issue 2; June 2016.
- Ethical Value system re-orientation as veritable tools towards promoting functional education in Nigeria. Paper presented Colleges of Education Staff Union (COEASU) Federal College Education Pankshin from 26th-29th August 2015.
- Creative Biology: Focus on Peeled Locust been extract Pod extract, A base for paint making: Chapter contribution in the Book practical approach to the teaching of science School of Science FCEP 2(1) 2013
- Inculcating Environmental ethics in students through multidisciplinary and problem solving approaches: A call for curricular innovations in Nigerian schools : A paper presented at Plateau State Science Students Association from 3rd -6th July 2013
- Creative Biology: A base for paint making. A paper presented at an International Workshop on a theme "Practical approach to the teaching of science" Organised by school of science, Federal College of Education Pankshin, Plateau State, Nigeria. From 12-16 July 2011.
- Improvisation in Biology Teaching as a Panacea for the Realisation of Vision 20:2020. The Belt Journal of Education in Nigeria. Vol. 2 No.1 2011
- General Contributions on Sustainability towards the Realisation of vision of vision 20:2020. The Belt Journal of Education in Nigeria. 2 (2) 2011
- General Contributions on Sustainability towards the Realization of Vision 20: 20 20. Paper presented at Colleges of Education Academic Staff Union Conference. The Belt Journal of Education, June 2011. 2(3) 2011
- Improvisation in Biology Teaching as a Panacea for the Realization of vision 20:2020. A Paper presented at Colleges of Education Academic Staff Union Conference- The Belt Journal of Education, June 2011
- Combating Child Labour and Trafficking in Nigeria through Education Journal of Women in College of Education. Vo.13 No. 2 October, 2009.

- Strategies for Effective Teaching and Learning of Adaptation in living organism. A publication of the school of science journal Federal College of Education (FCE) Pankshin.
- Making Science Interesting, Enjoyable and Fun through the use of Local Resources in the Environment. A publication of the school of Science Journal Federal College of Education (FCE) 2005.

Books Written

1. Introduction to Fish Production and Management, 2015
2. Introduction to Environmental Education in Nigeria – In press

Interest and Activities: Science and Technology, reading, singing and praying

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