CURRICULUM CONTENT, PEDAGOGICAL CONTENT KNOWLEDGE, STUDENT-RELATED FACTORS AND LEARNING OUTCOMES IN ENVIRONMENTAL CONCEPTS IN BIOLOGY IN EKITI STATE, NIGERIA

BY

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ABSTRACT

Environmental concepts are taught in senior secondary schools Biology to equip students with knowledge to solve societal problems. However, reports have shown that students' learning outcomes related to environmental concepts in Biology are low in Ekiti State, Nigeria. These have been largely attributed to teachers' poor knowledge of curriculum content, teachers' poor pedagogical content knowledge and student-related factors. Previous studies focused largely on intervention programmes through the use of teaching strategies, with little attention paid to curriculum content, pedagogical content knowledge and student-related factors that could influence learning outcomes in environmental concepts (achievement, attitude to and practices). This study, therefore, was carried out to investigate curriculum content, pedagogical content knowledge, student-related factors (motivation, emotional intelligence and cognitive style) and learning outcomes in environmental concepts in Biology in Ekiti State, Nigeria.

Heider's Attribution, Ausubel's Meaningful Reception Learning and Social Constructivist theories provided the framework, while the survey design of correlational type was adopted. Three Local Governments Areas (LGAs) (Ado, Ikere, Ido-Osi) were randomly selected in Ekiti State. From each LGA, five senior secondary schools were randomly selected, making a total of 15 schools. Intact classes were used and a total of 1000 students participated, while 15 Biology teachers were enumerated. The instruments used were Biology Students' Environmental Achievement (r=0.83), Students Cognitive Style (r=0.81) tests, Biology Environmental Attitudinal (α=0.88) scale, Biology Students' Environmental Practices (α=0.82), Biology Curriculum Content Rating (r=0.87), Teachers' Pedagogical Content Knowledge Rating(r=0.88), Students Motivation (α=0.80) and Students Emotional Intelligence (α=0.80) scales. Data were subjected to descriptive statistics, Pearson's product moment correlation and Multiple regression at 0.05 level of significance.

The majority of the teachers were male (88.2%), while the majority of the students were female (65%). Biology curriculum content(r =0.62), students' emotional intelligence (r=0.01) and motivation (r=0.11) had significant positive relationships with students' achievement, while pedagogical content knowledge and cognitive style were not related to achievement. Motivation (r=0.18), emotional intelligence (r=0.33) and cognitive style (0.25) had significant positive relationships with students' attitude, while curriculum content and pedagogical content knowledge were not related to attitude. Motivation (r=0.16), emotional intelligence (r=0.31) and cognitive style (r=0.24) had significant positive relationships with students' practices in environmental concepts in Biology. There was a significant joint contribution of the

independent variables (curriculum content, pedagogical content knowledge, motivation, emotional intelligence and cognitive styles) to the achievement in environmental concepts in Biology ($F_{(3.11)=}$2.63; Adj. R^2=0.26),accounting for 26% of its variance; but they did not jointly contribute to attitude and practices. Curriculum content (β=0.58; t =2.23) contributed to students' achievement in Biology environmental concepts, but did not contribute to attitude and practices. Motivation (β=0.26) and cognitive style (β=0.15) relatively contributed to attitude, but did not relatively contribute to achievement and practices in environmental concepts in Biology.

Curriculum content enhanced students' achievement in environmental concepts in Biology in senior secondary schools in Ekiti State, Nigeria. Therefore, there is the need to strengthen Biology teachers' pedagogical content knowledge for improved learning outcomes.

Keywords: Curriculum content, Environmental concepts in Biology, Pedagogical content knowledge, Emotional Intelligence, Cognitive style

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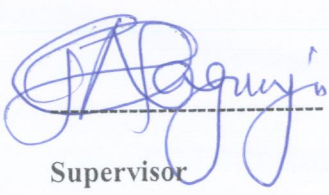
CERTIFICATION

I certify that this research work was carried out by OMOSEEBI Oluwatosin Bimbo in the Department of Science and Technology Education, Faculty of Education, University of Ibadan, Ibadan.



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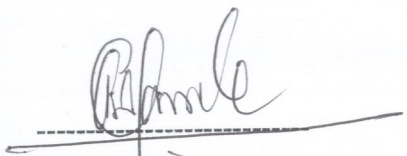

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DEDICATION

This thesis is dedicated to Almighty God, the ancient of days, the beginning and ending

“ ma fi eko mi yin o logo, ma fo gbon ti mo ni yin o baba, ere ki lo le je fun mi, ni gba ti moba ti wo inu ile lo, erupe ile ko le yin o logo baba mi”

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LIST OF ABREVIATIONS

BCC: Biology Curriculum Content

CK: Content Knowledge

NECO: National Examination Council

MRA: Multiple Regression Analysis

PCK: Pedagogical Content Knowledge

PK: Pedagogical Knowledge

WAEC: West Africa Examination Council

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Biology is one of the science subjects offered at the Senior Secondary School level and higher institutions in Nigeria. It is generally defined as the study of life. The significance of Biology in the Nigerian Secondary School curriculum cannot be overemphasized as equipping students with sound background in theories and practical knowledge of Biology would contribute greatly to their ability to manage natural resources in their immediate environment and the larger society (Chukwuemeka, 2011). Among the so many concepts learnt in Biology are environmental concepts such as the natural environment, natural resources, pollution, solid waste disposal, degradation, population, famine, health issues, energy conservation, global warming, deforestation and desertification and ozone depletion. According to Mustafa and Osman(2008), Biological studies include understanding the system of classification from molecules to ecosystems. Biology, as a science subject, cuts across all levels of education ranging from basic science at the primary level to specialised subjects such as medicine at the tertiary level of education.

Education has been acknowledged as the utmost weapon that can facilitate change in an environment. In Nigeria, education has been recognised as a great instrument which brings about national development. Therefore, investing greatly in it becomes very important as a nation wanting to experience rapid development in the area of economic growth, political stability, sociological and personnel management. Having realized this, Nigeria then formulated a policy on education which seeks to impress upon the citizens the need *for consciousness and national unity, positive value and behaviour and positive attitudes toward the environment for the existence of the citizen and the nation at large; the preparation of the psyche in comprehension of the world around; and the gaining of pertinent aptitude and capabilities both intellectual and physical as equipment for the person to live in and add to the advancement of the society.*

Education is a tool that helps in creating awareness and sensitizing people about their environment as the goal of environmental education is to have people who can acquire knowledge about their environment and have the skills, attitude, drive and commitment to work on their own or in groups in order to proffer solutions to the problems emanating from their environment and guide against the onset of new ones. Therefore, for this to be

accomplished, the school system needs to be involved as it is the highest organised structure where environmental education and action can take place. Also, the school system provides materials and teaching aids which help to effectively teach environmental education and inculcate the right environmental values to the students, (Medayese, 2009).

The protection of our environment is everyone's duty. Therefore, it becomes necessary for the inclusion of the environmental concepts into the Biology curriculum at the Senior Secondary School level so as to educate the students and equip them with adequate knowledge about their environment in order to be able to develop positive attitude and practices which will enable them to participate actively in the conservation of their environment. This adequate knowledge will also enable them to train the people they are living with in their community thereby achieving the goal of environmental education which is a sustainable environment. Clearly, the protection of our environment is of utmost importance to our lives as it is concerned with the surroundings in which we live and have our full life

In spite of the immense contribution of Biology to the inclusive advancement of human beings and the environment, the performance of learners in public examinations has consistently been poor over the years, (Abimbola 2013). Ogundele (2005) noted that, of the three core science subjects (Biology, Physics and Chemistry), Biology had the highest failure rate of 51%. This finding affirms that the problem of low performance of leaners in Biology is a recurring problem and efforts to address this problem have not yielded the desired result. The main concern of all educational effort is to see that a learner achieves good result. In spite of this realization, achievement of students in Environmental Concepts in Biology remains a serious issue that needs to be addressed. This is corroborated by reports of the past results of students in Biology examinations which have shown that students perform poorly at such examinations (Oloyede, 2015, and Ndioho, 2012). This situation is the same in Ekiti State. Table 1.1 summary of -student performance in Biology from 2005- 2015 in the State.

Table 1.1 The Summary of Students Performance in Biology in May/ June SSCE Results in Ekiti State from 2005-2015.

Year	**Number of candidates examined**	**Number and % of candidates with A1-C6**		**Number and % of candidates with D7-E8**		**Number and % of candidates with F9**	
		Number	%	Number	%	Number	%
2005	14301	3,243	22.67	5,469	38.22	5,589	39.11
2006	5456	834	15.29	2,110	38.67	2,512	46.04
2007	7987	1,525	19.00	2,936	36.78	3,526	55.78
2008	5141	1,947	37.87	1,668	32.45	1,526	29.68
2009	4904	1,645	33.50	474	28.81	2,785	37.69
2010	12634	1,371	10.85	8,988	71.14	2,275	18.01
2011	9954	3,098-	31.00	2,204	22.14	4,562	46.86
2012	8750	3,004	34.33	1,186	13.55	4,560	52.12
2013	16426	8,654	52.70	3,538	21.54	4,334	25.76
2014	10578	3,760	35.50	1,002	9.47	5,816	55.03
2015	8878	3,758	42.00	1,594	17.95	3,526	40.05

Source: ***Research and Statistics Department, Ministry of Education, Ado, Ekiti State, Nigeria.***

A careful study of Table 1.1 shows that the trend in students' performance in Biology has not changed over the years as greater percentage of students are scoring below credit grade except in 2013 where there was slight improvement that could not be sustained in the following year. This slight improvement recorded in 2013 may have been due to the increase in enrolment (16,426) against the previous and subsequent years under review. In 2014 and 2015 when the enrolments were lower, the poor performance became very obvious as students who passed within A1 –C6 ranges were just 35.5% and 42% respectively. In essence, over 60% of the candidates that sat for Biology in 2014 and 2015 failed the subject.

The West African Examinations Council (WAEC) Chief Examiners report revealed that most of the candidates who wrote the 2007 Senior Secondary School Certificate Examinations (SSCE) in Biology could explain convincingly, conservation of natural resources, pollution and erosion. Also in (2008) it was indicated that few candidates performed in questions on sources of Noise Pollution but failed to perform on items requiring answers on the effect and prevention of Noise Pollution. The same trend occurred in Chief Examiner's Report in Nigeria (2009) where few candidates were able to answer questions on the flow of Energy through the food chain in ecology. This trend continued in 2010 where candidates failed to explain convincingly the terms: Niche, Population Density and Climatic Community. Majority of the candidates that sat for 2010 Biology examination were unable to explain the interaction between abiotic and biotic components of an ecosystem. These are environmental terminologies that candidates need to be conversant with. In 2011, a lot of candidates found it difficult to state and explain the second law of thermodynamics. In 2012, candidates were unable to state the importance of decomposers in the ecosystem and could not give correct examples. They were unable to explain the term endangered species. Through these years, candidates' weaknesses were also found in their incapability to recognize certain exemplified animals; incapability to provide accurate motives for classifying labelled parts and mistakes in spelling biological terms. In 2013-2015, learners found it hard to respond to questions on ecology and pollution.

Furthermore, Oloyede (2015) reported that attitude influences learning of environmental concepts in Biology. It performs a major role in students' learning outcomes in Biology. Attitude is also a regular propensity to respond in a specific manner repeatedly positively or negatively to every matter. Environmental attitude has been defined as learned disposition to react constantly constructively or with hostility with reference to the environment (Gabriela et al, 2018). The environmental attitude of people (both students and

adults) is observed to be negative, and has, in so many ways, become a detrimental trend in the nation. Despite all the efforts by the government to see to the improvement of environmental quality, it is still being observed that the community at large including the students still pollute the environment. Ifegbesan (2010) in his study revealed that the destructive behaviour of the community to the environment include the school systems. Olagunju and Oloyede (2015) revealed that Nigerian students' predominant knowledge, attitude and practices in relation to conservation of natural resources are poor. Bala and Mohamed (2015) observed that students exhibit negative attitude toward science due to poor performance often recorded. These negative attitudes has been credited to absence of enthusiasm for the subject, passive technique of instruction used by the instructor, the curriculum content which is voluminous and tend to be abstract, unstable emotional intelligence of the students, classroom environment.

These negative attitude exhibited by the student has made one of the objectives of Biology which states that students must be able to cultivate a reasonable and functional scientific attitude because positive attitude toward Biology positively correlate students' achievement. Thus, there is need to inculcate into the students the right attitude as attitude is an effective predictor of learning outcome, (Kurbanoglu, Akim and Takunyaci, 2010). Hofstein and Mamlok-Naaman (2012) confirmed that active participation during the teaching goes a long way in improving the attitude of students in science subjects of which Biology is included.Environmental Education is of critical importance for promoting Responsible Environmental Behavior (REB) and sustainable development. Teachers, thus, play a very significant role in developing desirable attitude towards the environment among students as this will leads to the development of skill that will enable them to protect their environment.

Environmental practices are those actions people can take to improve the environment's performance**.** Our long-term social and economic well-being depend on the well-being of life-supporting environment. It is not news that good environmental practices make good economic sense (Gelberg, 2010). Ajiboye and Ajitoni (2008) in their studies observed that Nigerians show negative attitude to the environment. Oloyede (2015) asserts that the major purpose for executing environmental practices is to have a clean environment and to preserve the natural resources in our domain. Thus, delivering good environmental performance is major to our day-to-day activities. Environmental Practices should be geared towards sustainable use of the natural resources for both the present and future generations. Oloyede (2015) reported that beliefs and misconceptions, which young people have, tend to stick to them for a long period later in life. Therefore, students remain the most complex set of population who should be

introduced to, get involved in and trained in bringing solution to environmental problem which emanate in the society because they are usually interested ,strongly motivated and proficient in comprehending an Environmental Education that is esteem, network situated and worried about human posterity. Various researchers over the years have pointed out that the students are aware of environmental problems and possibly the solutions but have not been able to put into practice this knowledge.

Ogundiwin (2014) reported that daily experiences in Nigeria have revealed very poor environmental practices. This study revealed that students had adequate knowledge and awareness about environmental issues but this knowledge did not affect their behaviour and attitude as their practices remained poor. Sivamoorthy, Nalini, Satheesh Kumar, (2013) who worked on the correlation between environmental awareness and practices among secondary school learners observed that there was no correlation between environmental consciousness (awareness) and what they put into practice (practices). This indicates that the college learners are conscious of environmental issues but failed to practise. These results contradicts one of the goals and purposes of education in Nigeria which state that teaching must purpose at assisting the students to acquire suitable talents, skills and proficiencies, both intellectual and physical as tools for the people to dwell in and contribute to the growth of the public.

In the urban centres, there is an alarming rate of poor waste generation and disposal by people, traders of different commodities in market places and corporate bodies as well as ineffective waste managing scheme and regulation by the government. All these may rightly be attributed to earlier submission that ignorance or lack of environmental awareness of the right action to take is the greatest single contributor to environmental degradation problems (Ojo, et al, 2014).A sustainable practical solution for conservation of natural resources is of interest to the government and the citizens as everybody benefits from a sustainable environment (Ajiboye and Olatundun, 2010). Thus, positive environmental practices are of utmost importance to avert environmental degradation of which, if not checked, can destroy the natural resources, human well-being and environments with devastating penalties for the existing and upcoming generations of Nigerians. Oladapo,(2011) was of the opinion that the public needs to be informed about issues that affect their well-being especially pollution and national resources depletion with adverse and or disastrous health consequences including the common practices which are becoming the order of the day in all the towns and villages without environmental considerations. Well informed students on environmental education will in turn have a positive influence on the society at large.

Regrettably, Nigerian students exhibit negative attitude and practices which result to very poor performance academically. It is obvious that students who are taught environmental concepts that have been in existence for some time did not manifest the element in their daily lives.

Curriculum is defined by Akudolu (2004) as a structured knowledge offered to students in a school, inserting every component in the learning setting. Curriculum is all the skills students have under the tutelage of teachers. In line with the above, Ali (2006) sees curriculum as a structured contents or course of instruction required by the students who is required to exhibit some intentions or behavioural change. The components of a good curriculum include extra class activities and counseling activities and all these components are interwoven. The primary focus of a curriculum is on what is to be taught, how and when learning will take place. It is also a course which students undertake as they compete for their academic work. Curriculum drive its content (from international principles and indigenous aims) and constructs it into a design for efficient training and learning. Therefore curriculum is not just a list of topics, facts and skills to be taught; it is a plan of how to achieve academic excellence.

The curriculum embraces the experiences and activities of students while in school, the distinctive philosophical and psychological viewpoints of the teacher which are graded according to the social need of the children or society, a group of prescribed course or sequence or sequences of subjects required for certification and the source through which the educational objectives and needs of a particular society, the learner and the subject matters are achieved. Therefore, the curriculum must be adjusted to suit the age, need, ability and aptitude of the learners. It must be learner centred; that is, the teacher must follow the curriculum by teaching the learners according to specified teaching activities in the curriculum and not the subject.The core value of training (Education) in Nigeria is the outfitting of each resident with such learning, aptitudes, mentalities and qualities so as to empower that person to fit in the society, live a fulfilled life and contribute meaningfully to the progress and safety of the community as noted by (Anore ,2011).

Biology was introduced into the curriculum as one of the subjects students must do at Senior Secondary School level. Biology curriculum has undergone several modifications and changes since its introduction into the school system. Note that after the 1985 curriculum conference, a new Biology curriculum evolved. And this was introduced into the school system. The content of the curriculum is sectioned into four parts mainly organism and its

environment; organism at work; organization of life. The environmental contents aspect of the curriculum includes conservation of natural resources, micro-organism in action, pollution, ecology. Olabode (2017) observed that curriculum laid more emphasis on the affective and psychomotor domains. This implies that the curriculum should be able to impact in the students the right attitude and change their orientation towards the environment. The Biology curriculum content in the Senior Secondary Schools had a clear objective spelt out by CESAC thus, realising these goals, therefore means that every student must learn the topic, comprehend and grasp all the concepts. Apart from the objectives, it also contains the teachers' activities, students' activities, evaluation and assignment. This makes the current curriculum learner centred and not teacher centred. (Achoret al, 2013).

Recently, it was found out that the students were not performing well; this makes the curriculum expert to revise the curriculum to accommodate other biological concepts. This is the reason the current Biology curriculum content is structured into four themes, namely: organization of life, the organism at work, the organism and its environment and continuity of life. The Biology curriculum content is meant to impact current Biology courses as well as meet the desires of humanity through significance and practicality in its content, process, procedures and presentation. The topics in the curriculum that are of direct importance to the public contain: ecological studies and principles; applied ecology; man and microbes, health and personal hygiene, pollution, conservation of natural resources and erosion; and these topics are about 40% of the total curriculum.

Unfortunately, the objectives of teaching these environmental concepts have not been achieved as many teachers rush to complete the curriculum skip some topics and even avoid teaching of some topics in the curriculum. Such behaviour does not support effective learning but contributes to poor achievement, negative attitude and poor practices among students. Also, Olagunju (2002) observes that the current curriculum content is deficient in the area of imparting the right attitude and skill that the students need in order to carry out specific task related to environmental concepts in Biology. It has been observed that most of the tasks that are students activities and teachers activities in the curriculum are being skipped by the teacher due to the fact that they are time consuming and most of the tasks recommended in the curriculum are not practicable by the students and the teachers because the materials are not readily available in the school. Kafu (2010). Kamande (2013) indicates that the reason the Curriculum is not covered in the specified period is due to time wastage. This finding is consistent with observations made by Verspoor (2008) that, no matter how good curriculum

content is, if it is not taught as planned by teachers with adequate content and pedagogical competence, the performance of learners, their attitude and practices will be affected when they are exposed to examinations

Apart from curriculum content, another factor that affects students' learning outcomes is teachers' pedagogical content knowledge.

Teachers are the determinants of a successful educational scheme. Therefore, for this to happen in the classroom, teachers must possess ample knowledge of the content and the right pedagogy to use in order to facilitate the learning effectively as pedagogical content knowledge for specific discipline is required. (Van Direl and Berry, 2010). Thus, PCK is the amalgamation of understanding of content of the topic and strategy that guides the teachers on how subject matter, difficulties, or topics planned are transferred to students in order to arouse their interests and abilities through prior knowledge (Loughran, 2007). This is needed by teachers to direct their decisions and actions during teaching in the classroom. Mastery of PCK allows educators to tackle the challenges associated with learning in the teaching space and appraise their coaching process by responding to questions from the students (Atay, 2010).

Teacher's PCK is assessed by investigating the Teachers' Content Knowledge (CK) and Teachers' Pedagogical Knowledge (PK). Teacher's Content knowledge (CK) is teachers' comprehension of the topic to be taught and learned by the learners. It is also the understanding of the vital ideas, values, and interactions in a curricular domain, as well as understanding another way these can be denoted in instructional situations. CK contain understanding of ideas, models, philosophies, structural outlines, understanding of proof and evidence, recognised practices and methods which are very important for the teacher as this differ from one discipline to another. It is very imperative for science educators to comprehend scientific facts, theories, method and evidence based reasoning which is fundamental in their disciplines as this will enable them to convey to their students the right knowledge. The cost of not having this all inclusive based content knowledge can make students to have false impression about the content as a result of incorrect information received from the teacher (National Research Council, 2018). This was corroborated by Okebukola (2014) who observed that top academic achievement in school subject depends on three substantive knowledge areas, CK, PK and PCK. Regrettably educators in the school system are frequently deficient in this substantive knowledge area hence demonstrate poor knowledge of their teaching subject. Studies that have investigated the PCK of newly trained teachers and teachers who have longer teaching experience have found out that newly trained teachers lack PCK especially topic-specific PCK.

Okebukola, (2014) asserts that the teachers that we have in Nigerian are vast in both understanding of topics and various teaching methodologies of teaching but the skills required in passing it across to the student is very weak as many teachers have inadequate training in their disciplines and this leads to both the teachers and students having misconceptions and alternative frameworks about the subject. These misconceptions make the student to lose interest in the subject thereby exhibiting negative attitude and poor practice. Hence, there is need to address subject matter preparation of teacher of Biology.

Student-related factors such as students' academic motivation, emotional intelligence and cognitive style are of interest in the work. Students' motivation is defined as the factors that arouse student's desire, energy and interest which make them to be committed to their academic pursuit and goals.(Martin 2010). Akinlana (2013) stated that passion for success differs in individual as it may be high in some people whereas it may be very low in other people as a result of environmental influence, background and learning environment.

Students' motivation and academic achievement among students have received a lot of attention from scholars so as to improve the achievement of students academically. Moula, (2010) associates motivation with achievement and said that students who are propelled are probably going to perform well in their assessment. It has also been perceived that the starting point for learners to acquire expertise and potentials that are needed to thrive well in the future is at the secondary school level; but unfortunately, students at this level of education do not receive adequate motivation. Wormington, Corpus and Anderson, (2011) found that students that were successful were those who were motivated by themselves and those who were motivated by external factors to study.

Christiana (2009) reveals that learning in the school system influenced by motivation. Also, students who are not well motivated exhibit negative attitude towards their educational goals and these make them to show poor practices. AliMcInerney, (2009), corroborates that motivation significantly predicts achievement, attitude and practices. However, the relationship between Motivation and students' achievement in, attitude to and practices in Environmental concepts in Biology has not been researched into adequately especially in Secondary Schools in Ekiti State.

Emotional Intelligence (EI) is another variable of interest which involves abilities related to emotions, and has a broad interest in the scientific field. Mayer and Salovey, (1997) define Emotional intelligence as the ability to sense perfectly, assess, and express emotion; the

ability to access or generate feelings when they facilitate thought; the ability to understand emotion and emotional knowledge; and the ability to regulate emotions to promote emotional and intellectual growth. It is also the capability to recognise, comprehend, deal with your emotions and have an effect on others emotions. In a practicable term, this means having the understanding that emotion can drive our attitude and influence others positively or negatively and studying how to cope with our emotions and that of others' particularly when under stress. EI is also a personal attribute that empower individuals to prevail (succeed) throughout every day of their lives. This attribute include mindfulness (self-awareness), sympathy (empathy), fearlessness (self-confidence) and self-control. According to Saibani,*etal* (2012),Emotional Intelligence has turned into an intriguing subject in academics as it entails the use and the impact of feeling on students learning outcomes.

Developing Emotional Intelligence in students is essential to preparing them for academic success. Thus, adequate attention ought to be given to the Emotional insight of students as it affects their achievements and personal growth. Students whose emotional needs are met and managed by their parents and educators are able to cope with their academic work. Studies carried out by Kattekar, (2010) on the influence of emotional intelligence on the academic achievement of learners found out that emotional intelligence positively correlate achievement of students. This implies that students whose emotional intelligence is very high have higher academic attainment. In spite of the result from the past research which found out correlation between emotional intelligence and academic achievement, Han and Johnson, (2012) stated that negative relationship exist between student emotional intelligence and their achievement when exposed to synchronous online interaction. Audrey and Eagan (2007) also found out that weak relationship exist between emotional intelligence and academic achievement. Therefore, students need to be emotionally ready so as to get the best in the course of teaching as these affect their achievement, their attitude to and practices in Environmental concepts of Biology.

Cognitive style refers to the way students' process information, think, remember or solve problem. Cognitive style also represents the manner by which people receive and process information. Majority of the differences that are observed in students' learning and utilization of facts acquired could be referred to in terms of various approach in which students observe and analyse a given problem and how to solve the problem. An understanding of the cognitive styles of students by the teachers would greatly enhance an understanding of the diversity in their inert environmental problem solving abilities and the utilization of these abilities.

Therefore, for meaningful learning to take place, consideration should be given to the cognitive style of individual learners as it mediates learning, (Olagunju and Ogundiwin 2008).

Cognitive styles positively and significantly predict students' learning outcomes. It was observed that students who are assimilators have a higher grade than their counterpart who are accommodators. This was because the assimilators have the ability to integrate new information with the already known information thereby making them to have adequate knowledge about the concepts whereas the accommodators are set of students who have the ability to adapt enough to receive new information without a major change, (Alireza, Rahil, Habibah, Shafee and Jaafar 2011). Also, Cognitive style significantly affect students' attitude and practices in environmental concepts. This shows that students who have the right attitude to learning have the ability to process information and retrieve it when necessary. (Agboghoroma 2015; Oloyede 2015). This implies students with high cognitive style have the capability to transfer assimilated facts to resolve some difficulties. In contradiction to the above, Azizi and Syazwani (2011) found that cognitive style has no impact on learners' achievement.

Despite the effort to address the complexities of learners in relation to their cognitive styles and academic achievement in, attitude to and practices in environmental concepts many students continue to score low grades in different academic subjects. There is need to determine the cognitive styles of students and how this influences their performances.

It is obvious that there is deterioration in the result of learners in Biology which calls for attention. In view of this, there is therefore the urgent need to carry out a study that will investigate the extent to which certain factors such as Biology curriculum content, pedagogical content knowledge and student-related factors (motivation, emotional intelligence and cognitive style) would predict the Senior Secondary students' learning outcomes in Environmental concepts in Biology in Ekiti State, Nigeria.

1.2 **Statement of the Problem**

Biology is a core science subject offered at the Senior Secondary School level of education in Nigeria. It is valuable for its application in all spheres of life. However, reports from West African Examinations Council (WAEC) and National Examination Council (NECO) over the years revealed that students record poor achievement in Biology and this is as a result of their poor attitude to the subject. The West African Examinations Council Chief

Examiners' Reports in the last ten years have identified poor achievement in Environmental concepts as part of the major cause of students' under- achievement in Biology.

Past research papers mainly focused on efficient teaching strategies of Ecology and Genetics with little consideration for other variables such as Biology Curriculum content, Pedagogical content knowledge and student-related factors (Motivation, Emotional Intelligence and Cognitive style). Studies have shown that these variables are greatly related to students learning outcomes in Mathematics, Basic Science and Literature-in-English but then the degree to which they would correlate learners achievement, attitude to and practices in Environmental concepts in Biology in Ekiti State has not been given adequate research attention. Thus, the study investigated whether Biology curriculum content, teachers' PCK and student-related factors (motivation, emotional intelligence and cognitive style) would predict students' learning outcomes in environmental concept in Biology in Ekiti State, Nigeria.

1.3 Research Questions

1a. What is the level of: (a) student attitude, (b) practices, (c) emotional intelligence, (d) cognitive style, (e) motivation (f) teachers' pedagogical content knowledge and (g) Biology curriculum content knowledge to environmental concepts in Biology?

2. What relationship exists between Biology Curriculum content and (a) Students' Achievement in Environmental Concept in Biology? (b) Students' Attitude to Environmental Concept in Biology? (c) Students' Practices in Environmental Concept in Biology?

3. What relationship exists between Pedagogical Content Knowledge and(a) Students' Achievement in Environmental Concept in Biology? (b) Students' Attitude to Environmental Concept in Biology? (c) Students' Practices in Environmental Concept in Biology?

4. What relationship exists between student factors (emotional intelligence, student motivation and cognitive style) and(a) Students' Achievement in Environmental Concept in Biology? (b) Students' Attitude to Environmental Concept in Biology? (c) Students' Practices in Environmental Concept in Biology?

5. What is the joint contribution of Biology Curriculum Content, Pedagogical Content Knowledge and Student factor to (a) Students' Achievement in Environmental Concept

in Biology? (b) Students' Attitude to Environmental Concept in Biology? (c) Students' Practices in Environmental Concept in Biology?

6. What is the relative contribution of Biology Curriculum, Pedagogical Content Knowledge and student factors (emotional intelligence, student motivation, cognitive style) to (a) Students' Achievement in Environmental Concept in Biology? (b) Students' Attitude to Environmental Concept in Biology? (c) Students' Practices in Environmental Concept in Biology?

7. Which of the Biology Curriculum, Pedagogical Content Knowledge and student factors (emotional intelligence, student motivation and cognitive style) would predict (a) Students' Achievement in Environmental Concept in Biology? (b) Students' Attitude to Environmental Concept in Biology? (c) Students' Practices in Environmental Concept in Biology?

1.4 Scope of the Study

The study covered Public Co-Educational Senior Secondary II students in three local government areas of Ekiti State. This study investigated the Biology Curriculum Content, PCK and Student-related factors as predictors of Students' learning outcomes in Biology in Ekiti State, Nigeria. The content area for this study is environmental concepts in Biology comprising of conservation of natural resources, pollution, and erosion.

1.5 Significance of the Study

The results of this study would reveal the extent to which Biology curriculum content, pedagogical content knowledge of teachers and students-related factors would predict students' achievement in, attitude to and practices towards Environmental concepts in Biology thereby identifying factors to be addressed in improving learning outcomes. This study would also add to the existing body of knowledge that are geared towards solving the problems of poor performance in Environmental concepts in Biology.

The study would provide empirical evidence on how Biology curriculum, and student factors coupled with their PCK would predict Senior Secondary students' achievement in and attitude towards Environmental concepts in Biology. This would in turn lead to providing an improvement guide for Biology educators by all stakeholders in order to enhance performance of students in Biology.

The findings of the study would also be relevant to the education sector by revealing the need for training staff or personnel on content and pedagogy to be used in teaching and learning for the realization of educational goals.

It is also anticipated that the finding of this study would provide information on the importance of active participation of students during teaching and learning process which would improve their emotional intelligence and attitude towards environmental concept in Biology. It is expected to provide information for students, teachers, and stake holders in the educational sector in Nigeria on the effect of students' motivation, emotional intelligence, and Cognitive style which would improve students' learning outcomes and practices in environmental concepts in Biology.

1.6 Operational Definition of Terms

The following terms have been operationally defined as they would be used within the context of this study:

Achievement in Environmental Concept: Achievement of students was determined from the scores obtained in an Environmental achievement test.

Attitude to environmental concepts in Biology: - This refers to students' behaviour or predisposition towards environmental concepts in Biology.

Biology Curriculum Content: This refers to 2009 Biology Curriculum for Senior Secondaru School by as contained in the National Educational Research Development Council.

Cognitive Style: Cognitive style is the students preferred way of receiving thinking and processing information in order to learn.

Emotional Intelligence: Emotional Intelligence (EI) is the capacity of individuals to recognize their own, and other people's emotions, to discriminate between different feelings and label them appropriately, and to use emotional information to guide thinking and behaviour.

Environmental Practices: This refers to students' disposition to solving environmental problems.

Learning Outcomes: These are learners' success (achievement) in, behaviour (attitude) to and practices of environmental education

Pedagogical Content Knowledge (PCK) is a form of practical knowledge that is used by teachers to guide their actions in highly contextualized classroom setting.

Pedagogy Knowledge (**PK)** refers to how much of the approaches, methods or techniques used in delivering the subject matter that the teacher is familiar with.

Students-related Factors: These are motivation, emotional intelligence and cognitive styles.

Students' Motivation: Motivation is defined as the internal and external factors that stimulate desire and energy in students to be continually interested and committed to a job, role or subject, or to make an effort to attain a goal.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Literature would be reviewed under the following themes: theoretical framework, conceptual review and empirical review.

2.1 Conceptual Review

2.1.1 Biology Curriculum Content

2.1.2 Shulman's Conceptual Framework of Pedagogical Content Knowledge

2.1.2.1 Pedagogical Content Knowledge as transformation of Content Knowledge

2.1.2.1 Pedagogical and Professional Experience Repertoires (PaP-eRs)

2.1.3 Models of Pedagogical Content Knowledge

2.1.4 Students' Achievement in Environmental Concepts

2.1.5 Students' Attitude to Environmental Concepts

2.1.6 Students' Environmental Practice Concepts

2.1.7 Students' Motivation to Environmental Concepts

2.1.8 Students' Emotional Intelligence to Environmental Concepts

2.1.9 Students' Cognitive Style to Environmental Concepts

2.2.0 Theoretical framework

2.2.1 Vygotsky Social constructivist Theory

2.2.2 Heider's Attribution Theory

2.2.3 Ausubel's Meaningful Reception Learning Theory

2.2.4 Educational Implication of the Theories

2.3 **Empirical Review**

2.3.1 Biology Curriculum Content and Students' Success (Achievement) in Environmental Concepts in Biology

2.3.2 Biology Curriculum Content and Students' Attitude to Environmental Concepts in Biology

2.3.3 Biology Curriculum Content and Students' Environmental Practices in Environmental Concepts in Biology

2.3.4 Teachers PCK and Students' Achievement in Environmental Concepts in Biology

2.3.5 Teachers PCK and Students' Attitude to Environmental Concepts in Biology

2.3.6 Teachers PCK and Students' Environmental Practices in Environmental Concepts in Biology

2.3.7 Motivation and Students' Achievement in Environmental Concepts in Biology

2.3.8 Motivation and Students' Attitude to Environmental Concepts in Biology

2.3.9 Motivation and Students' Environmental Practices in Environmental Concepts in Biology

2.3.10 Emotional Intelligence and Students' Achievement in Environmental Concepts in Biology

2.3.11 Emotional Intelligence and Students' Attitude to Environmental Concepts in Biology

2.3.12 Emotional Intelligence and students' Environmental Practices in Environmental Concepts in Biology

2.3.13 Cognitive Style and Students' Achievement in Environmental Concepts in Biology

2.3.14 Cognitive Style and Students' Attitude to Environmental Concepts in Biology

2.3.15 Cognitive Style and Students' Environmental Practices in Environmental Concepts in Biology

2.4 Appraisal of Literature.

2.1 Conceptual framework

2.1.1 Historical Background of Curriculum Development

The educational system of any country should be based on the needs and demands of the people. In support of this, Akujieze (2007) noted that the attempt to base the education of Nigeria, especially science education on the needs and demands of Nigerian people has resulted into series of commissions, committees and conferences. Notable among these are the Phelps Strokes Commission of 1920, the Ashby Commission of 1950, the Alvan Ikoku conference on curriculum. All these conferences, committees and commissions were geared towards providing a functional Science Education programme in Nigeria.

According to Idika (2008), the different commissions, conferences and committees were set up at different stages of development of science education in Nigeria. In other words, a new commission, committee or conference arises as a result of a new need or problem in the country, or as a result of criticism on the preceding one. These various commissions, committees and conferences have effects on the development of Science Education in Nigeria. Onyeokoro (2003) found that the effect of the Ashby Report was seen among others in diversification of Senior Secondary science curriculum.

The importance of all these conferences cannot be overemphasized as it led to the development of educational goals, formulation of the National Policy on Education (NPE) and National Philosophy on Nigeria Education which are:

- The people living in the society should be indoctrinated on the right attitude and value necessary for their survival in the environment.
- The mind should be trained in constructing valued ideas, generalization and appreciating the world around us.
- Acquiring necessary appropriate talents, skills and proficiency both mental and physical.
- Equipping the people to live in the society.
- Gaining related and sensible information about ideas both at local and world at large.

As a result of the philosophy for Nigeria education and other development in Nigeria, both the federal and state ministries of education put up a draft for a National Policy on Education (NPE) and a seminar to make proposals for NPE was held. Among the issues considered in the seminar were:

•A curriculum review which lay emphasis on the teaching of science and technology.

•The role of the teachers, the parents and local communities

This seminar resulted to the publication of the NPE in 1977 which became effective in 1982. The aim of introducing NPE in 1981(FRN, 2004) is to make education functional and responsive to the societal needs and problems. This led to the introduction of new curricula and syllabuses for educational institutions in the nation. Since the introduction of the NPE in 1982, education policy has not made substantive impact on our secondary school system because of indifference and lip service of the stakeholders.

2.1.2 Biology Curriculum and its Content

Education in the four walls of the classroom requires a well-planned programme of study which must embrace varieties of subjects in order to meet the various professional and academic needs of the learners. Curriculum encompasses syllabus and the required course content which are learnt in the school system. Northeast Texas Network Consortium (NTNC 2002), defined curriculum as programme of courses to be taken in pursuit of a degree. The concept of the curriculum is divided into bodies of knowledge (for example, Mathematics, English and Science); summaries of the wanted behaviour and morals; including the valued expertise determined by the prevalent theories of knowledge; and accommodates ideological, vocational and technical thoughts.

Curriculum is the means by which the philosophy of education can be actualized. Ango (1984) stated that curriculum is all the experiences that a school offers and all experiences which a child has regardless of when or how they take place. Such experiences are acquired through the courses within certain fields designed for certain pupils' purposes. The aspects, a viable, functional or effective curriculum's nature should essentially consist of aims and objectives, the content (what to study), the method of instruction (how to study and teach it), sequence of instruction (order of presenting the various subjects), materials (means for instruction), evaluation (feedbacks of the content implemented), the implementers (teachers and instructors) and pupils or learners. Curriculum is also an organized sequence of intentional knowledge and skills provided and controlled by school the system in a bid to accomplish the set goals. These include purposes, the subject-matter, and method of achieving the set goals, evaluation means, the child, the teacher (chief implementer of the curriculum) as well as physical and psychological environment. Kọ́láwọ̀lé (2006) noted that curriculum as an important element in the procedure of imparting facts summarizes such tenets and abilities fore

grounded in specific specialisation that are acquired in the four walls of a school and handed over to humanity in form of education.

Curriculum is characterised as the activities that must take place in the lecture theatre (classroom). It explains the themes, the sub-topic, students' activities and evaluation contained within the contents benchmarks. Content standards are the outline of a curriculum. Curriculum content emphases the delivery of the important ideas and topics that the content standard classify as essential for the student to comprehend and utilise.

The purpose of a curriculum planning and designing programme of education should be to foster worthwhile principles and standards of a people and allow the people to gradually reach their social, fiscal and civil goals. However, Tanner and Tanner (1975) stated that "curriculum is the intended and directed learning experiences and anticipated learning outcomes, designed through the organized modernization of knowledge and skills under the umbrella of the school, for the students' continuous growth in personal and social competence". This is to say that curriculum is the totality of experiences to which a learner is exposed to under the guidance of the school. If education is to take place in a school setting, a good curriculum must be put in place. For any nation to make a remarkable progress in the humanities, physical sciences, or medicine, it must make a properly designed and implemented curriculum its priority. Essentially, the functionalism and relevance of a curriculum include all that affects and influences a child relevant to his society.

Science Education reformed curriculum started in 1960s and in 1970s with the launching into space Sputnik Satellite by the defunct Soviet Union in 1957. This reform led to the inquiry into the methods of science teaching or learning and the nature of the science curriculum that was in existence. Also, the reform brought about the advent of numerous fresh science curricula part of which was Biological Science Study (BSCS). In 1962, Nigeria as a nation developed the first curriculum in science which was Basic Science for Nigerian Secondary Schools (BSNSS). In 1971, Science Teachers Association of Nigeria, (STAN) developed Nigerian Integrated Science Project (NISP). In 1969, Comparative Education Study and Adaptation Centre (CESAC), the Nigerian Educational Research Council (NERC), which amalgamated to develop into the Nigerian Educational Research and Development Council (NERDC) participated in other science curriculum development projects both at the primary and secondary levels of our educational system. However, with the advent of this curriculum reforms science subjects are still being taught in the schools in a traditional way and this has led to the negative attitude of students to the subjects, poor understanding of scientific concepts

and inability of the citizens to understand science and technological issues proficiency expected in a rapidly developing nation.

The current Biology Curriculum was modified and reviewed from 1985 edition developed by Comparative Education Study and Adaptation Centre (CESAC) and the objectives as stated by the Nigerian Educational Research and Development Council (NERDC, 2005) in Nigeria as follows:

(i) To enable the children appreciate how their environments are related to them and how they are related to their environments.

(ii) To prepare the students for higher education and to have interest in biological career, e.g medicine.

(iii) To enable the individuals understand their body, their functions eg circulation of blood, respiration, excretion etc.

(iv) To enable the children acquire scientific skills. These include laboratory and field skills.

(v) To enable the individual understand certain key biological contents necessary for a successful living.

(vi) To instil the practice of analytical reflection;

(vii) To enable the individuals to question some superstitious beliefs;

(viii) To shed more light on the sexual problem, replication, population, development, pollution, disease control, well-being, food production for the advantage of the humanity;

(ix) To provide opportunity for technical improvement;

(x) To increase the students' aesthetic appreciation of nature. The new 2013 edition of the Biology curriculum (NERDC, 2013) now has only four themes.

The Biology curriculum content for Senior Secondary School as produced by the NERDC 2013 has the following coverage topics for the Senior Secondary School one (SSS 1) Recognising Living Things, Classification of Living Things, The Cell, The Cell and Its Environment, Some Properties and Functions of the Cell, Tissue And Supporting Systems, Nutrition in Animals, Basic Ecological Concepts, Functioning Ecosystem, Energy Transformation in Nature, Relevance of Biology to Agriculture, Micro-Organisms Around Us,

Micro-Organism in Action, Micro-Organism and Better Health, Aquatic Habitats, Terrestrial Habitats, Reproduction in Unicellular Organism and Invertebrate.

The Senior Secondary School Two (SSS II) also has the following topics: Classification of Plants, Digestive System, Transport System, Respiratory System, Excretory System, Nutrient Cycling In Nature, Ecological Management, Conservation of Natural Resources, Pest and Diseases of Crops, Reproductive System in Vertebrates, Reproductive Systems in Plants and Pollination in Plants.

Equally, the Senior Secondary School Three (SSS III) covers the following topics Regulation of Internal Environment, Nervous Co-Ordination, Sense Organ, Ecology of Population, Balance in Nature, Reproductive System and Reproduction in Humans, Development of New Seeds, Fruits, Reproductive Behaviour, Biology of Heredity, Variation and Evolution, Adaptation for Survival, Evolution and Plant Nutrition.

The Environmental Education Concepts for Senior Secondary School One to Three segments (SSS I-III) infused under the theme Organism and its Environment has a wider coverage. Topics in the area of Environmental Concept in SSS I include meaning of Ecology, Biotic Community, Biomes of the World, Population Studies, Ecological Factors, Simple Measurement of Ecological Factors, Autotrophy and Heterotrophy, Food Chain, Food Webs and Trophic Level, Pyramid of Number, Pyramid of Energy, Flow of Energy, Energy Loss in the Ecosystem, Law of Thermodynamics.

The Senior Secondary School Two (SSS II) Environmental Concept in Biology include: Biological Association, Tolerance, Pollution and Conservation of Natural Resources. The components of Senior Secondary School Three (SSS III) Environmental Concept in Biology include Ecological Succession, Overcrowding, Food Shortage, Factor Affecting Population, Dynamic Equilibrium for Balance in Nature and Family Planning and Birth Control.The environmental concepts in Senior Secondary School Biology Curriculum which are of interest to this research work include Pollution and Conservation of Natural Resources.

The curriculum content has the following subheadings: the main topic, the sub-topics which are the concepts to be taught under the main topic, the behavioural objectives which are the guidelines to be followed by the teacher in teaching what the student must understand about the concepts; the teaching aids which are the instructional materials that the teacher can make use of in order to facilitate learning easily; the teachers' activities which are the activities the teacher must carry out in the course of the teaching of the concepts; the students' activities

which can be indoor activities or outdoor activities. Indoor activities are carried out in the classroom and it can be in form of practical, drawing and observation. Outdoor activities are carried out outside the classroom in form of excursion, observation, identification, site seeing. Evaluation is in form of questions to be asked from the students so as to ascertain whether the students comprehend the topic being taught or not. The last one are the assignments which is to test the writing skills and the critical thinking skills of the students. All these make up the whole content of the curriculum.

2.1.2.1 Environmental Concept: Pollution

Pollution is defined as the discharge of injurious materials into the environment by the natural forces. These harmful substances that cause pollution are called pollutants.

Types of pollution

I Air pollution

ii. Noise pollution

iii. Land pollution

iv. Water pollution

Air pollution

Table on the major air pollutants, their sources, harmful effects and their control

S/N	Air pollutant	Sources	Effects
1	Carbon monoxide	Burning of fuel in cars and some industrial processes	It causes suffocation
2	Sulphur dioxide	Coal mining and cement factory	It causes impaired health and acid rain
3	Nitrogen oxides	Electrical discharge in air and industrial processes	It irritates the skin and respiratory system
4	Smoke and soot	Burning of substances	It damages the lungs, it reduces visibility and photosynthesis
5	Radio-active rays	Industrial processes	It impairs health
6	Dust particles	Mining and industrial processes	It irritates respiratory system and causes diseases

Control of air pollution

(i) Conditions must be created for complete combustion for fuel in internal combustion of engines

(ii) Chemical waste should not be discharged into the air through fume chamber

(iii) Industries should be sited far away from residential areas

(iv) Legislation should be made against indiscriminate burning of waste.

Land pollution

Table on the major land pollutants, their sources, harmful effects and their control

S/N	Land pollutants	Sources	Effects
1	Refuse	Home, office, industries, school and market	Offensive odour, respiratory disorder
2	Sewage	Home and offices	Offensive odour and breeding ground for diseases
3	Metal scraps	Abandoned vehicle and machine	It prevents proper use of land
4	Crude oil	Oil drilling, loading or unloading of oil tanker	It destroys soil and renders it infertile
5	Chemicals	Chemical waste from industries	Plant poisonings

Control of land pollution

i. Refuse should be burnt in incinerator

ii. Sewage should be properly treated before disposal

iii. Legislation should be made against indiscriminate disposal of waste.

Water pollution

Table on the major water pollutants, their sources, harmful effects and their control

S/N	Water pollutant	Sources	Effects
1	Sewage	City sewage system	It makes water unfit for drinking It can also kill aquatic organisms
2	Excreta or faeces	Humans and animals	It produces unpleasant odour It's a medium of breeding of pathogens
3	Crude oil	Oil drilling	Food chain is affected, it leads to migration of animals
4	Pesticides and fertilizer	Washed by erosion from farm to rivers, streams or pond	It makes water unfit for drinking It leads to rapid vegetative growth

Control of water pollution

i. Effective and appropriate dirt discarding method

ii. Discarding of petro-chemical by-products into the stream must be evaded

iii. Industrial effluent should be recycled

iv. Government should monitor the industries strictly

Conservation of natural resources

Conservation of natural resources is the preservation of natural resources from loss, water or exploitation through rational use and to ensure their continued use or availability and preserve the quality or original nature of the natural resources.

Conservation of renewable resources

The most important renewable natural resources are the atmosphere, soil, water, forest and wildlife.

Methods of conserving wildlife

i. Establishment of game reserve

ii. Prohibition of poaching

iii. Creation of awareness on the importance of wildlife

iv. Prevention of water pollution to prevent the killing of aquatic animals

Methods of conserving water

i. Storage of water in tanks

ii. Damming of rivers to allow effective management

iii. Planting of tree to provide vegetative cover and reduce the rate of evaporation.

Methods of conserving forest

i. Reforestations

ii. Establishment of forest reserve

iii. Prevention of bush burning

iv. Cutting trees without destroying the undergrowth

Methods of conserving soil

i. Prevention of overgrazing which can lead to erosion

ii. Prevention of bush burning

iii. Prevention of soil erosion

iv. Adoption of better farming system

Methods of conserving the air

i. Proper treatment of sewage before disposal

ii. Proper burning of waste to prevent smoke and sooth

iii. Proper disposal of dust from construction site

Methods of conserving mineral resources

i. Legislation against indiscriminate mining of mineral resource

ii. Efficient and effective use of mineral resources

iii. Over dependence on one mineral resource should be discouraged

Benefit of conservation of natural resources

Wildlife

i. Source of food

ii. Source of income for the government

iii. It serves as tourist attraction.

iv. Source of employment

Water

i. It is used for hydro-electric power generation

ii. It is used for agricultural purpose

iii. It provides employment

iv. It is used for recreational purpose

Air

i. It serves as natural habitat to the aquatic animals

ii. It supports agricultural activities

iii. It provides oxygen used in respiration by plant and animals

iv. It provides gaseous nitrogen used by plant to manufacture protein

Mineral resources

i. it serve as the source of fuel

ii. It is used for construction purposes

iii. It provides employment opportunity

Soil

i. It is the home of some organisms

ii. It supports wild life resources

iii. It supports agricultural activities

iv. Mineral resources are obtained from the soil

Problem associated with conservation of natural resources

i. Oil spillage leads to loss of terrestrial and aquatic lives

ii. Indiscriminate fishing leads to extinction of aquatic organisms

iii. it can lead to natural disaster

iv Overgrazing caused by cattle.

Therefore, Environmental Education is set to put an end to the insufficient environmental morals, lack of knowledge and insufficient environmental responsiveness, understanding and talents in learner and this could simply be achieved through education, (Mahboubeh, 2014).There is therefore the need for the sensitization of the citizens about the importance of conservation of the natural resources in their environment and the effect of pollution in order to avert environmental disaster. When students are imparted with knowledge, they are motivated to proffer solutions to the existing problem and this leads to change of attitude because we learn better when we realize how important our environment is to us.

2.1.2.2 Environmental Challenges and Efforts to combat them

Environmental problems become complex, and severe as a result of accumulative environmental disorder. The air round many cities in the developing countries of the world are loaded with hazardous substances rising from manufacturing industries and companies while massive plots of lands have been destroyed by incessant discarding of waste and sewage disposal; insecticides applied on agrarian lands are also endangering the lives of human and other organisms. All these and other chemicals, biological and physical environmental degradation often cause a lot of harm to the populace.

Environmental deterioration which has grown to their present state of near uncontrollable stage dates back to the 1890's when a Swedish Chemist, Svante Arrhenius alerted the people around that burning fossil fuel and clearing of standing forests used for various developmental purposes had released an unusual amount of Carbon IV oxide into the atmosphere resulting in the increased warming of the climate. Consequently, Americans and Chinese generate the highest carbon (iv) oxide in the world (Guardian. UK, 2007). About 400 million metric tons of hazardous wastes are generated yearly.(Microsoft Encarta 2009). The United States alone produces about 250 million metric tons. Studies conducted by David, *etal* (2010) found out that 50,000 Americans are killed because of pollution and ecological disturbance. Also, 656,000 people die untimely death due to air pollution in China. According to the National Academy of Science (2005), in India, 527,700 lost their life yearly due to air pollution. World Resources Institute (2008 Monthly Update) indicates that polluted air destroys life including human being and that ozone contamination can cause respiration disorder, cardiac infection, esophagus soreness, chest pain and mobbing of the digestive tract.

According to Guardian, UK, 2007, the death toll per day as a result of water contamination is approximately 14,000 and this is as a result of untreated sewage deposited in the water. Also 700 million Indians have no access to a suitable toilet which results in the death of 1,000 children as a result of diarrhea sickness every day. Nearly 500 million Chinese lack access to safe drinking water.

Natural disasters are primarily caused by environmental degradation which tends to have become part of the world's daily experiences as it accounts for the destruction of millions of lives and property worth billions of dollars. Stan Hurricane that occurred in Guatemala, El-Savador and Mexico recorded lowest death toll of 1,598 including the flood in Pakistan that recorded highest death toll of 2million(Wikipedia,2010).

Nigeria as a country is not left out as she started facing severe and complicated environmental problems such as over-population, toxic waste, unconstrained industrial development, over-exploitation of natural resources, swamping, wearing a-way of top soil, difficulty in disposing sewage, desert encroachment and scarcity of water in 1980 and the earth on which all creatures hinge on for existence are declining quickly because of human actions. The incessant throwing away of dirt into the rivers, gutter and streams led to several floods experienced across the nation. Furthermore in 1988 poisonous dangerous waste was at Koko port in Delta State which led to loss of lives. These incidents brought environmental degradation into limelight. In order to avert these problems subsequently preventive efforts were made by the government and the populace. The worst that had happened to Nigeria was in 2012 where thousands of lives were lost in the country through environmental flooding. Other large scale industries with a high profile pollution load are raw material oriented industries located in the countryside such as cement and paper manufacturing. Other sources of these environmental problems are from flaring of oil and gas related activities. Natural gas associated with crude oil has been flared in the Niger Delta region of Nigeria for more than four decades. Statistics on crude oil production indicated that about 70 percent of the total gas associated with crude oil was flared in obvious disregard for the country's 1979 Gas Injection Legislation. In 2010 Baird reported that between 9 million and 13 million barrels of oil have been spilled in Niger Delta, the burning of gases by oil firms in Nigeria accounted 2.5 billion cubic feet which has resulted to environmental pollution and cutting the life of people and other organism in the environment short. (Ogundiwin, 2014)

Though there are no adequately articulated data on the level of economic and human losses from the devastating effects of environmental disasters in Nigeria, there are signs that

virtually all the thirty six States of the country including Abuja, the Federal Capital Territory is being ravaged by one or more forms of degradation problems or the other.

In order to tackle these devastating environmental problems, successive governments in Nigeria have made series of efforts towards protecting its environment through;

(1) Establishment of one percent Ecological Disaster Fund for combating natural disasters.

(2) Involvement of Presidency in tree planting campaigns

(3) Adoption of a National Conservation Strategy for Nigeria in 1988.

(4) The government Launched National Policy on Environment in 1989.

(5) Annual organization of workshops and seminars to mark the World Environmental Day every 5^{th} June.

(6) Internationally sponsored training programmes on Environmental Education (EE) for Nigerians.

(7) Establishment of National Parks, forest reserve and wetland sanctuaries.

(8) Formation of School Conservation clubs

(9) Establishment of Natural Co-coordinating Committee on EE (N.C.C.E.E) with secretariat at NERDC (a parastatal of Federal Ministry of Education).

(10) Establishment of EE units in Ministries of Education

(11) Promulgation of decrees and legislations on Environmental matters such as;

(a) Environmental Sanitation Decree 1 of 1984

(b) Endangered Species Decree No. 11 of 1985

(c) The Factory Decree No 16 of 1987.

(d) Dangerous chemical(Waste)Verdict Number. 42 of 1988

(e) Federal Environmental Protection Agency (FEPA) Decree 58 of 1988

(f) Natural Resources Conservation Decree 50 of 1989.

(g) Land Use Act cap. 202 LFN 1990

(h) The Environmental Impact Assessment (EIA) Decree 86 of 1992 etc.

In addition to the afore-mentioned Federal Government efforts in solving environmental problems and in the development of EE in Nigeria, the development of EE publications as a mass literacy tool is being pursued by some bodies in Nigeria. Some of those in circulation include;

(i) Tortoises (NCF, Lagos) for primary and secondary school pupils

(ii) EEU News (College of Education, Ekiadolor) for general readership.

(iii) Teacher's Guide to conservation clubs (NCF, Lagos).

(iv) NCF News line (NCF, Lagos) for general readership

(v) EE strategies series (STAN)

Furthermore, series of efforts and recommendations were made to improve the Nigerian educational system and to enrich EE in order to solve Nigerian environmental problems. These include;

(1) Interdisciplinary and holistic approach as in the teaching of EE concepts.

(2) Integration of Science – Technology Society (STS) based instructions (STAN Proceedings 2001-2012).

(3) EE as indoor and outdoor activities (Olagunju, 2002).

(4) Environmental knowledge and attitudinal change curricula and programmes (STAN EE Workshop Series 2001-2012).

Internationally, the last three decades have witnessed the birth of several initiatives concerned with the protection of the natural environment. These efforts include the launch in 1970 of the Man and the Biosphere (MAB) programme at the 16^{th} session of the general conference of UNESCO and at the world conservation conferences, (UNEP, FAO and IUCN).The need to protect the environment in times of conflict was also stressed in various United Nations and bilateral agreements, including resolution 2603A (XXIV) of the General Assembly.

Globally, the rate of environmental depletion is at alarming rate and these calls for urgent attention. As a result of this, Climate Change Conference was held in Copenhagen in

December 2009 in the course of which methods of combating environmental problems were pondered on. Previously, UNESCO, UNAIDS, WORLD BANK have called for the need to sustain the environment and these result in the inclusion of some ecological concepts into the biology curriculum, also legislation and execution of decrees and consciousness through the cleanliness of the environment. The incident of environmental degradation in Nigeria had also led to the setting up of the Federal Environmental Protection Agency (FEPA) at the federal level and State Environmental protection Agency at the state level. These agencies are mandated to formulate policies that will help in the sustenance of the environment. (Oloyede, 2015)

In spite of all these efforts, our environment is continuously being degraded on a high scale (Ogundiwin and Olagunju, 2015). Recently Lagos state experienced a flood on the 9th of July, 2011 which destroyed life and properties, Apete flooding that claimed hundreds of lives in Ibadan on 26th of August, 2011 also resulted in deterioration of the surroundings. In Ebonyi State, Nigeria, a household of eight breathe their last breathed because of suffocation from fumes of electric generator on July 9, 2012.

It has become an incessant occurrence that loss of lives and properties must accompany long period of rainfall and this occurrence is owing to the destructive behaviour and the practices of discarding refuse in water courses, channels, brooks, uncompleted houses, structures on gutter and channels. This necessitates the need for Nigerians to understand the nature and magnitude of these environmental problems.

2.1.3 Shulman's Pedagogical Content Knowledge Framework

Shulman (1986) initiated PCK as a connection between pedagogical knowledge, content knowledge and other knowledge bases. It represents the most potent; resemblances illustration, examples and demonstrations a teacher integrates in a lesson that makes the lesson teachable and meaningful to the students. PCK is the consolidation of subject matter and methods of teaching into an understanding of how typical subjects, difficulties and matters are structured and modified to the varied interest and capabilities of students before being offered for instruction. PCK can be integrative or transformative. An integrative model of PCK explains the teacher's knowledge as a connection of subject matter and methods of teaching, while the transformative model presents PCK as an amalgamation of the total facts needed by a teacher for effectiveness. The relationship between subject matter and pedagogy was also

considered and PCK was identified as the specific kind of teachers' knowledge expected to differentiate between the comprehensions of the topic from the pedagogy.

Shulman ascertain that, PCK also comprises an understanding of what makes the learning of specific topic simple or problematic as well as the formations of fixed idea that learners of diverse age difference and backgrounds carry with them to the learning of those most regularly imparted subject content and teachings. Shulman ultimately makes claim that for teachers to be strong and highly effective they must have a rich and adequate PCK. This is because PCK is more than awareness about the subject matter it extends to the scopes of knowledge of the content which will be used for teaching. Shulman summarized PCK as understanding what, why, when and how to impart knowledge making use of the accumulated knowledge of good teaching exercise and skill. By this statement, what refers to knowledge of subject matter to be taught, why refers to the reason or purpose of teaching a particular concept, when refers to the best time of teaching and who the teacher is teaching (stage of the learners' development) while how refers to the instructional procedure as well as the strategies that must be adopted by the teacher to ensure meaningful learning. This implies that a good and effective teacher must show mastery or better understanding of the concept to be taught. The purpose of teaching the concept must be spelt out during the course of the teaching. Also the time of teaching and who the learner is should be considered in terms of the age, readiness, background as well as his development stage. The teacher must take into account the instructional procedure as well as appropriate strategies to be adopted to ensure meaningful learning.

The key elements of Shulmans' conception includes: knowledge representation and knowledge presentation. Knowledge representation involves the planning of the instruction by the teacher putting into consideration what to be taught, why, when, who to be taught and how it will be taught while knowledge presentation refers to everything the teacher does in the classroom to make the lesson meaningful and understandable to the learners. It includes all the robust comparison, diagrams. Samples, illustrations that the teacher inculcates into the teaching that bring about meaningful learning.

The highlights of Shulmans' conceptual framework can be summarized as follows:

i. Good knowledge representation and knowledge presentation result to effective teaching and learning

ii. Proper planning of the instruction should be done by the teacher prior to teaching.

iii. Students' diversity in age, interest, attitude, background among others must be put into consideration by the teacher during planning and instruction.

iv. Students' thinking, learning difficulties, conceptions (pre and misconceptions) should be addressed by the teacher to avoid confusion

v. Students' previous knowledge must be linked to the new concept to be taught using analogies, illustrations, examples, demonstration among others.

Loughran, *etal* (2004) adapted Shulmans' ideas of PCK in developing an evaluation or measuring tool for teachers' PCK. The tool is made up of two elements: Content Representation (CoRe) and Pedagogical and Professional-Experience Repertoires (PaP-eRs). Content representation comprises an outline of the specific content taught to be taught. it deals with what, why, and how of the content to be taught by showing the important ideas (concept) which the teacher considers important for the students to improve their understanding. It also contains the following: what the teacher intends to teach the student, why it is imperative for the learners to learn the concept, additional information the teacher knows about the ideas or concept to be taught, the difficulties or limitations linked with the teaching of the ideas, knowledge about student thinking that can influence the teaching of the ideas or concept, the teaching procedures to be incorporated in the lesson and ways of determining students' knowledge or misconception on the concept. PaP-eRs gives detailed account of the teachers' practices that explains CoRe in the classroom. It reveals further the teachers thought around a specific part of PCK in a specified concept and is established round classroom activities. It represents the reasoning, thought and deeds of a fruitful science educator in teaching precise science concept.

Knowledge representation refers to the comprehensive lesson plan prepared by the teacher prior to teaching. The teacher writes out the sub topics of the main concept to be taught, states the reasons why the subtopics must be taught, students' thinking about the topics, their difficulties, preconceptions as well as misconceptions. The instructional strategy and the ways of ascertaining students' understanding of the lesson are also stated. This implies that in CoRe there is evidence of integration and transformation of subject matter knowledge, knowledge of teaching strategies, understanding of how students' thinking and instructional materials among others. These portray the knowledge of what, why, where and how instructions are delivered by the teacher. Under knowledge presentation, the teacher brings into the fore students' diversity in age, interest, attitude, background among others. Relationships or

links are established between the students' previous knowledge and the new concept by the use of potent explanation, pictures, and demonstrations and so on while the students' learning difficulties or limitations, misconceptions they may bring into the classroom are given utmost priority during the classroom interaction.

Teachers' knowledge is an important aspect to ensure the quality of teaching and learning in a classroom. A significant component of this teachers' knowledge based on teaching is often called PCK. PCK help to determine our knowledge in deciding what we need to know about science, to learn what to teach and to solve problems of science education (teaching and learning). The problem that secondary science teachers face in the classroom is a general problem that cut across the globe and these problems are related to the knowledge of science, goals students, curriculum organisation, teaching strategies, evaluation of resources. Tapan in shamnaz et al (2017) mentioned that implementation of the present curricular at secondary science education in Nigeria had it been successful as the teachers used to face difficulties regarding modern concept of textbook, activities loaded curriculum, teaching aids, assessment, examination procedure and appropriate training. Moreover, heavy teaching load often puts pressure on the teachers to provide quality teaching in the classroom (Rahman in shamnaz et al 2017).

Having PCK for a science teacher is thus important to ensure a quality education which can overcome the technical, academic challenges in secondary school setting. The present scenario of teacher depicts that the need further exist to understand teachers' PCK in the first stage and resolve the gaps by conducting appropriate training. The use of Content Representation (CoRe) by Loghran (2006) portrays the overall knowledge of teachers in conducting a class where the knowledge is linked to the content, students and teachers' practice. Aydin and Boss (2012) state that all the major components of PCK are related to the themes of CoRe as it provide a means through which issue of a specific science subject matter and specific way of teaching can be captured and portrayed for others. CoRe becomes a particular a generalizable form of the particular teachers' PCK as its link the in what way, why and what the content to be taught with what they agree to be important in a particular topic, including in shaping students' learning and teachers' teaching.

The components of PCK have been varied over the years; however, there are some core components of PCK which are knowledge of science, goal and students. PCK component called the knowledge of goal can be link to the knowledge of the aim of science education in secondary school which is to have the mastery of science and this can only be attained in the

course of proper teaching and learning techniques. One of the distinct features of PCK is that it bridges the gaps between the teachers' CK and the method adopted in teaching. This is because PCK ensures that the teaching of content (subject) is significant to learning and that deliberations on instruction pay attention to content (subject). It has been found that PCK correlate students' achievement.

The exceptional thing about teaching method adopted by a teacher is that it enables the teacher to convert their content knowledge for teaching purpose. This innovation takes place as the teacher analytically mirrors on and understands the content of the topic; look for methods such as comparisons, illustrations, problems, presentations, and or classroom activities to facilitate learning; adjustment of teaching aids to students' developmental levels and abilities, gender, previous knowledge, and erroneous belief; and finally adapts the teaching aids to the level of the students to be taught. This alteration procedure is a continuous reform of content knowledge for the intention of teaching; and it is important for teachers retaining a larger amount of their content knowledge in order to enable them have an over view of the content of some topics in a different way depending on the need of the learners.

Various researchers have studied teachers' PCK from different perspectives. Studies that have investigated the PCK of newly trained teachers and teachers who have longer teaching experience have found out that newly trained teachers lack PCK especially topic-specific PCK. PCK is therefore dynamic in nature and not static and develops over a long period of time as teachers acquire knowledge from their preparation, programme, from teaching experiences in classroom as well as length of teaching and professional development opportunities (Abell in Mim, Rahman and Jahanara 2017). The task of devising meaningful ways to transform and represent scientific ideas for specific learners during instruction is not a problem for new teacher alone, but even for experienced teachers who have acquired quite substantial SCK through post-graduate degree in specific subject areas (Martin 2008). Teachers whose teaching of a particular content area promote student learning, are likely to have well-developed PCK in that specific content areas. This presupposes that enhancing science teachers topic-specific PCK is attainable in those area they are found to be deficient.

2.1.3.1Developing Science Teachers' PCK

Factors Influencing the Development of Science Teachers' PCK: The developments of teachers' PCK depend on a multiple of factors and occur through diverse means. Studies show that science teaching orientations greatly influence PCK development (Freidrichsen, Van

Driel and Abell 2011). Students' questions, critical thinking, verbal or nonverbal responses and evidence of learning as well as teacher understanding of students' misconception and self-efficacy have also been indicated to influence PCK development (Park and Oliver 2008). in addition, teacher' CK in a particular subject domain, the pedagogical decisions the teacher make, interactions between the teacher and the students, students prior conceptions and how reflective the teacher is about all these before during and after teaching also influence teachers PCK development.

Science Teaching Orientation: Science teaching orientation is defined as a set of beliefs about science and belief about teaching and learning**.** With respect to the sources of teaching orientations, teachers were highly influence by the classroom environment and their opinions about the student and learning. It follows that PCK developments is not a straight forward matter of having knowledge. This implies that direct comparison of PCK among teachers must be done with caution since its development is idiosyncratic even for the same topic (Park and Oliver 2008).

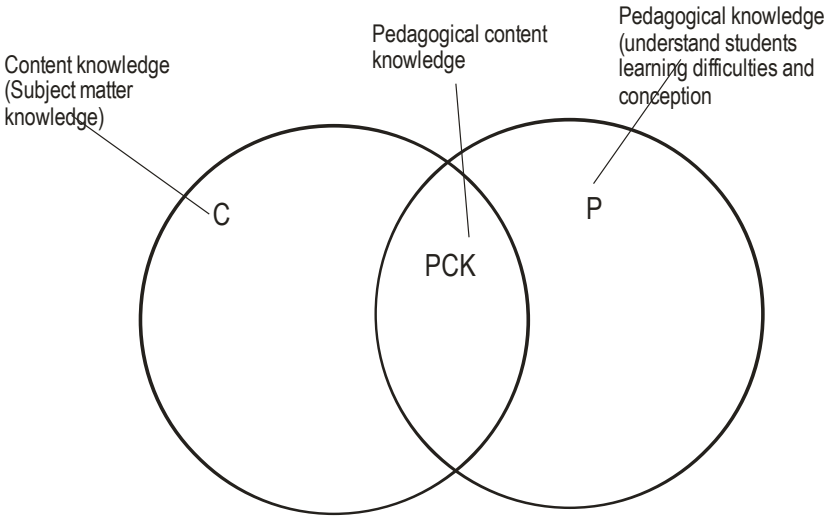
Reflection over Instruction: PCK development requires reflection both in action and on action that is reflection on situation or issues while teaching (in action) and after teaching (on action). This will result in the development of some or all of the individual components of PCK or their integrations, to reflect the interactions among them and their interdependence. Improvement of PCK in this way has students' learning as a focus (Park, Jang, Chen and Jung 2011).

Student Response: there are three ways through which students directly influenced teachers PCK. These are challenging questions student posed to teachers, informal assessment of students' contribution in class and students' creative and critical ideas. The challenging questions students posed to teachers often made it possible for teachers to deepen and broaden their subject matter knowledge. This increased the teachers' reflectivity on subject matter through which PCK is developed since adequate SMK is a criterion for PCK development. It implies that questions which teachers have no answer to are due to insufficient SMK will lead the teacher to reflecting over it and searching for an answer.

2.1.3.2 Shulman's Pedagogical Content Knowledge Model (1986)

This model conceptualised PCK as the interception of content and pedagogy. It denotes the combination of content and pedagogy into an understanding of how specificpart of subject matter are structured, modified and denoted for instruction. This connectionamong content and

pedagogy comprises the most frequently taught topics in ones subject area, the most valuable forms of presentation of those concepts, the most powerful analogies, illustrations, examples, explanations and demonstration that the teacher incorporates in his teaching to make the lesson understandable to learner. The key elements in Shulman's model are knowledge of subject matter and understanding of student's specific learning difficulties and conception.



Diagrammatical representation of shulman's model (1986)

Shulman later included PCK in the categories and elements of teachers' knowledge base. These categories include content knowledge, curriculum knowledge, general pedagogy, learners and their characteristics, educational contexts and educational purposes. For a teacher to be effective, there is need to confront issues of content and pedagogy concurrently, subject matter should be interpreted meaningfully and better strategies should be adopted in presenting it so that it can be used efficiently and meaningfully in the classroom teaching.

2.1.4 Environmental Knowledge

Man lives, resides, organizes, reacts, adapts to and exploits the environment in order to sustain and improve the value of life. It has long been known that the basis for many environmental problems and issues is irresponsible environmental behaviour. The relationship between population and ecology has shown that the environment in which man lives is such that it is not only man that affects the environment; human beings are also influenced by the environment.

In order to continue to exist in that environment, man must deal with the problems emanating in the environment which pose a threat to his survival by contributing resources potentially useful for the preservation of life. A human population transforms its environment to a better or smaller degree by just residing in the environment as well as by the misuse of its resources, thus bringing a change to the nature of the environment in addition to those created by other organisms, geological processes and the like. Not only does the environment act upon the population, but also the human population affect the environment either directly or through co-action with other species. We can therefore say that the adjustment of a population to its environment is not a state of being static, but a continuing and dynamic process (Ogundiwin, 2014).

As a matter of fact man's interaction with the environment is a multi-dimensional phenomenon and touches virtually every area of life. This interaction has caused a lot of environmental problems now affecting our entire world. These problems include air pollution, global warming, hazardous wastes, ozone depletion, water pollution, overpopulation and rain forest destruction. Because man possesses a potential dominance over the environment, his misuse and over-exploitation of environmental resources have resulted in these detrimental effects which have not only affected the environment itself, but also man. Man damages the environment either intentionally by design or unintentionally by accident. Whatever the sources of damage, man is usually at the receiving end, and he is the one bearing the brunt. The

day-to-day damage and the deterioration of the environment ultimately pose a devastating threat to man and other living species (Mahboubeh2017)

The severity of the outcome of these issues vary in intensity and spatial occurrence and include severe pressure on our resource base, exposure of the soil to erosion (especially gully erosion), destruction of the ozone layer, desertification; air, water and soil pollution, depletion of marine life, severe damage to water shed, loss of valuable land, mounting heaps of solid wastes in cities, production of acid rain.

Students have been observed to exhibit poor environmental knowledge and attitude. This is observed in their poor performance in the environmental concept questions posed to them in external examinations conducted by WAEC and NECO. Ogundiwin (2015) stated that students demonstrated poor understanding (Knowledge), destructive manner (attitude) and dangerous practices towards wholesome surroundings. According to Babalola et al (2010) stated that having adequate knowledge about the environment help to sharpened the behaviour toward sustainable environmental management, this is because when people have adequate knowledge about their environment and its associated problems they would be motivated and inspired to provide solutions to the problems and conserve the natural resources in the environment which would eventually be a benefit for the present generation and for the future generations (Olagunju 2002).

This necessitate the need for Environmental education which should form an essential part of formal education at all levels, from the pre-primary to the tertiary level, as a means of providing the necessary cognitive, affective and psychomotor needed by the Nigerian populace in tackling the various environmental problems facing the world today (Mahboubeh, 2017). According to Ojo (2008as cited by Oloyede, 2015), teaching Environmental Education in our schools should deviate from the traditional teacher-centered method to activity methods that encourage participation and group work (Ahove,1999 as cited by Oloyede 2015). It is assumed that if students have the comprehensive understanding 0f their environment, the related complications, subsequent solutions and motivated for actions, the situation would eventually change for the advantage of both existing and upcoming generations (Olagunju,2002). Emphasis on the knowledge of the effects of air, land and water pollution including conservation of environmental resources through the use of adequate teaching strategies to teach these important environmental concepts will bring about great achievement in Biology as well as improved quality of living and positive attitude.

2.1.5**Environmental Attitude**

Attitude is combination of cognitions, feelings and readiness to do something (Karimi, 2010). Environmental attitudes have been extensively discussed, regularly evaluated, and poorly comprehended. Environmental attitude has also been defined as an acquired disposition to react constantly, positively or adversely with respect to the environment (Pelstring, 2009). Environmental attitudes are related to environmental problems

Students' attitude to environmental issues is of utmost importance because they ultimately will be affected by any environmental problem in their society and there is need for them to proffer way out to environmental complications emanating from present-day actions. As upcoming scientists, legislators and leaders they will be accountable for preserving the environment; therefore, they must be persuaded through education to imbibe positive attitude in order to pay the costs of future environmental policies. No doubt, effective environmental education for secondary school student is very crucial as attitudes are developed right from a tender age. By the time they reach adolescence, they must have understood some ecological concepts like pollution, conservation of natural resources and technology which will help them to formulate their own view about the environment and how each of these concepts affect the environment

Education, information and experience bring about attitudinal change towards an object as attitudes are not innate but are learnt. It can be learned or acquired by following examples or opinions of parents, teachers or friends. It may be positive or negative towards certain objects and are usually traceable to culture and tradition. One way of influencing our attitude and behavior to our environment will be through education from infancy to adulthood and must transcend both formal and informal sectors. Environmental Education is of critical importance for realising and analysing environmental issues and sustainable development (Mahboubeh, 2017). The study of Akomolafe (2011) revealed that students' knowledge about the environment is a predictor of their environmental attitude. This finding might be due to the fact that the knowledge acquired in the classroom while teaching environmental concepts constitutes great influence on their attitude. Thus, teachers and education officers have a significant role to play in helping the students to develop a positive attitude towards the environment as it is impossible for them to develop a positive attitude towards the environment without instilling it into them.

In spite of many research works which investigates learners' attitude with regard to the environment which revealed that learners' exhibited positive attitude, environmental devastation has continued to be on the increase both at the developing countries and developed countries.

2.1.6 Environmental Practices

The actual environmental practices of the people are a necessary factor towards attainment of a clean and healthy environment. It involves preserving the environment from degradation and over exploitation of natural resources within their environment. This knowledge about the environment that will enable the students to do this is acquired during the course of teaching in the school. Ogundiwin (2014) reported that daily experiences in Nigeria had revealed very poor environmental practices. It is also assumed that beliefs and misconceptions, which young people had, tend to stick to them for a long period later in life. Students enter secondary schools between ages 11 and 14years and leave between the ages 16 and 19years. Secondary schools students belong to one of the most responsive persons in a population, who may be initiated, involved and equipped for accepting and dealing with the environment problem to the extent possible. They are usually amenable and strongly interested and skillful in embracing an environmental education that has value for the people living within the community and have to do with the wellness of the people. Hence, Environmental Practices should be geared towards sustainable use of the natural resources for both the existing and upcoming generations.

2.1.7 Student Factor: Students' Motivation

One of the problems encountered by teachers is how to motivate their students to learn and to actively participate in the classroom during educational discourse. When students are not motivated learning becomes difficult, participation is low, there are distractions and desired information is not retained. Several reasons while students are unmotivated include teacher's method of teaching, difficulty in assimilating the difficult concepts, classroom management, the curriculum content, poor result and external forces. It has been observed that students who appeared to be unmotivated have difficulty in learning and they need special attention.

Motivating students is a demanding assignment but the rewards of it are more than the demerits of it. Teaching a class of motivated students is interesting as they participate actively and are willing to learn. Some students have passion and natural love for learning and are self-

motivated. But even when students are not motivated to learn an experience teacher can motivate them and make them to see the reasons for learning.

The efficient ways to motivate student to learn include:

1. Encouraging Students: teachers can motivate their students through positive reinforcement and approval of what they do in the classroom during the course of teaching as this makes them to feel that their work is accepted and appreciated. Active participation should be encouraged through talking as this makes students to feel free and important in the classroom and excited. Praise your students frequently and identify them for their contributions. If your classroom is a welcoming place where students feel received and appreciated, they will be more willing to learn and participate actively.

2. Students involvement: assigning role to students during the course of teaching makes students to feel very important in the classroom. Make involvement active by giving each students work such as reading, group discussion, cleaning of the board, all these make student to have a sensation of belonging in the classroom and it also makes them to feel accomplished and it encourages active participation in class.

3. Incentives: offering incentives goes a long way in encouraging students to learn and to be actively involved in the classroom. Incentives vary from lesser to greater ones like giving an exceptional honour to a model student. Rewards make students to have a sense of accomplishment and also motivate them to work hard in order to achieve their goals

4. Creativity: several methods of teaching can be employed in order to motivate students to learn. These methods include the use of games, puzzle, discussion, computer assisted instruction, diagrams, and video rather than lecture method. Video can even be projected to the students to make the teaching fascinating. The classroom environment must be exciting through sticking of poster on the wall, hanging of models, and students' projects.

5. Draw Connections to Real Life: for students to be motivated to lean there is need to connect the topic with what they can see in their environment. Students fail to learn when they cannot see the connectivity between what they are learning and the real world in which they are living in. Also students will not learn if they perceive that what they are learning is not important and relevant to them therefore it is important to establish how the subject relates to them. If you're teaching conservation of natural resources take time to tell them the importance of conserving the natural resources in our environment and the danger inherent in destroying

the natural resources as this will enable them to take cognisance of it and preserve it. Also telling them about the usefulness of these natural resources in their environment can also make some of them to choose a career in environmental studies. They may never be excited about conservation of natural resources but if they see how it relates to them, they will be motivated to learn attentively.

2.1.8 Student-related factor: Emotional Intelligence

Emotional Intelligence has received the critical acknowledgment of researchers over the last two decades. It the capability to comprehend and control emotions and it plays an significant part in achievement, attitude and practices of students. Emotional intelligence has been recognised has a non-cognitive factor that contributes to the success achieved by a student. Therefore, the capability to controls one's emotions, authenticate one's state of mind and ability to proffer solution to personal problems are very significant for achieving success. Furthermore, students who are emotionally intelligent have strong determination and passion about success.

Emotional intelligence has five components which are:

i. Self-awareness: this is being self-conscious of the consequence of your own actions, dispositions and emotions of other students. Self-aware individuals recognise the relationship between their feelings and behaviour. They also recognize their strength and weak point academically, they receive new information, experiences and learn from their dealings with others

ii. Self-regulation: this is expressing your emotions appropriately. Students with this skill tend to be more flexible and adapt well to different methods and strategies of teaching employed by the educator in the process instruction. They are also good at managing difficult situations within and outside the fore wall of the classroom. They are thoughtful of how to influence other students and the people living in their community at large to participate in proffering solution to the problems confronting them in their environment. They also communicate good environmental practices to the people.

iii. Social skill: this is the ability to put information acquired to work on a daily basis and ability to communicate and interact with other in order to achieve a common goal. Student with this kind of skill are able to put into practice the skills acquired during the teaching of environmental concepts and also train

others who do not have the privilege of listening to such a topic on how to do the same. They also have the ability to persuade others to get involve in a task and have a positive attitude towards the environment which is beneficial.

iv. Empathy: this is the ability to understand how others are feeling and your responses to people based on the information received. This bring about healthy interaction in the classroom when a concept is been taught and a student feel bad because he or she does not understand the concept based on these the other student with high emotional intelligence come to his or her aid in order to explain better so that the concept can be well understood.

v. Motivation: intrinsic motivation plays an important part in emotional intelligence. Students who are emotionally intelligent are not motivated by the external reward instead they are driven by desire to accomplish their innermost aims and objectives. Students who show competency in this aspect are action-oriented. They aspire for accomplishment and are continually searching for approaches to improve. They are additionally dedicated and are great at stepping up when a job is put forward to them.

Emotional intelligence (EI) has been observed to be a predictor of learning outcomes, Several research have been carried out in several disciplines to examine the relationship between Emotional intelligence and student learning outcomes and different results have been generated as some studies observed that emotional intelligence predict learning outcomes while some finds no significant correlation between emotional intelligence and students' learning outcomes,(Li, etal, 2012; Parker et al, 2009). Therefore, it has been proposed that emotional intelligence predicts students learning outcomes. Hence, this study offers systematic review of the literature to focus on the relationship between Emotional Intelligence, academic achievement, attitude and practices in environmental concepts in biology.

2.1.9 Student-related factor: Cognitive Styles

Cognitive style refers to the way a person perceives, reason, remember, and solve problems, Allport (1937). The cognitive styles refer to the way a person obtains information and the way the information is being developed. (Conceptualization). Cognitive styles are associated with mental behaviours usually applied by an individual to solve problems, obtain in formation, sorting and utilizing the information. It also affects attitudes, qualities and social cooperation. Cognitive style is made up of (i) generality and consistency. (ii) Relative dependency of cognitive styles (iii) interaction with other feature which affects learning. It has

been observed that cognitive styles affect motivation and academic achievement positively or negatively subject to the nature of the learning activities.

There are different types of cognitive styles which have been recognized and explored over the years. Out of all these cognitive style, Field independence and field dependence has been widely studied. Field dependence-independence was proposed by Witkin in 1950 and 1960 and it has been widely researched into. This theory categorised students into two based on the way they receive and process information. It was discovered that students are either field-dependence or field-independence depending on the way they process information. Field independence students are capable of distinguishing facts as distinct from their background in comparison to the field dependence students who are subjected to events in an undistinguishable way. Additionally, field dependence students have more noteworthy social direction in respect relative to field independence students. Field independence students are probably going to adapt successfully under natural inspiration and are less affected by social fortification.

The significance of this type of cognitive style to an individual's ability to solve problem is that students who in their observation, cannot differentiate between an item and their environment are relatively field dependent and such students will encounter problems in the classroom because the solution to the problem entails taking some essential component of the topic presented and rearranging the problematic fact so that it can be used in several contexts. He also observed that students' who are field dependence have preference for working with their peers and want a form of motivation and reinforcement from their teachers whereas, field independent students have preference for working on their own without interference from their fellow students and they derive motivation from the task they engage in.

2.2 Theoretical framework

2.2.1 Learning theory: Constructivist theory of Vygotsky (1896-1934)

The constructivist theories see knowledge as a self-made object. The approach is established on the principle that, by thinking on our understanding we build our own understanding of the world we live in. Social constructivist theory laid down by Vygotsky observed that when learners were subjected to individual task they hardly perform very well as when they are attached to an adult who walk in collaboration with them. Therefore it is not all about a teacher teaching them how to perform a task but that when the teacher performs the task together with them as it helps to refine their thought, makes them perform excellently and actively in the

learning process. Vygotsky sees learning as appropriation, in his view, knowledge brings about change through gradual assimilation of the concept that is been taught and interaction with the outside world. Vygotsky's theory opine that human development is a sociogenetic procedure by which learners acquired a comprehensive knowledge about their environment in the course of interacting with the people and the environment itself. As a result persons use their own mental construct to create their experiences. Some of the basic principles of constructivism that are in line with this study are: Learning is a search for meaning. Hence, learning entails giving meaning to issues based on personal understanding. In addition, Social aspect of learning is also a vital part of the constructivist view of learning which typifies that student cannot learn in isolation but learn from one another in the course of interaction.

Vygotsky opines that social interaction performing a significant part in the development of intellect and that in the process of making meaning, the environment plays a significant role; hence, human thinking is affected to some extent by the things found in the environment where he or she lives. Learning is an essential and general feature of the procedure of improving traditionally structured explicitly human psychosomatic function. In other words, social learning has a tendency to progress from (i.e. come before) development as advanced intellectual process in a person which has its source in social processes. He propounded that students obtain considerable content of their thought (cognition) from the environment and secondly, they obtain the procedures or means of their thinking from it. Therefore, learning depends on interaction with the environment. Vygosky highlighted that students learn better with the help of an adult.

The constructivist learning theory is applicable to this study in that the knowledge of the students' on environment with what the child is taught affects the child's attitude in the environment. Through the students' interaction with the environment, the knowledge of what the child is taught is affected. Also, the theory is relevant in that the student bases his attitude and performances on his personal interpretation. Students are affected by what they learn from their teachers, society with peer group inclusive. There is no doubt that the content of what is taught and learnt under environmental content in the school is at par with what is being practiced as observed in students in the environment.

2.2.1 Heiders' Attribution theory

Witkin's Attribution theory is related to how a person understands a concept which is a function of the reasoning faculty. This theory believes that persons attribute meanings to

people's behaviour and actions. Attribution is in two ways (1) internal attribution which is a person's behaviour because of its peculiarities such as attitude, character or personality while external attribution is refers to person's comportment due to the situation he/she finds himself or herself.

Attribution theory has been of help in differentiating between students who are highly motivated and those who are poorly motivated. According to attribution theory, high achievers approaches task related to success rather than avoiding it because they have confidence that success is achieved through putting in more effort and that failure is due to bad luck which they believe is not their making. Thus, their self-confidence is not affected by failure but success makes them to have confidence and pride. On the other hand, students who are low achievers avoid chores related to success because they do not have confidence in themselves and believe that success is by luck. Thus, success doesn't matter to them.

Constructivist and motivation theories recognize that student's perception of a fact and activities often has a significant influence on how motivated students will be. Past researchers have identified that adequate understanding of a concept and expertise form the basis for scientific literacy and creativeness. (Down, 1991 in Ng, 2005). Treffinger, et al. (2002) found out that students' peculiar innovative characteristics could be evaluated based on four levels of current performance which are'(i) constructing concepts; (ii) Digging deeper into ideas; (iii) Openness and bravery to discover ideas; (iv) paying attention to one's innermost voice'. Students who are 'Digging deeper into ideas' allow other learners who remain innovative to take decision, appraise, pick and progress into encouraging choices which lead to innovative and creative results. Students with ability to listen to one's innermost voice' are frequently connected to self-consciousness and motivational natures and these encompasses ability to direct oneself, awareness of creativity, tenacity or doggedness, internal focus of control, self-examination, liberty from stereotyping, attentiveness, vigour and work code. The creative students have vision, passion, strength and convictions. This type of motivation is called achievement motivation and it is categorised into two which are (i) motive to achieve success (ii) motive to avoid.

2.2.3 Ausubel's Meaningful Reception Learning Theory (MRLT)

David Ausubel (1963) propounded a theory of meaningful reception learning which focuses on how students learn meaningful from verbal or textual presentations in the classroom. Ausubel recommended that knowledge is founded upon the kinds of superordinate,

representational and combinatorial processes that occur during the presentation and reception of new information. According to Ausubel, the initial process of learning is assumption when first-hand facts are subsumed to related ideas in the existing cognitive structure of the learner. Learning becomes meaningful, when new information is successfully linked to the exiting information or the learners prior knowledge.

The highlight of Ausubel principle of meaningful reception learning theory can be summarized below:

i. The greatest significant element influencing leanings is what the student previously knows (prior knowledge)

ii. The most universal concepts of a subject must be made known to students first and then gradually distinguished in terms of details and specificity

iii. Classroom instruction must endeavour to incorporate innovative information or experience with previously held experience through evaluation and cross-referencing of new and old ideas

iv. Teachers need to incorporate or use a clear ideas when teaching a new concept before the details of the subject matter are dealt with

v. Teachers should use a number of concepts while focusing on the similarities and differences because concept examples are for good teaching and meaning making

vi. Classroom application of Ausubel's theory discourages routine learning of concepts which can be learned in a more meaningful way. Classroom teaching should encourage students to take possession of their learning through construction of their own meaning rather than learning through rote memorization.

Based on the above principles, Ausubel recommended four methods by which important learning can occur. The processes includes: derived subsumption, correlative subsumption, super ordinate learning and combinational learning.

i. Derived subsumption is a condition in which new information learnt is an instance of a concept that has already been leant

ii. Correlative subsumption means accommodating new information into previously formed concept, thereby elaborating and forming a higher-level concept

iii. Superordinate learning is a situation whereby learners are familiar with examples of a concept but not the exert concept until they are taught

iv. Combinatorial learning is a situation whereby new knowledge is gotten from a different concept which is not higher nor lower in the order but at the same level in a separate but correlated concepts. Ausubel's meaningful learning is based on the fact that concept depend on their similarity for meaning.

The above principles within the classroom setting are related to the components and stages involved in the use of PCK instructional strategy in the teaching and learning of Biology. The theory emphasises that the most significant distinct element influencing learning is the learner's previous knowledge. This is the basic grounds on which PCK instructional strategy is derived. The students' prior knowledge is paramount and acts as a subsume framework upon which a new concept will be built to make meaning to the students. It is for this reason that the PCK instructional strategy encourages the teacher to use powerful analogies, illustration demonstration to teach resemblances and dissimilarities that exist among long-standing and innovative concept. The teacher also teaches the concept bearing in mind students' difficulties, misconception and others. The pedagogical content instructional strategy discourages rote learning and encourages meaningful learning as it uses concept mapping and other techniques to ascertain students' understanding of the new concept.

This theory is applicable to this study in that learners are given the privilege to acquire all-inclusive knowledge through involvement particularly grounded directly on battling with everyday ecological problem and communal difficulties in order to bring about significant and noteworthy learning. This effect is expected to bring about particular development and progress in the individual and the expected attitude towards the environment. Knowledge would be organized in a manner that would enable learners to be able to grasp the needed information, especially in a realistic setting and be able to internalize the knowledge. Based on their personal experiences students are able to generate their personal knowledge about the developments and happenings in their surroundings and be able, via motivation and emotional intelligence and positive discerning, cultivate the skill to resolve difficulties, confront and solve the difficulties emanating within the community.

2.2.4 Educational Implication

The attribution theory and social constructivist learning theories are applicable to this work in that the knowledge of the students' environment with what he or she is taught affects

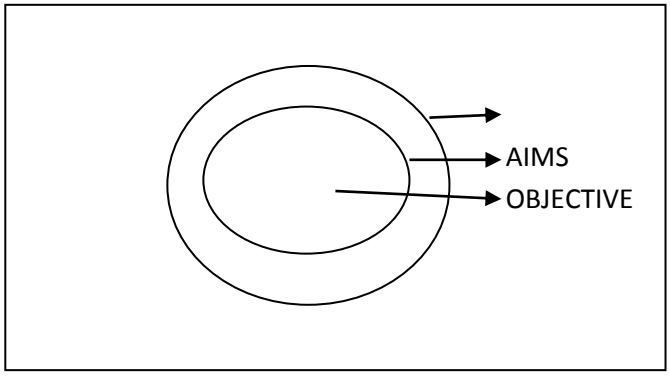
his/her attitude and practices in the environment. Through the students' interaction with the environment, the knowledge of what he/she is taught is affected. The significance of the constructivist theory to the study is that the student bases his or her attitude and performances on his or her personal interpretation. Students are affected by what they learn. There is no doubt that the content of what is taught and learnt under environmental concepts in the school is at par with what is being practiced as observed in students in the environment. Also motivation is very important in learning because it boosts the morale of students and it enables them to perform very well enabling them to make use of their emotional intelligence in and out of the classroom.

2.3 Empirical Review

2.3.1 Biology Curriculum Content and Student achievement in and attitude to and practices in Environmental Concept in Biology

Curriculum and achievement are great concepts in the development of curriculum content. Curriculum content is the base form, the step by step process or strategy the teacher adopts to enable the learners have a great and positive experience. The academic achievement, attitude and practices exhibited by the student explain if the content of the curriculum has been actualised or not. Learning outcomes are exhibited aspects of human behavior that need to be judged for appropriateness. Therefore, in teaching and evaluation, the first step is to determine the learning outcomes to be expected from the students' experiences in and out of the classroom (Osadebe and Odili, 2005). Teaching the subject matter in a liable way (i.e. disciplinary and other real-world contexts) is the significant theme of present restructuring movement. Eber and Parker (2007) argued that it is crucial to move students up the nomenclature for achievement, but the nomenclature becomes significant if teaching process concentrate on the higher levels of perception. Hence, curriculum content performs an important role in the process of teaching and learning.

Kọ́láwọ́lé (2006) described the concepts of aims, goals and objectives as concepts that demonstrate reasons education is important in any society and serve as guides to teachers in their teaching. The diagram below gives detailed explanation on the relationship that exists among aims, goals and objective


AIMS
OBJECTIVE

The curriculum content has a great impact on student knowledge. The teacher teach the content of the curriculum to the students and the students are equip with the knowledge derived from what they are been taught by their teachers. This in turn affects their attitude toward the student. The content of the curriculum affect the attitude of the students to the subject. When a curriculum is overloaded students tend to exhibit negative attitude towards the subject rather than exhibiting positive attitude. It has also been observed that some of the content of the curriculum are abstract and students finds it difficult to comprehend and assimilate and this affect their performance at examination. Also the content of the curriculum affect students practices in the sense that the nature of the curriculum has a great influence on the practice of the students. The students activities included in the curriculum are not what students can practice in and outside the classroom. Therefore the psychomotor domain of the students are not been developed and the skills they should acquire in the classroom which will enable them to combat environmental problems in their society are not acquired this makes it difficult for them to proffer solutions to the challenges in their environment. Also they are unable to create awareness in their community on the danger of environmental degradation because they are not been equip with the appropriate skills needed for the task. Therefore the content of the curriculum has a great impact on the knowledge, attitude and practices of the students.

2.3.2a.PCK and Student Achievement in Environmental Concepts in Biology

Teachers' Content knowledge allows him or her to be able to convert the subject matter into significant learning outcomes for the students. Moreover, it enables the teacher to give a detailed explanation about the concept to be taught so that the students will gain maximally from it. Therefore, having content knowledge is very essential for teachers although it is not sufficient on its own to improve student learning outcomes as knowledge of different learning strategy, skills and the knowledge of child development is also very essential, Adedoyin, (2011). Having the knowledge about the environment becomes necessary for the teacher in order to teach environmental education to the students efficiently. Hence, teachers need PCK for effective teaching of specific topic and content, (Rusilawati and Zainon, 2009; Van Direl and Berry, 2010). Inadequate CK in the midst of educators is a major causative factor of ineffectual execution of Biology Curriculum content as the amalgamation or the fusion of teachers' PK and their CK makes PCK. Research findings show that teachers' PCK predict student academic achievement

PCK has been found to make a difference for instructional quality and student learning. Kunter (2013); Baumert, etal (2010) in their studies revealed that teachers' CK and teachers'

PCK has a significant effect on student achievement. A teacher who is vast in CK and PK will be able to disseminate information appropriately to the learners. This will go far in affecting their academic achievement as their will be improvement in their performances. This is corroborated by Marissa and Mayhunga (2015) who found out that teachers' PCK significantly affect student academic achievement. Hence, for the quality of education to witness rapid growth teachers PCK must be invested in. Raimundo, etal, (2014) showed that Content Knowledge and the teacher's PCK are significantly related with students' progress and achievement, although not at a very strong point.

John and Allen (2016) state that any nation wanting to witness economic growth must invest greatly in the student's knowledge and skills; this can only be achieved through the learners and educators' purposeful endeavors. Darling-Hammond (2006) opines that the vital determining factor of students' achievement is teacher qualities. Therefore, PCK is an indispensable teacher's factor in measuring the academic achievement of student in environmental concepts in biology.

2.3.2b Pedagogical Content Knowledge and Students' Attitude to Environmental concepts in Biology

Pedagogical content knowledge of the educator impacts the attitude of the learners in a subject. Pedagogical knowledge connotes the knowledge of teaching strategies. The amount of this knowledge possessed by a teacher enables him or her to know the right one to use in teaching a specific topic at a particular time. Using the right strategies has been found to improve on students' attitude to learning. As students become active and not passive in the course of teaching enables them to develop interest in the subject. When a teacher fails to make use of the right methods of teaching and does not have the mastery of the topic he or she want to teach the students, teaching becomes monotonous and learning becomes difficult.

2.3.2cPedagogical Content Knowledge and Students' Practices to Environmental concepts in Biology

PCK had been found to have a positive influence on the practices of students. In the study of Na'Omi (2013), it was revealed that teachers who are degree holder that is B.SC(Ed) or B.Ed. tend to have substantive content knowledge as this is seen in the significant increase of the practice skills of their students. This is because these teachers have been exposed to different course work and they have been taught different methodologies which they can use in the teaching of different concepts and these make them to stand at a better chance in

disseminating this practice skills to their students and these knowledge possessed by these teachers have been found to boost the skills acquired by their students.

Kathirveloo et al, (2014) revealed that teachers' pedagogical content knowledge has a significant impact on student practices. Deliberate and systematic efforts are needed by the teacher to facilitate their PCK for the improvement of student practices in environmental concepts. It is therefore clear that teachers' possession of adequate PCK will show in the skills possessed by their students and also in their ability to proffer solutions to environmental problems.

2.3.3a Student Factor: Emotional Intelligence and Student Achievement in Environmental Concept in Biology

Studies conducted on the correlation between emotional intelligence and academic performance has produced diverse outcomes because several factors like parental educational background, school environment, teachers' behaviour, motivation may directly or indirectly affect the emotional intelligence of the student and this will in turn affect the achievement of the students as students whose emotional needs are taken care of at home by their parents tend to perform better than those whose emotional needs are not met. Emotional intelligence has been found to mediate learning at different level of education. This was revealed in the research carried out by (Han and Johnson 2012). Therefore, emotional intelligence of students is very necessary and need to be taken care off if academic achievement will be achieved

Gamze and Cengiz (2013); Chumundeswari (2013); Ngu et al (2016), found out that emotional intelligence predict academic excellent in students. The result implies that students with high degree of emotional intelligence perform excellently well in their academic than their fellow students who have low emotional intelligence. The ability to manage stress by students is very essential to their academic success because any student that fails to manage stress may find it difficult to concentrate in the classroom during the teaching process and reading can become very difficult. Any student who fails to read is planning to fail in an examination. Also adaptability is also an essential component of emotional intelligence as it mean the ability of an individual to adjust to environmental changes in his or her surroundings which has effect on him or her. A students who has everything at his or her disposal at home getting to school he or she may meet a different situation, because the academic work can be very tedious and challenging, hence, there is the need for him to cope or else he may become emotionally destabilised which will have a negative effect on his academic performance. But if such

students adapt to the academic environment quickly, academic work will be very easy and academic achievement becomes attainable.

Han and Johnson (2012) findings revealed that negative relationship exists between emotional intelligence and achievement. This result may look different from what is expected from the normal classroom settings. Punia and Sangwan (2011) established that girls are more emotionally intelligent than boys. Sania and Sherish (2016) established from his study that the relationship between emotional intelligence and academic performance was weak.

Thus, past studies carried out arrived at different results which make it hard to generalise. Considering several factors that affect emotional intelligence and the effect they have on it, it is therefore important that carrying out numerous researches on this field, at different places by using diverse variables.

2.3.3b Student factor: Emotional Intelligence and Student Attitude to Environmental Concept in Biology

Attitudes and emotions in human life is a field of greatly difficult cognition, and rarely taken into cognizance during teaching and learning process in the schools by teachers and school administrators. In a definite term, attitude is a consistent response to certain groups of stimuli. In a practical term, attitude has been most often related with emotionally toned answers. Also attitude can be said to be a favorable or unfavourable assessment whether shown in principles, outlooks, or feeling toward something.

Attitude is referred to as belief held by an individual and his or her mode of reasoning which results in the behaviour being manifested. This implies that an individual's feeling can serve as a guide to the way he reacts to the situation around him as a result people's actions are the resultants of their attitude. Furthermore, attitude is a link between an object and the way we evaluate the object, when this connection becomes very strong, assessing attitude becomes easy. Therefore attitude embraces assessment. Also attitude is acquired in a way that will either make you active or redundant. Because of this, it was established that actions are predicted by attitude if other external and internal factors that can influence such attitude are controlled.

Emotional intelligence is an individual capability to coordinate her emotion and that of other people, to differentiate one emotion from another and make use of the facts gathered to control the process of thinking and behavior. According to Ogundokun and Adeyemo (2010)

there is a significant relationship between the intrapersonal aspect of emotional intelligence and attitude.

However, a student with emotional stressor cannot reach his or her academic potential because of the negative attitude such student will put up in school thereby affecting his or academic success. Therefore adequate attention needs to be given to students emotional needs in the classroom in order to enhance their attitude, if this is done student will manifest positive attitude. Students whose emotional needs are not met by their parents at home will be deficient academically and those whose emotional needs are met by their parents tend to manifest positive emotional attitude and participate actively in the classroom. Emotional intelligence is related to learners willingness to contribute actively in school and readiness to cope with life which has impact on their academic success. Emotional intelligence is a component of social intelligence and lays emphasis on the effect emotion has on the capability to view the situation accurately and to comprehend themselves and others. This evidence indicates that the teaching and learning process from the primary school to tertiary level which took place over the decades centers on the cognitive aspect of learning thereby leaving the affective aspect behind which has developed systematically over time.

2.3.3c Student factor: Emotional Intelligence and Student practices to Environmental Concept in Biology

There is a significant relationship between emotional intelligence and student practices in environmental concepts in biology. Students with high emotional intelligence are able to solve problems in their environment and students with low emotional intelligence will not be able to proffer solutions to problems because of the state of their mind.

2.3.4a Student factor: Students' Motivation and Achievement in Environmental Concept in Biology

Motivation is a multidimensional construct. Motivating students is very essential for a better performance academically as there is a positive and significant correlation between motivation and students achievement. Awanbor (2005) stated that some factors which include poor motivation, poor salaries of teachers, inadequate instructional materials, unmotivated students, poor classroom environment are responsible for student's unwillingness to learn and ineffectiveness of teachers in their teaching profession as teachers are no longer willing to teach and students are not ready to learn. He recommended that motivation will help to proffer solution to learner's academic problem and the general problems facing educational system. He

further stated that students become more responsible and interested in academic activities when motivated. Also the level of students dropping out of school, truancy will reduce if not eliminated completely. Therefore motivating students becomes very important in order to have a better performance academically (Awan *et al* 2011).Muola (2010) opine that students need to motivate themselves for an excellent performance although other people can help to motivate them.

According to Charlse and Harriett (2017), the role of motivating students is not limited to their teachers alone but the school administrators also have a role to play in the motivation of the learners for a better performance academically because students' spend most of their time in school.It is ascertained that when a school has a better organization, conducive classroom environment, teaching aids and qualified teachers with skills, this can go a long way in motivating students to learn as they have a better opportunity than their mates from other schools without all the afore mentioned qualities.

Motivation has been found to predict learning outcomes of students from the past researches. Täht and Must, (2010) observed that social variables related to motivation predict achievement of students. Thus he found out that motivation is an essential predictor of academic achievement in students. This is corroborated by(Awan, *et al* 2011;Busato, *et al*, 2009; Gallagher, *et al*2007; Molavi, *et al*2007;Tella, 2007).Therefore, the teachers should motivate their student intrinsically and extrinsically as these affect their academic performances.

Regrettably, inadequate motivation leads to worriedness, gloominess, and dejection this leads to student's failure. In order to avert the consequence of inadequate motivation, education should be presented in an appropriate way with adequate teaching aids which will motivate student to learn in a better way and all stakeholders in education should put in their effort in motivating students to learn.

2.3.4b Student factor: Motivation and Student Attitude to Environmental Concept in Biology.

Attitude and motivation is an element which is most essential in quality education. It also provides primary impetus to initiate learning of environmental concepts in biology and later the propelling drive to uphold the long and often tedious learning process. Lack of attention to these factors can lead to inefficiencies in learning. Students' shows positive attitude when they are motivated to learn through active participation in the classroom

during the course of teaching, through giving them of task, contributing excitedly in questions and answers session. This motivation can be inform of giving recognition to the students when he or she answer any question correctly in the course of teaching or giving of gift to the best students when they pas excellently in the examination.

2.3.4c Student factor: Motivation and Students' Environmental Practices in Environmental concepts in Biology.

According to Shernoff, (2013) ; Wang and Eccles, (2013); Larson, (2011) and Zedan, (2010) student motivation to learn and student practices are the key features of learning environmental concepts which promotes meaningful engagement and environmental sustenance, particularly when they are combined together. Student practices has been related with numerous environmental challenge which incorporates clear objectives, high expectations which give chances to investigating and taking care of significant issues, the mastery of new skills, educators' high expectations for learners success which is pertinent to school undertakings and learners real lives. Various components of ecological support that have been identified with learners' practices incorporate strong relationship with the educator.

The methods adopted by students in solving problems differ. Kirton (1976) categorised human being into two the innovators and the adaptors. The innovators solve problems with the aid of innovative technology they look beyond what they are provided with in solving the problems whereas the adaptors make use of what they are provided with in solving a problem that is they use the adaptive approach. Therefore, there is a positive relationship between motivating student to learn and the practices they exhibited.

2.3.5aStudent factor: Cognitive Style Test (CST) and Student Achievement in Environmental Concept in Biology

Cognitive styles have been found to affect students' academic achievement. Awolola, (2009); Ramlah and Md. Nasir (2007) found out that students' cognitive styles predicts academic achievement. This is corroborated by Ahmadzaide and Shoeje (2013);Alireza, *et al* (2011). The findings of their study shows that there is a significance positive relationship between students' field dependence and field independence and their academic achievements therefore cognitive styles is a significant predictor of academic achievement. This contradicted the findings of Ipek (2010); Azmiza (2009) and Dragon (2009) who found out that cognitive style does not significantly have impact on achievement of student in their studies.

2.3.5b Student factor: Cognitive Style Test (CST) and Student Attitude to Environmental Concepts in Biology

Learning is a difficult undertaking that necessitates a learner to use and apply a range of cognitive skills but unfortunately, some students struggle and eventually fail to process information efficiently due to their attitude which, in turn, adversely affects the outcome of instruction (Watson and Gable, 2011). Student with positive attitude have the ability to process information logically whereas a student that exhibit negative attitude toward learning cannot gain anything during the process of teaching. This negative attitude will affect the cognitive style of learning because there is no information to be processed by the, Smith (2011). The result of the study conducted by Ogundiwin (2006) revealed that cognitive style of students does not have a positive impact their attitude towards environmental concepts. The habitual pattern identified by Olagunju and Abiona (2004) in their research on cognitive styles and Developing Scientific Attitude confirmed that Cognitive style significantly affect students' attitude, this in turn will affect individual knowledge and practices towards environment

In addition, providing the chance and the learning environment for students to restructure their own theoretical knowledge and understanding leads to lifelong development of students' attitudes to learning thereby, giving them greater chance of success in their studies and lives Movahedzadeh, (2011).

2.3.5c Student factor: Cognitive Style Test (CST) and Student Environmental Practices in Environmental concepts in Biology

Students' with a field-dependent style takes information given to them by their teacher holistically and use it to solve environmental problems. But students who are field independent obtain information from outside the classroom and add it to what they learnt. This knowledge acquired is used in solving problems in their society. Ogundiwin (2015) ascertain that cognitive style predicts students learning outcome in ecological concepts in biology. This contradicts the finding of Oloyede (2015) who found out that cognitive style did not have any significance influence on students' environmental practices. The influence of cognitive style made no noticeable contribution to students' environmental practices.

2.4. Appraisal of Literature

Literature reviewed indicated that pedagogical content knowledge is an educational tool that influences learning environment and allows the use of inert knowledge already developed

by students. This will make them active participants and responsible citizens of the society especially as it relates to the environment.

Literature reviewed showed that the style in which learners obtain and handle facts has been found to be influenced the methods used by a teacher presents subject matter and the mastery of content knowledge. This also involve some very important teacher factor and student factors put into consideration by the teacher in the process of preparing, planning and presentation of content matter to the student.

Literature reviewed indicates that no investigation has been conducted on teacher Pedagogical content knowledge in biology and its relationship to student learning outcome especially on environmental concepts.

Literature had been reviewed on Teachers' pedagogical content knowledge and biology curriculum as it affects teachers. Literature reviewed indicated that these factors involve knowledge of numerous approaches or action structures that direct a successful learner in studying of environmental concepts.

Literature had been reviewed on students-related factors comprising of Emotional intelligence, Motivation and cognitive style in sciences, they have been found to have significant effects on students' learning outcomes. Students' factors serve as the independent variable on the achievement, attitude and practices in this research.

CHAPTER THREE
METHODOLOGY

This chapter deals with research design, sample, and sampling technique, instrument, validation and reliability, procedure for data collection and method of data analysis.

3.1 Research Design

The research design adopted for this study was descriptive survey research design of correlational type as it examined the magnitude to which the independent variables (Biology Curriculum Content, PCK and Students-related Factors) predict achievement in and attitude to and practices in environmental concepts in Biology

3.2 Variables in the Study

A. Independent Variables

The following independent variables are used. These are

1. Biology Curriculum Content

2. Pedagogical Content Knowledge

3. Student Factors (i) Student's Motivation,

(ii) Student's Emotional Intelligence

(iii) Student's Cognitive Style,

B. Dependent Variables: These are students' learning outcomes, which are

(i) Achievement in Environmental Concepts in Biology

(ii) Attitude to Environment Concepts in Biology

(iii) Students' Environmental Practices

3.3.1 Population

The population for the study comprised all Senior Secondary Two (SSS II) Biology students and their Biology teachers in Ekiti State

3.3.2 Sample and Sampling Techniques-

Multi-stage sampling procedure was employed in this study. Three Local Government Areas out of sixteen were randomly selected from the Three Senatorial Districts in Ekiti State. Five schools were randomly selected in each of the three senatorial districts making a total number of fifteen Schools. From each of the selected schools, 1000 Senior Secondary School Two (SS II) students were used. A Biology teacher teaching SSS II in each of the schools was involved in this study which adds up to 15 teachers.

3.4 Research Instruments

Eight instruments were used in the collection of data. These are:

1. Biology Students' Environmental Achievement Test (BSEAT)

2. Biology Students' Environmental Attitudinal Scale (BSEAS)

3. Biology Students' Environmental Practices Scale (BSEPS)

4. Biology Curriculum Content Rating Scale

5. Teachers' Pedagogical Content Knowledge Rating Scale

6. Students Motivation Scale

7. Students Emotional Intelligence Scale

8. Students Cognitive Style Test

3.4.1 Biology Students' Environmental Achievement Test (BSEAT):

The instrument was constructed by the researcher and it was designed to collect information on SSS II academic achievement in Environmental concept in Biology. The instrument is made up of two sections.

Section A - This consisted of the personal data of the learners.

Section B – This contained of 40 multiple test items covering conservation of natural resources and pollution. Learners were requested to pick the answer that best suits the questions. All questions are in multiple choices with answers ranging from A to D. Learners are to choose the right option from the answers given by underlining the correct answer. The table 3.1 which

is the table of description for the instrument is in accordance with Bloom's six levels of taxonomy.

Validation of Instrument (BSEAT)

This instrument was giving to specialists in science education for their remarks, critique and submissions in order to ascertain its content validity. These scholars were requested to define its appropriateness, clearness, breath and linguistic. Through the contributions of experts, out of the initial 50 items prepared, only 40 items survived scrutiny. After, the instrument was tested on a sample of 20 students in a different school which is not part of the selected school for the study. The average difficulty and discriminating indices were then determined. Only the questions with difficulty and discriminating indices ranging from 0.40 and 0.60 were selected, they were 40 in number. The reliability coefficient was obtained using Kuder Richardson (KR.20) and it was 0.83.

Table 3.1: Table of Specification for BSEAT

Topics	**Remembering (Knowledge)**	**Understanding Comprehension and Application**	**Thinking(Analysis, Synthesis, Evaluation)**	**Total**
Conservation of natural resources	2,3,4,6	11,12,13,17,18 31,32,	23,30,33,39	15
Pollution	1,5,9	10,14,15,20,24,	27,28,34,	11
Erosion	19,37	25	35, 39	5
Environment	7,8,16	21,22, 29, 36, 39	40	9
Total	12	18	10	40

In the 1950s, Bloom found that most of the test questions developed to assess students' learning required them only to think at the lowest level of learning, the recall of information (Hobgood, Thibault and Walbert, 2005 in Oloyede 2015). Today, a considerable amount of attention is given to students' abilities to think critically about what they do. These thinking resources will help foster thinking skills that lead to greater comprehension for all students using the original and revised Bloom's Taxonomy (Anderson, et.al, 2001in Oloyede 2015).

3.4.2 Biology Students' Environmental Attitudinal Scale (BSEAS):

The instrumentis designed to investigate or test the affective domain of the students especially their attitude to the environmental problems as expressed in the environmental education concepts in Biology. The questionnaire was structured by the researcher.

The instrument is divided into two sections:

Section A – Section A comprises the students' bio data.

Section B – Section B has 20 items to collect relevant information on students' attitude towards environmental problem. The 20 items covered the environmental concept in biology. The items contained equal numbers of positive and negative items reflecting certain attitudinal disposition to learning of environmental concept in biology. The items were placed on a 4-point likert type ordinal scale ranging from Strongly Agree (SA) 4, Agree (A) 3, Disagree (D) 2, and Strongly Disagree (SD) 1.

Validation of BSEAS

This questionnaire was given to lecturer to ascertain its content validity and for their comments, criticism and suggestions. These experts were asked to determine its appropriateness for the target students in terms of simplicity, breath and words. The first version contains 40questions which were condensed to 20 in the last version by the professionals. The reliability coefficient of the instrument was determined using Cronbach Alpha and 0.88 was obtained.

3.4.3 Biology Student Environmental Practice Scale (BSEPS)

This instrument was adapted from Oladapo (2011) participants' environmental education programme for market men and women. It was modified by considering the educational and maturity level of secondary students, and found suitable. The instrument was divided into two parts.

Part A: This is made up of the data of the participants such as: name of School of the participants, the class and gender.

Part B: This section has 20 items with statements that assess theparticipants' practices on environmental pollution and conservation techniques.

Table 3.2: Table of Specification on BSEPS

S/N	Concepts/Topics	(+) Positive	(-) Negative	Total No
1	Air pollution	(3)3, 4,5	(2) 1, 2	5
2	Water pollution	(2) 6, 7	(3) 8, 9, 10	5
3	Land pollution	(3)11, 12, 15	(2) 13, 14	5
4	Conservation techniques	(2) 18, 19	(3)16, 17, 20	5
	Total	**10**	**10**	**20**

The scoring of BSEPS is as follows:

Very Often (VO) - 4 marks

Often (O)- 3 marks

Seldom (S) – 2 marks

Never (N) – 1 mark

The above goes for positively worded statement while the reverse was used for negatively worded statements i.e.

Very Often (VO) - 1 mark

Often (O)- 2 marks

Seldom (S) –3 marks

Never (N) – 4 marks

3.4.3.1 Validation of BSEPS

The instrument was also given to colleagues, in related disciplines as well as professionals in the field of Environmental Education. Their comments, criticisms and suggestions were used to expunge, and add some items where necessary. The final drafts were administered to senior secondary school students who are not going to partake in the main work. Cronbach alpha measure was used to establish the reliability after trial testing. An index of 0.82 was obtained.

3.3.4 Biology Curriculum Content Rating Scale (BCCRS)

The instrument was adapted from Sotonwa (1999).

The instrument is divided into two (2) sections. Section A seeks information on teachers' bio-data in terms of: name of school, teaching experience, qualification and area of specialization. Section B contains twenty (20) items to elicit information on teachers' rating of the curriculum in terms of adequacy, suitability and relevance of Environmental concepts, objective, content (subject matter), the learning activities and the evaluation techniques. Biology subject teachers will respond by expressing their level of agreement to the statements

in BCCRS in a Likert scale ranging from Strongly Agree (SA) 4, Agree (A) 3, Disagree (D) 2, and Strongly Disagree (SD) 1.

Validation of BCCRS

The items in the instrument were given to experts in Science Education Unit, Department of Teacher Education for face and content validity in terms of the wording of the items, phrasing and coverage. Thereafter, the reliability test was determined by administering the instrument on twenty senior secondary two (SSS 2) teachers who are not meant for the research. Scott pie of 0.87 was obtained when the BCCRS instrument was validated.

3.3.5 Teachers' PCK Rating Scale (TPCKRS)

The instrument was designed by the researcher to measure Biology's Teachers' Pedagogical Content Knowledge. It is comprised of two segments: A and B. Segment A comprises statistic data on educators of Biology. Segment B covers 23 questions which are organized on likert rating scale of 1, 2, 3, 4, and 5.

The items covered extent of activation of prior knowledge, relating concepts taught to real life, engaging student in meaningful activities, giving explanatory notes on concept taught, use of current facts and examples and knowledge or clear technical terms in the subject. The instrument was hand over to lecturers in the Department of Teacher Education, for validity and their input were utilized to develop the questions. The questionnaire was thereafter administered to two Biology educators during coaching from a senior secondary school in Ibadan who is not going to be part of the main study. Scott Pie was used in determining the inter-rater reliability in which 0.88 was obtained.

3.4.5 Emotional Intelligence Scale

Emotional intelligence scale was adopted and modified from Schutte, Malouff, Haggerty, Cooper, Golden, and Dornheim (1998) to measure an individual's positive or negative orientation towards himself or herself for an overall evaluation of his or her feelings or thinking. EIS is a 15-items questionnaire with four-point scale of SA-Strongly Agree, A-Agree, D- Disagree, and SD-Strongly Disagree. To score the instrument 4, 3, 2, and 1 was assigned to each scale respectively.

Validation of EIS

Emotional intelligence scale was revalidated by trial testing it on a sample of 20 students from a school that will not be part of main study. The reliability coefficient using Cronbach Alpha method was found to be 0.80.

3.3.6 Student Motivation Questionnaire

Student Motivation Questionnaire aimed at investigating the motivation of student towards biology most especially environmental concepts was used. It was constructed by the researcher.

The instrument is divided into two sections:

Section A – Section A contain the students' bio data.

Section B – Section B has forty items to collect relevant information on students' motivation towards learning of environmental concept in biology. The items were placed on a 4-point likert type ordinal scale ranging from Strongly Agree (SA) 4, Agree (A) 3, Disagree (D) 2, and Strongly Disagree (SD) 1.

Validation of SMQ

The face validity of SMQ was done by showing the items to two Biology teachers and two lecturers to determine their suitability in terms of language of presentation, clarity of ideas and class level, length and relevance or applicability to the study. The first version comprising 50 questions were condensed to 40.The instrument was then tested on population which is not part of the study to certify its reliability using Cronbach Co-efficient Alpha, which gave 0.80.

3.3.7 Cognitive Style Test

Cognitive Style Field Questionnaire (Independence or Dependence)

By Robert Wyss (2002)

Instructions to learners:

Check any box that best portray you. Boxes A and E show that the statement is similar to you, Boxes B and D shows that the statements is pretty much like you, Box C show that you have no specific tendency one way or other. The questionnaire contained 9 statements for each

of the two cognitive styles (Field Dependent or Field independence) which were used to measure the participant's preference for each cognitive style dimension. The highest score in the field dependence/independence is 27. The highest score between the two dimensions (FD or FI) indicated strength or inclination to that cognitive style. The lowest score is 9, which indicate that the learner is not inclined to either field dependence or field independence cognitive dimension.

3.4.4.4 Validation of Cognitive Style Questionnaire (CSQ)

The face validity of CSQ was done by showing the items to two Biology teachers and two lecturers to determine their suitability in terms of language of presentation, clarity of ideas and class level, length and relevance or applicability to the study. For the present study the CSQ was trial tested twice (separated by four weeks to allow consistency of feedback expected from the students and in order to further ensure its validity and reliability) using 20 SS II students and test-retest reliability value of 0.81 was gotten.

3.5 Procedure for Data Collection

A letter of introduction was collected from the Department of Teacher Education University of Ibadan to the schools where the research will be carried out. The researcher proceeded to obtain permission from the school principal, teacher and student of the participating schools. The educators were educated on the objectives of the research and what it entails. Briefing session was organised for the teacher and students that participated in the study. These preliminary activities take two weeks. Research assistant were trained to help in the observation of the teacher during the lessons and the training lasted for one week.Thus, the researcher alongside with the competent research assistants number the instruments before administering them in all the sampled schools. The notes of lessons of the teachers teaching SS two students Biology was assessed by the researcher in order to determine the level of implementation of the Biology curriculum content in terms of environmental aspect. The Biology teachers were observed twice in each of the fifteen schools in order to measure their Pedagogical Content Knowledge. The remaining instrument such as Biology Student Environmental Achievement Test (BSEAT), Biology Student Environmental Attitudinal Scale (BSAES), Biology Student Environmental Practices Scale (BSEPS), Emotional Intelligent Questionnaire (EIQ), Student Motivation Questionnaire (SMQ) And Cognitive Style Test (CST) was administered to the students in all the participating schools of the study. The researcher was assisted by the research assistant to administer and supervise the test. The

administration and collection of teachers and student instruments covered a period of about twelve weeks in all the Local Government Areas selected for the study.

2 weeks	briefing session
1 week	training of research assistants
8 weeks	administration of questionnaires, assessment of teachers' note of lesson and observation of teachers in the classroom
1 week	collation of questionnaires

3.6 Data Analysis

Data were analyzed using descriptive statistics (frequency count, percentage, mean and standard deviation). Data were analyzed using Pearson Product Moment Correlation to Multiple Regression Analysis to determine the measure of relationship between independent variables and dependent variables. Multiple Regression was used to determine the joint contribution of independent to dependent variables as well determining which of the variables predicted students' learning outcomes in Biology.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the result and discussion. The seven research questions generated were tested at 0.05 level of significance and the discussions of the results are guided by the findings of the study. These are presented as follows:

4.1 Testing of research questions

This section presents the result of the analysis of the level of student's attitude, emotional intelligence, motivation, biology curriculum content knowledge and teachers' pedagogical content knowledge. It clearly shows the relationship between the independent variables (emotional intelligence, motivation, biology curriculum content knowledge and teachers pedagogical content knowledge) and the dependent variables (achievement, attitude and practices). It also revealed the joint contribution and relative contributions of the independent variables on the dependent variables. Tables in this section also reflect the degree of frequency (df), mean square. Frequency ration (f) and denote (*) significance at 0.05 level of significance.

4.4.1: Student Level of Environmental Attitude

RQ 1a: What are students' environmental attitudes?

Table 4.1 Summary of the Analysis of Students' Environmental Attitude Scale

S/N	Item	SA	A	D	SD	Me	STD.
1	I think it will be difficult to make our illiterate populace understand air pollution.	369 37.2%	269 27.1%	222 22.4%	133 13.4%	2.12	1.057
2	I think air pollution is only a problem that affects female gender but not everybody.	70 7.1%	143 14.4%	209 21.1%	570 57.5%	3.29	0.958
3	I feel field investigation of causes of air pollution could help in research work to eradicate air pollution.	535 54.5%	265 27.0%	101 10.3%	80 8.2%	3.28	0.947
4	I prefer group efforts to be used in combating the causes of air pollution.	524 54.8%	301 31.5%	69 7.2%	63 6.6%	3.34	0.875
5	I feel the objective report made on previous air pollution effect will serve as unforgettable experience.	463 48.4%	369 38.6%	79 8.3%	45 4.7%	3.31	0.813
6	It is preferable to visit the source of water before purification method will be applied.	486 50.3%	309 32.0%	109 11.3%	63 6.5%	3.26	0.900
7	It is interesting and enjoyable to see groups working together to prevent water pollution.	649 67.5%	199 20.7%	86 8.9%	28 2.9%	3.53	0.777
8	I feel waste water does not constitute nuisance.	143 15.2%	198 21.1%	291 31.0%	308 32.8%	2.81	1.055
9	I feel cesspit or drainage channels constructed near source of water cannot pollute water	113 11.7%	137 14.2%	252 26.1%	463 48.0%	3.10	1.040
10	It is desirable to kill fish with chemicals	135 13.8%	130 13.3%	218 22.3%	493 50.5%	3.10	1.088
11	I prefer working with individuals make innovations on treatment of solid waste	510 52.1%	325 33.2%	104 10.6%	39 4.0%	3.34	0.822
12	It is interesting to see boys and girls keeping their environment clean	792 80.2%	104 10.5%	67 6.8%	25 2.5%	3.68	0.710
13	I prefer having first hand field experience than finding out from experts the causes and effects of land pollution.	408 41.5%	335 34.1%	140 14.3%	99 10.1%	3.07	0.978
14	I feel that I gain nothing in learning environmental pollution on land since my environment is clean.	90 9.2%	133 13.6%	322 32.8%	436 44.4%	3.13	0.966
15	I like learning about land pollution because of its effect on environment.	455 46.1%	330 33.4%	120 12.2%	82 8.3%	3.17	0.941
16	I dislike learning about conservation techniques because it cannot supply all the answers to our questions about useful living.	160 16.3%	111 11.3%	362 36.8%	350 35.6%	2.92	1.056
17	I feel there could be misconception about conservation ideas hence it may not be necessary.	157 16.2%	249 25.7%	323 33.3%	241 24.8%	2.67	1.022
18	I will like boys and girls to learn conservation of resources in Biology.	671 69.2%	241 24.8%	40 4.1%	18 1.9%	3.61	0.657
19	It is enjoyable to see groups and corporate bodies participating in conservation of resources.	597 61.4%	295 30.3%	42 4.3%	38 3.9%	3.49	0.756
20	I hate field work exercise used for conversation of our natural resources.	173 17.9%	161 16.7%	303 31.4%	327 33.9%	2.81	1.091
21	I always find a way of reducing environmental pollution	499 50.6%	362 36.7%	66 6.7%	59 6.0%	3.32	0.843
22	I feel burning of refuse is a harmless way of disposing of our garbage	309 31.1%	163 16.4%	233 23.5%	287 28.9%	2.50	1.205
23	Boiling of water before drinking it is hygienic	655 66.2%	239 24.1%	79 8.0%	17 1.7%	3.55	0.715
Weighted mean = 3.15							

Table 4.1show the analysis of students to environmental attitudinal scale.

Table 4.1show a weighted mean of 3.15 out of the greatest attainable mark of 4.00 which is greater than the standard mean of 2.50. This indicated that the students had positive environmental attitude.

4.2.2 The Level of Students' Environmental Practices in Environmental Concepts In Biology

Research question 1B: What is students' environmental practice?

Table 4.2: Summary of the Analysis of Students' Environmental Practices Scale

S/N	How frequently do you do the following?	VO	O	S	N	Mean	STD. D
1.	Sleep in a room immediately after spraying insecticides.	65 6.5%	49 4.9%	70 7.0%	809 81.5%	3.63	0.81
2.	See people smoking along the streets without being cautioned.	266 26.7%	310 31.2%	150 15.1%	269 27.0%	2.42	1.15
3.	Control Bush burning not to produce smoke that will disturb people.	388 39.1%	355 35.8%	147 14.8%	102 10.2%	3.04	0.98
4.	Purify the air around by using air purifier like Air Fresheners	501 51.1%	311 31.7%	93 9.5%	75 7.7%	3.26	0.92
5.	Stay away from unpleasant odour in the environment.	699 70.4%	196 19.7%	69 6.9%	29 2.9%	3.58	0.75
6.	Treat your well/borehole	614 62.2%	265 26.8%	79 8.0%	29 2.9%	3.48	0.77
7.	Drink water when it is treated.	562 56.9%	280 28.4%	109 11.0%	36 3.6%	3.39	0.82
8.	Educate fishermen on the danger of continuous fishing on water bodies without permission from the necessary authority.	303 30.6%	298 30.1%	237 23.9%	152 15.4%	2.76	1.05
9.	Read newspaper articles alerting people on the threats posed on our health by using polluted water	408 41.3%	283 28.7%	162 16.4%	134 13.6%	2.98	1.06
10.	Allow people to get away with tapping petroleum products illegally without reporting to the necessary authority concerned.	178 18.1%	181 18.5%	153 15.6%	469 47.8%	2.93	1.18
11.	Provide dust bin for refuse disposal.	606 61.3%	246 24.9%	83 8.4%	54 5.5%	3.42	0.86
12.	Sweep a dusty sandy place after wetting the soil.	537 54.7%	265 27.0%	87 8.9%	92 9.4%	3.27	0.97
13.	Stay very close to heavy heaps of refuse in the environment.	165 16.8%	103 10.5%	101 10.3%	616 62.5%	3.19	1.17
14.	Pick waste on the floor when I have the time.	365 37.0%	306 31.0%	185 18.7%	131 13.3%	2.92	1.04
15.	Observing environmental sanitation exercise.	554 56.8%	299 30.6%	90 9.2%	33 3.4%	3.41	0.79
16.	Dig holes during extraction without covering the holes after the extraction.	168 17.2%	117 12.05	123 12.6%	569 58.2%	3.12	1.17
17.	Leave people dumping wastes into the drainage systems during rainfall without correcting their actions.	142 14.3%	124 12.5%	109 11.0%	615 62.1%	3.21	1.13
18.	Educate people on conservation techniques.	577 58.2%	252 25.4%	128 12.9%	35 3.5%	3.38	0.84
19.	Educate hunters on the danger of poaching.	367 37.3%	362 36.8%	136 13.8%	120 12.2%	2.99	1.00
20.	Empty septic tank in rivers and streams as a Conservation technique.	231 23.3%	264 26.6%	99 10.0%	397 40.1%	2.67	1.22
Weighted mean = 3.15							

Table 4.2 revealed students responses to environmental practices questionnaire. Table 4.2show a weighted mean of 3.15 out of the utmost attainable mark of 4.00 which is greater than the standard mean of 2.50. This indicated that students' environmental practices are high.

4.3. Level of Biology Teachers' Curriculum Content Knowledge

Research question 1C: What is the level of teachers' biology curriculum content knowledge?

Table 4.3: Summary of the Analysis of Teachers' Biology Curriculum Content Knowledge Scale

/N	Items	SA	A	D	SD	Mean	STD.D
1	The objectives of the Environmental Concept in Biology Curriculum are adequate	- -	- -	12 80.0%	3 20.0%	3.20	0.414
2	The learning activities provided in the curriculum are not adequate.	5 33.3%	- -	8 53.3%	2 13.3%	2.53	1.126
3	The Environmental content of the Topics in Biology Curriculum is easy to understand.	1 6.7%	11 73.3%	1 6.7%	2 13.3%	2.27	0.799
4	The Environmental contents of the Concept in Biology curriculum are too shallow.	- -	2 13.3%	8 53.3%	5 33.3%	3.20	0.676
5	Majority of the learning materials listed in the curriculum are not easily accessible	2 13.3%	5 33.3%	5 33.3%	3 20.0%	2.60	0.987
6	Some Environmental contents of the curriculum are outdated.	- -	- -	10 66.7%	5 33.3%	3.33	0.488
7	Some of the Environmental content in the curriculum is too loaded for senior secondary school level	- -	3 20.0%	9 60.0%	3 20.0%	3.00	0.655
8	Some aspect of the curriculum are better treated in the tertiary institutions	- -	8 53.3%	4 26.7%	3 20.0%	2.33	0.817
9	The objectives in the curriculum are well stated.	2 13.3%	13 86.7%	- -	- -	3.13	0.352
10	Concept in Biology curriculum is more meaningful and significant to students and can improve their environmental practices, achievement in and attitude to Biology.	2 13.3%	13 86.7%	- -	- -	3.20	0.414
11	The various concepts and principles of the Environmental Concept in Biology curriculum are well understood.	2 13.3%	13 86.7%	- -	- -	3.13	0.352
12	Teaching environmental concepts in the curriculum is difficult for the teachers	- -	- -	6 40.0%	9 60.0%	3.60	0.507
13	The Environmental contents in Biology curriculum are well conceptualized and relevant to the students' socio-cultural needs.	2 13.3%	13 86.7%	- -	- -	3.13	0.352
14	Students find it hard to comprehend the Environmental content ofConcepts in Biology curriculum.	- -	3 20.0%	5 33.3%	7 46.7%	3.27	0.799
15	Students are always ready to learn the subject content of the Biology curriculum.	- -	12 80.0%	3 20.0%	- -	2.20	0.414
16	Government policy changes often affect Biology Curriculum	2 13.3%	10 66.7%	2 13.3%	1 6.7%	2.87	0.743
17	Concept in Biology curriculum is more meaningful and significant to students and can improve their environmental achievement	2 13.3%	13 86.7%	- -	- -	1.87	0.352
18	Concept in Biology curriculum is more meaningful and significant to students and can improve their environmental attitude to Biology.	2 13.3%	13 86.7%	-	- -	1.87	0.352
19	The outdoor activities in the environmental concept in the curriculum are not adequate	- -	10 66.7%	3 20.0%	2 13.3%	2.53	0.743
20	The indoor activities in the curriculum are not practicable	- -	1 6.7%	7 46.7%	7 46.7%	3.40	0.635
Weighted mean = 2.83							

Table 4.3 revealed the teachers responses to biology curriculum content knowledge scale. Table 4.3showed a weighted mean of 2.83 out of the highest available mark of 4.00 which is higher than the standard mean of 2.50. This indicated that teachers' biology curriculum content is fair.

4.4. The Level of Teachers' Pedagogical Content Knowledge

Research question 1D: What is the level of teachers' pedagogical content knowledge?

Table 4.4: Summary of the Analysis of Teachers' Pedagogical Content Knowledge Scale

S/N	Items	1	2	3	4	5	Mean	STD.D
1	Teachers use suitable set of introduction at the commencement of the class.	- -	3 20.0%	6 40.0%	5 33.3%	1 6.7%	3.27	0.884
2	Teachers uses time effectively in the lesson	- -	1 6.7%	9 60.0%	4 26.7%	1 6.7%	3.33	0.724
3	Teachers uses suitable learning and teaching aids	- -	10 66.7%	2 13.3%	2 13.3%	1 6.7%	2.60	0.986
4	Teachers effectively use voice in the lesson.	- -	2 13.3%	9 60.0%	4 26.7%	- -	3.13	0.640
5	Teachers correct learner's mistakes in accord with their responses.	- -	4 26.7%	7 46.7%	4 26.7%	- -	3.00	0.756
6	Teachers shows sufficient understanding of the right method of teaching	- -	9 60.0%	4 26.7%	1 6.7%	1 6.7%	2.60	0.910
7	Teachers present lesson systematically in steps.	- -	2 13.3%	11 73.3%	1 6.7%	1 6.7%	3.07	0.704
8	Teachers control his or her emotions during lessons.	- -	3 20.0%	9 60.0%	2 13.3%	1 6.7%	3.07	0.799
9	Teachers use questions judiciously during the lesson.	- -	8 53.3%	5 33.3%	1 6.7%	1 6.7%	2.67	0.900
10	Teachers teaches concepts using graphic and concrete representations	- -	8 53.3%	5 33.3%	1 6.7%	1 6.7%	2.67	0.900
11	Teachers' note of lesson contains significant topics to be taught.	- -	7 46.7%	4 26.7%	3 20.0%	1 6.7%	2.87	0.990
12	Teachers use reward, punishment and reinforcement appropriately.	2 13.3%	5 33.3%	4 26.7%	1 6.7%	3 20.0%	2.87	1.356
13	Teachers Uses assessment to support learning.	- -	9 60.0%	2 13.3%	3 20.0%	1 6.7%	2.73	1.033
14	Teachers Uses appropriate teaching strategies	- -	11 73.3%	3 20.0%	1 6.7%	- -	2.33	0.617
15	Teachers Provides adequate practice exercises for students.	- -	7 46.7%	5 33.3%	1 6.7%	2 13.3%	2.87	1.060
16	Teachers exemplifies the topics with what the students experience daily	- -	7 46.7%	4 26.7%	4 26.7%	- -	2.80	0.862
17	Teachers communicate with learners in simple English.	- -	- -	14 93.3%	- -	1 6.7%	3.13	0.516
18	Teachers cater for individual differences among learners.	1 6.7%	10 66.7%	4 26.7%	- -	- -	2.20	0.561
19	Teacher'sprogresses from abstract to concrete and from easy to difficult topics.	- -	8 53.3%	5 33.3%	1 6.7%	1 6.7%	2.67	0.900
20	Teachers do the appraisals of former class before beginning the presentation of new topic	- -	9 60.0%	3 20.0%	- -	3 20.0%	2.80	1.207
21	Teachersallow students to participate enthusiastically during teaching	1 6.7%	9 60.0%	2 13.3%	3 20.0%	- -	2.47	0.916
22	Teachers links prior knowledge to present learning.	- -	7 46.7%	7 46.7%	- -	1 6.7%	2.68	0.817
23	Teachers demonstrate knowledge and use of various assessment techniques.	1 6.7%	6 40.0%	4 26.7%	2 13.3%	2 13.3%	2.87	1.187
24	Teachers use different instructional strategies in lesson presentation.	1 6.7%	10 66.7%	2 13.3%	1 6.7%	1 6.7%	2.40	0.986
25	Teachers uses rewards and punishment appropriately	- -	6 40.0%	5 33.3%	2 13.3%	2 13.3%	3.00	1.069
Weighted mean = 2.80								

Table 4.4show the responses of the teachers to pedagogical content knowledge scale. Table 4.4showed a weighted mean of 2.80 out of the highest attainable mark of 5.00 which is lesser than the mean of 3.00. This indicated that teachers had poor pedagogical content knowledge.

4.5. Level of Student Motivation in Environmental Concepts in Biology

Research question 1E: What is the level of student motivation?

Table 4.5: Summary of the Analysis of Students Motivation Scale

S/N	Item	SA	A	SD	D	Mean	STD.D
1	I partake more when class work includes intriguing undertakings	706 70.7%	238 23.8%	28 2.8%	26 2.6%	3.63	0.668
2	In a unit of study like this I lean toward modules that truly tasking me in order for me to adapt new skills	626 62.9%	340 34.1%	15 1.5%	15 1.5%	3.58	0.603
3	I need to do well in biology since it is essential to demonstrate my capacity to my family, companions, boss, or others.	700 70.4%	198 19.9%	64 6.4%	32 3.2%	3.58	0.753
4	I will partake in biology class on the grounds that the educator utilizes an different of instructing techniques	661 66.2%	214 21.4%	38 3.8%	85 8.5%	3.45	0.914
5	The major reason while I attend biology class is to enable me obtain practical skill	570 57.3%	312 31.4%	44 4.4%	69 6.9%	3.39	0.862
6	I'm self-confident I have the ability to learn the basic facts taught in this study	656 66.2%	282 28.5%	45 4.5%	8 0.8%	3.60	0.616
7	I partake willingly in the lesson because the contents is exciting and changeable	523 52.8%	322 32.5%	70 7.1%	76 7.7%	3.30	0.902
8	Whenever I am opportune I pick assignment that will boost my knowledge even if it will not earn me good marks.	499 50.2%	381 38.3%	41 4.1%	74 7.4%	3.31	0.862
9	The most important goal I want to achieve in environmental studies is to make me ready for my chosen career	553 55.6%	304 30.6%	62 6.2%	75 7.5%	3.34	0.896
10	I am eager to take part in the practical aspect of environmental concepts since it is interesting	559 56.5%	345 34.8%	35 3.5%	51 5.2%	3.43	0.791
11	I enjoy environmental concepts in the biology curriculum	562 58.0%	303 31.3%	99 10.2%	5 0.5%	3.47	0.696
12	I'm convinced I can become proficient in the know-how being taught in environmental concept	545 54.9%	359 36.2%	55 5.5%	34 3.4%	3.43	0.749
13	I expect to do well in environmental topics.	559 56.8%	353 35.8%	48 4.9%	25 2.5%	3.47	0.707
14	I have the impression that every environmental concept is greatly stimulating once I get involved in it	562 56.7%	336 33.9%	50 5.0%	43 4.3%	3.43	0.779
15	I reflect I will be able to relate what I acquire in this unit of study in my community.	632 63.4%	273 27.4%	63 6.3%	29 2.9%	3.51	0.742
16	Having a high score in environmental concepts is what satisfies me the most.	462 46.6%	401 40.4%	65 6.6%	64 6.5%	3.27	0.847
17	Bearing in mind the complexity of the topics, I believe I will perform excellently well in my study with the help of my instructor, and my expertise.	465 48.5%	403 42.0%	56 5.8%	35 3.6%	3.35	0.752
18	I study very well because I discovered that the topics are fascinating	549 57.2%	318 33.1%	80 8.3%	13 1.4%	3.46	0.705
19	What satisfies me most in environmental concepts is having adequate knowledge of the topics comprehensively.	557 58.3%	301 31.5%	51 5.3%	47 4.9%	3.43	0.805
20	I have confidence in having a high score in environmental topics as this will boost my result.	625 62.8%	287 28.8%	50 5.0%	33 3.3%	3.51	0.742
21	Learning science is pertinent to my life	647 65.2%	227 22.9%	65 6.6%	53 5.3%	3.48	0.838

22	I like to have a higher grade than my classmate whenever test is been conducted in biology.	671 67.4%	234 23.5%	68 6.8%	22 2.2%	3.56	0.718
23	Learning science is interesting	655 66.5%	238 24.2%	47 4.8%	45 4.6%	5.53	0.787
24	I put an adequate amount of effort into studying science	679 68.4%	245 24.7%	50 5.0%	18 1.8%	3.60	0.671
25	I apply different method in studying science (environmental concepts in biology).	563 56.6%	359 36.1%	52 5.2%	202.0%	3.47	0.689
26	Studying science will assist me in getting a desired job.	694 70.0%	242 24.4%	37 3.7%	19 1.9%	3.62	0.652
27	It is essential that I have distinction in my science subject most especially biology	685 68.5%	265 26.7%	26 2.6%	18 1.8%	3.63	0.629
28	I have assurance that I will pass excellently in biology tests.	649 66.4%	243 24.8%	76 7.8%	10 1.0%	3.57	0.680
29	Having a comprehensive knowledge of biology gives me career advantage.	615 62.6%	283 28.8%	57 5.8%	27 2.7%	3.51	0.729
30	I devote quality time to studying biology	511 51.4%	373 37.5%	59 5.9%	51 5.1%	3.35	0.810
31	Studying biology add meaning to my life.	646 65.1%	246 24.8%	60 6.0%	41 4.1%	3.51	0.787
32	Comprehending biology will benefits my career	710 71.6%	245 24.7%	27 2.7%	10 1.0%	3.67	0.581
33	I have self-assurance that I will perform excellently in practical and projects.	639 64.6%	295 29.8%	43 4.3%	12 1.2%	3.58	0.636
34	I have confidence in mastering biology knowledge and competence	657 66.6%	254 25.8%	62 6.3%	13 1.3%	3.58	0.670
35	I get ready well for biology tests and practical	594 60.2%	305 30.9%	60 6.1%	27 2.7%	3.49	0.732
36	I am inquisitive about innovations in biology	564 56.8%	286 28.8%	88 8.9%	55 5.5%	3.37	0.862
37	I enjoy learning science	659 67.1%	264 26.9%	48 4.9%	11 1.1%	3.60	0.637
38	I reflect on the score I will get in biology	644 65.4%	290 29.4%	42 4.3%	9 0.9%	3.59	0.618
39	My career will involve science	719 72.5%	179 18.0%	73 7.4%	21 2.1%	3.61	0.716
40	I will use science problem-solving skills in my career	649 65.4%	274 27.6%	48 4.8%	22 2.2%	3.56	0.690
Weighted mean = 3.55							

Table 4.5 revealed the students responses motivation questionnaire. Table 4.5showed a weighted mean of 3.55 out of the highest achievable mark of 4.00 which is greater than the standard mean of 2.50. This indicated that student's level of motivation is high.

4.5 Level of Students' Emotional Intelligence

Research question 1F: What is students' emotional intelligence?

Table 4.6: Summary of the Analysis of Students' Emotional Intelligence Scale

S/N	Item	SA	A	D	SD	Mean	STD.D
1	Most often I feel that I am bad.	227 23.0%	376 38.1%	172 17.4%	211 21.4%	2.37	1.060
2	It is easy for me to solve problems whenever I am in a good disposition.	616 63.4%	305 31.4%	45 4.6%	6 0.6%	3.56	0.612
3	I have the ability to formulate new concepts in environmental concepts whenever am in a good disposition.	613 62.4%	280 28.5%	87 8.9%	2 0.2%	3.53	0.663
4	I have control over my emotion	422 42.9%	400 40.7%	103 10.5%	59 6.0%	3.20	0.856
5	I inspire myself by picturing a worthy result to the question I take on in Environmental concepts	509 52.0%	324 33.1%	103 10.5%	42 4.3%	3.33	0.831
6	I give up whenever I am faced with a question in biology, because I believe I will fail	149 15.1%	129 13.1%	218 22.2%	488 49.6%	3.06	1.109
7	Generally, I am satisfied with myself	515 52.8%	331 33.9%	99 10.2%	30 3.1%	3.37	0.788
8	I know that I possessed numerous good qualities which will help me to do well in biology	540 54.7%	364 36.8%	53 5.4%	31 3.1%	3.43	0.736
9	I have the ability to solve problem as well as most of my classmate.	511 51.7%	355 35.9%	74 7.5%	48 4.9%	3.35	0.817
10	I believe I do not have a lot to be glad for	323 32.9%	288 29.3%	223 22.7%	149 15.2%	2.20	1.059
11	I indeed think that I am incompetent most of the time in solving environmental problems.	166 16.9%	238 24.3%	238 24.3%	339 34.6%	2.77	1.100
12	I feel that I am an individual of worth, at any rate the equivalent of others.	456 46.7%	382 39.1%	100 10.2%	38 3.9%	3.29	0.802
13	I hold a right attitude to myself	564 57.3%	314 31.9%	77 7.8%	30 3.0%	3.43	0.765
14	I wish I could have more regard for myself	530 54.2%	367 37.5%	61 6.2%	20 2.0%	3.44	0.703
15	I realize when to talk about my own issues to other people.	526 53.3%	339 34.4%	74 7.5%	47 4.8%	3.36	0.817
Weighted mean = 3.18							

Table 4.6 revealed the responses of the students to emotional intelligence questionnaire. Table 4.6showed a weighted mean of 3.18 out of the highest reachable mark of 4.00 which is higher than the standard mean of 2.50. This indicated that the level of students' emotional intelligence is high.

4.7. Level of Students' Cognitive Style

Research question 1G: What is students' cognitive styles

Table 4.7: Summary of the Analysis of Students' Cognitive Styles Scale

S/N	ITEMS	A	B	C	D	E	Mean	STD.D
1	I possess the ability to read when students are making noise and shouting in the classroom.	456 51.1%	193 21.6%	134 15.0%	75 8.4%	34 3.8%	4.08	1.156
2	I like to personally analyse the topics taught so that I can understand it better.	501 56.7%	186 21.05	107 12.1%	33 3.7%	57 6.4%	4.18	1.178
3	I sense it is necessity to comprehend every-thing I read and listen to in every subject in class	554 63.2%	146 16.7%	118 13.5%	12 1.4%	46 5.3%	4.31	1.095
4	I felt personal study brings about adequate understanding of the topic	419 47.1%	163 18.3%	155 17.4%	96 10.8%	57 6.4%	3.89	1.282
5	I like personal studying than studying in group.	259 29.3%	255 28.9%	165 18.7%	124 14.0%	80 9.1%	3.55	1.288
6	Getting response from my classmate certainly doesn't disturb my studying at all.	326 36.9%	260 29.0%	136 15.4%	104 11.8%	57 6.5%	3.79	1.237
7	I seek clarifications to the difficulties I encountered during studying by pondering and using my abilities and proficiencies.	544 62.3%	85 9.7%	139 15.9%	31 3.6%	74 8.5%	4.14	1.292
8	I love studying my books even when my peers are usually playing on the sport ground.	449 50.2%	157 17.5%	174 19.4%	62 6.9%	53 5.9%	3.99	1.228
9	I hate when other event disturbed my reading timetable.	438 50.1%	178 20.4%	107 12.2%	53 6.1%	98 11.2%	3.92	1.368
10	I pay adequate attention to my book when am reading in a noiseless surroundings.	437 50.8%	160 18.6%	121 14.1%	48 5.6%	94 10.9%	3.93	1.361
11	I discover it is wearisome and uninteresting to explore the topic content and important matters	32 3.6%	152 17.3%	273 31.1%	222 25.3%	200 22.8%	2.54	1.127
12	I don't mind reading or listening to subject teaching without understanding every single word as long as I 'catch' the main idea.	289 31.8%	243 26.8%	204 22.5%	97 10.7%	75 8.5%	3.63	1.257
13	I felt efficient studying of the topic is enhanced by group discussion.	458 51.9%	158 17.9%	102 11.6%	67 7.6%	97 11.0%	3.92	1.387
14	In fact I love working with my friends and others	439 18.5%	164 18.5%	112 12.6%	98 11.0%	74 8.3%	3.70	1.344
15	I discover that responses are beneficial as it enable me to comprehend areas where I have problems.	407 47.4%	196 22.8%	104 12.1%	50 5.8%	102 11.9%	3.88	1.373
16	Knowing how people cope with related problem and proffer solution to it is of interest to me.	436 49.5%	208 23.6%	106 12.0%	75 8.5%	56 6.4%	4.01	1.237
17	I assimilate very well when my mates are also reading and concentrating on their book.	522 58.6%	156 17.5%	93 10.4%	64 7.2%	56 6.3%	4.15	1.234
18	I love practical activities in the course of teaching so as to make the teaching interesting.	329 36.6%	226 25.2%	198 22.0%	97 10.8%	48 5.3%	3.77	1.204
Weighted mean = 3.85								

Table 4.7shows student responses to cognitive style test. Table 4.7showed a weighted mean of 3.85 out of the maximum obtainable score of 4.00 which is higher than the standard mean of 2.50. This indicated that students had high cognitive style

4..8 Relationship between biology curriculum content and students' achievement in environmental concepts in Biology?

Research question 2A: What relationship exists between biology curriculum content and students' achievement in environmental concepts in Biology?

Table 4.8: Relationship between Biology Curriculum Content and Students' Achievement in Environmental Concepts in Biology

Variables	Mean	Std.d	R	P value	Remark
biology curriculum content	50.60	3.961	0.622	0.013*	Sig.
Students' achievement	18.32	3.577			

* denotes significant at $p<0.05$

Table 4.8 showed that there was positive, moderate significant relationship between biology curriculum content ($r = 0.622$; $p<0.05$) and students' achievement in environmental concept in Biology. This indicates that biology curriculum content was correlated to learners' achievement in environmental concepts in Biology.

Table 4.9: Relationship between biology curriculum content and students' attitude to environmental concepts in biology

Research question 2B: What relationship exists between biology curriculum content and students' attitude to environmental concepts in biology?

Table 4.9: Relationship between Biology Curriculum Content and Students' Attitude to Environmental Concepts in Biology

Variables	Mean	Std.d	R	P value	Remark
biology curriculum content	50.60	3.961	-0.036	0.898	N.S.
Students' attitude	63.80	1.957			

N.S denotes not significant at $p<0.05$

Table 4.9 showed that there was a negative, non-significant relationship between biology curriculum content ($r = -0.036$; $p<0.05$) and students' attitude to environmental concept in Biology.

Table 4.10: Relationship between Biology Curriculum Content and Student Practices in Environmental Concepts in Biology

Research question 2C: What relationship exists between biology curriculum content and Students' practices in environmental concepts in biology?

Table 4.10: Relationship between Biology Curriculum Content and Student Practices in Environmental Concepts in Biology

Variables	Mean	Std.d	R	P value	Remark
biology curriculum content	50.60	3.961	-0.127	0.651	N.S.
Students' practices	54.30	2.099			

N.S. denotes non-significant at $p<0.05$

Table 4.10 showed that there was a negative, non-significant relationship between biology curriculum content ($r = -0.127$; $p>0.05$) and students' practices in environmental concept in Biology.

Table 4.11: Relationship between teachers' pedagogical content knowledge and student achievement in environmental concepts in biology

Research question 3A: What is relationship exist between teachers' pedagogical content knowledge and students' achievement in environmental concepts in Biology?

Table 4.11: Relationship between Teachers' Pedagogical Content Knowledge and Student Achievement in Environmental Concepts in Biology

Variables	Mean	Std.d	R	P value	Remark
Pedagogical content knowledge	64.13	12.200	0.369	0.176	N.S.
Students' achievement	18.32	3.577			

N.S. denotes non-significant at $p<0.05$

Table 4.11 showed that there was a positive, non-significant relationship between teachers' pedagogical content knowledge ($r = 0.369$; $p>0.05$) and students' achievement in environmental concept in Biology.

4.12: Relationship between teachers' pedagogical content knowledge and student attitude to environmental concepts in biology

Research question 3B: What is relationship exist between teachers' pedagogical content knowledge and students' attitude to environmental concepts in Biology?

Table 4.12: Relationship between Teachers' Pedagogical Content Knowledge and Student Attitude to Environmental Concepts in Biology

Variables	Mean	Std.d	R	P value	Remark
Pedagogical content knowledge	64.13	12.200	0.035	0.901	N.S.
Students' attitude	63.80	1.957			

N.S. denotes non-significant at $p<0.05$

Table 4.12 showed that there was a positive, non-significant relationship between biology curriculum content ($r = 0.035$; $p>0.05$) and students' attitude to environmental concepts in Biology.

4.13 Relationship between teachers' pedagogical content knowledge and students' practices in environmental concepts in biology

Research question 3C: What is relationship exist between teachers' PCK and students' practices in environmental concepts in Biology?

Table 4.13: Relationship between Teachers' Pedagogical Content Knowledge and Students' Practices in Environmental Concepts in Biology

Variables	Mean	Std.d	R	P value	Remark
Pedagogical content knowledge	64.13	12.200	-0.134	0.633	N.S.
Students' practices	54.30	2.099			

N.S. denotes non-significant at $p<0.05$

Table 4.13 showed that there was a negative, non-significant relationship between teachers' pedagogical content knowledge ($r = -0.134$; $p>0.05$) and students' practices in environmental concepts in Biology.

4.14 Relationship between student factors (emotional intelligence, student motivation and cognitive style) and students' achievement in environmental concepts in Biology

Research question 4A: What relationship exists between student factors (emotional intelligence, student motivation and cognitive style) and students' achievement in environmental concepts in Biology?

Table 4.14: Mean, Standard Deviation and Correlation Matrix of the Predictor Variables (Emotional Intelligence, Motivation and Cognitive Style) and the Criterion (Dependent Variable, Students' Achievement in Environmental Concepts in Biology)

Variables	Achievement	Emotional intelligence	Student motivation	Cognitive styles
Achievement	1			
Emotional intelligence	0.095* 0.001	1		
Student motivation	0.107* 0.001	0.401* 0.000	1	
Cognitive styles	0.040 0.205	0.305* 0.000	0.360* 0.000	1
Mean	18.28	134.50	46.25	63.82
STD.D	7.899	23.085	7.732	17.132

* denotes significant at $p<0.05$

Table 4.14 showed that there were significant weak positive relationship between emotional intelligence ($r = 0.095$; $p<0.05$) and students' achievement in environmental concepts in Biology. This implies that students' emotional intelligence was related to students' achievement in environmental concepts in Biology. There was a significant low positive relationship between student motivation ($r = 0.107$; $p<0.05$) and students' achievement in environmental concept in Biology. This indicated that students' motivation was related to students' achievement in environmental concepts in Biology. There was a non-significant positive relationship between cognitive styles ($r = 0.040$; $p>0.05$) and students' achievement in environmental concept in Biology. This indicated that cognitive style was not related to students' achievement in environmental concepts in Biology.

4.15 Relationship between student factors (emotional intelligence, student motivation and cognitive style) and students' attitude to environmental concepts in Biology

Research question 4B: What relationship exists between student factors (emotional intelligence, student motivation and cognitive style) and students' attitude to environmental concepts in Biology?

Table 4.15 Mean, Standard Deviation and Correlation Matrix of the Predictor Variables (Emotional Intelligence, Motivation and Cognitive Style) and the Criterion (Dependent Variable, Students' Achievement in Environmental Concepts in Biology)

Variables	Attitude	Emotional intelligence	Student motivation	Cognitive styles
Attitude	1			
Emotional intelligence	0.176* 0.000	1		
Student motivation	0.325* 0.000	0.401* 0.000	1	
Cognitive styles	0.249* 0.000	0.305* 0.000	0.360* 0.000	1
Mean	63.58	134.50	46.25	63.82
STD.D	10.07	23.085	7.732	17.132

* denotes significant at $p<0.05$

Table 4.15 showed that there were positive, low significant relationships between emotional intelligence ($r = 0.176$; $p<0.05$), student motivation ($r = 0.325$; $p<0.05$), cognitive styles ($r = 0.249$; $p<0.05$) and students' attitude to environmental concepts in Biology. This indicated that emotional intelligence, student motivation and cognitive styles were related to students' attitude to environmental concepts in Biology.

4.16 Relationship between student factors (emotional intelligence, student motivation and cognitive style) and students' practices in environmental concepts in Biology

Research question 4C: What relationship exists between student factors (emotional intelligence, student motivation and cognitive style) and students' practices in environmental concepts in Biology?

Table 4.16: Mean, Standard Deviation and Correlation Matrix of the Predictor Variables (Emotional Intelligence, Motivation and Cognitive Style) and the Criterion (Dependent Variable, Students' Achievement in Environmental Concepts in Biology)

Variables	Practices	Emotional intelligence	Student motivation	Cognitive styles
Practices	1			
Emotional intelligence	0.156* 0.000	1		
Student motivation	0.312* 0.000	0.401* 0.000	1	
Cognitive styles	0.236* 0.000	0.305* 0.000	0.360* 0.000	1
Mean	54.28	134.50	46.25	63.82
STD.D	9.76	23.085	7.732	17.132

* denotes significant at $p<0.05$

Table 4.16 showed that there were positive, low significant relationships between emotional intelligence ($r = 0.156$; $p<0.05$), student motivation ($r = 0.312$; $p<0.05$), cognitive styles ($r = 0.236$; $p<0.05$) and students' practices in environmental concept in Biology. This indicated that emotional intelligence, student motivation and cognitive styles were related to students' practices in environmental concepts in Biology.

4.17 Joint contribution of biology curriculum content, pedagogical content knowledge and student factors on students' achievement in environmental concept in Biology

Research question 5A: What is the joint contribution of biology curriculum content, pedagogical content knowledge and student factors on students' achievement in environmental concept in Biology?

Table 4.17: Multiple Regression Analysis of Joint Contribution of Biology Curriculum Content, PCK and Environmental Concepts in Biology

Sources of Variance	Sum of Squares	Df	Mean Square	F	Significant
Regression	74.741	3	24.914	2.626	0.038*
Residual	104.366	11	9.488		
Total	179.107	14			
R = 0.646 R Square = 0.417 Adjusted R Square = 0.258 Std. Error of the Estimate = 3.08022					

Table 4.17 revealed that the joint impact (contribution) of biology curriculum content, PCK and student-related factor to students' achievement in environmental concept in Biology was significant ($F_{(2,12)}$ = 2.626; $p<0.05$). This indicated that when biology curriculum content, pedagogical content knowledge and student factors were combined, they predicted students' achievement in environmental concept in Biology.

4.18 The joint contribution of biology curriculum content, pedagogical content knowledge and student factors to students' attitude to environmental concepts in Biology

Research question 5B: What is the joint contribution of biology curriculum content, pedagogical content knowledge and student factors to students' attitude to environmental concepts in Biology?

Table 4.18: Multiple Regression Analysis on Joint Impact of Biology Curriculum Content, Pedagogical Content Knowledge and Student Factors to Students' Attitude to Environmental Concepts in Biology

Sources of Variance	Sum of Squares	Df	Mean Square	F	Significant
Regression	10.344	4	3.448	0.877	0.483
Residual	43.264	11	3.933		
Total	53.608	14			
R = 0.439 R Square = 0.193 Adjusted R Square = -0.027 Std. Error of the Estimate = 1.98320					

Table 4.18 revealed that the joint impact of biology curriculum content and pedagogical content knowledge to students' attitude to environmental concept in Biology was not significant ($F_{(2,12)} = 0.877$; $p>0.05$). This indicated that when biology curriculum content and pedagogical content knowledge were combined as one, they did not jointly predict learners' attitude to environmental concept in Biology.

4.19 The joint contribution of biology curriculum content, pedagogical content knowledge and student factors to students' practices in environmental concepts in Biology

Research question 5C: What is the joint contribution of biology curriculum content, pedagogical content knowledge and student factors to students' practices in environmental concepts in Biology?

Table 4.19: Multiple Regression Analysis on Joint Impact of Biology Curriculum Content, Pedagogical Content Knowledge and Student Factors to Students' Practices in Environmental Concepts in Biology

Sources of Variance	Sum of Squares	Df	Mean Square	f	Significant
Regression	1.787	3	.596	0.109	0.953
Residual	59.886	12	5.444		
Total	61.673	14			
R = 0.170 R Square = 0.029 Adjusted R Square = -0.236 Std. Error of the Estimate = 2.33327					

Table 4.19 revealed that the joint impact of biology curriculum content, pedagogical content knowledge and student factors to students' practices in environmental concept in Biology was not significant ($F_{(2,12)}$ = 0.109; p>0.05). This indicated that when biology curriculum content and pedagogical content knowledge and student factors were taken together, they did not jointly predict students' practice in environmental concept in Biology.

4.20 The relative contributions of biology curriculum content, PCK and student factor on students' achievement in environmental concepts in Biology

Research question 6A: What are the relative contributions of biology curriculum content, PCK and student factor on students' achievement in environmental concepts in Biology?

Table 4.20: Relative Contribution of Biology Curriculum Content, Pedagogical Content Knowledge and Student-Related Factors on Achievement of Students in Environmental Concepts in Biology

Model	Under standardized Coefficients		Standardized Coefficient	Rank	t	Sig.
	Beta	Std. Error	Beta (β)			
(Constant)	-.424	45.361			-.009	993
Biology Curriculum Content	.051	.072	.175	2nd	.715	.047*
Pedagogical Content Knowledge	.526	.234	.582	1st	2.233	.490
Student Factor: Motivation	.022	.012	.064	4th	1.824	.068
Emotional Intelligence	.086	.036	.085	5th	2.372	.518
Cognitive Style	-.005	.016	-.010	6th	-.287	.774

Table 4.20 revealed that the relative contribution of biology curriculum content ($\beta = 0.051$; $t = 0.715$; $p<0.05$) to students' achievement in environmental concept in Biology was significant. The relative contribution of PCK to students' achievement in environmental concepts in Biology ($\beta = 0.526$; $t = 2.233$; $p>0.05$) was not significant. Also the relative impact of student factors: motivation (($\beta = 0.022$; $t = 1.824$; $p>0.05$); emotional intelligence (($\beta = 0.086$; $t = 2.372$; $p>0.05$); cognitive style ($\beta = -0.005$; $t = -.287$; $p>0.05$) were not significant to achievement in environmental concepts in biology.

4.21 The relative contributions of biology curriculum content, pedagogical content knowledge and student factor to students' attitude to environmental concept in Biology

Research question 6B: What are the relative contributions of biology curriculum content, pedagogical content knowledge and student factor to students' attitude to environmental concept in Biology?

Table 4.21: **Relative Contribution of Biology Curriculum Content, Pedagogical Content Knowledge and Student-Related Factors on Attitude of Students in Environmental Concept in Biology**

Model	Under standardized Coefficients		Standardized Coefficient	Rank	t	Sig.
	Beta	Std. Error	Beta (β)			
(Constant)	19.009	29.206			.651	.528
Biology Curriculum Content	.012	.046	.074	2nd	.257	.802
Pedagogical Content Knowledge	-.111	.152	-.224	1st	-.729	.481
Student Factor: Motivation	.011	.014	.026	4th	.791	.429
Emotional Intelligence	. 341	.044	.262	5th	7.794	.500*
Cognitive Style	. 087	.019	.147	6th	4.558	.530

Table 4.21 revealed that the relative contribution of biology curriculum content ($\beta = 0.012$; $t = 0.257$; $p<0.05$) to students' attitude in environmental concept in Biology was not significant. The relative contribution of PCK to students' attitude in environmental concepts in Biology ($\beta = 0.111$; $t = -.729$; $p>0.05$) was not significant. Also the relative contribution of student factors: motivation (($\beta = 0.011$; $t = .791$; $p>0.05$); cognitive style ($\beta = -0.087$; $t = 4-.558$; $p>0.05$) were not significant but emotional intelligence (($\beta = 0.341$; $t = 7.794$; $p>0.05$); was significant to attitude in environmental concepts in biology.

4.22 Relative contributions of biology curriculum content, pedagogical content knowledge and student factor to students' practices in environmental concepts in Biology

Research question 6C: What are the relative contributions of biology curriculum content, pedagogical content knowledge and student factor to students' practices in environmental concepts in Biology?

Table 4.22**: Relative Contribution of Biology Curriculum Content, Pedagogical Content Knowledge and Student-Related Factors on Practice of Students in Environmental Concept in Biology**

Model	Under standardized Coefficients		Standardized Coefficient	Rank	t	Sig.
	Beta	Std. Error	Beta (β)			
(Constant)	64.466	34.361			1.876	.807
Biology Curriculum Content	-.037	.178	-.070	3rd	-.207	.840
Pedagogical Content Knowledge	-.018	.054	-.106	4th	-.334	.745
Student Factor: Motivation	.004	.014	.010	5rd	.304	.761
Emotional Intelligence	.325	.043	.257	1st	7.617	.670
Cognitive Style	.080	.019	.140	2nd	4.318	.570

Table 4.22 revealed that the relative contributions of biology curriculum content (β = -0.037; t = -0.207; p> 0.05) and pedagogical content knowledge (β = -0.018; t = -0.334; p>0.05) were not significant to students' practices in environmental concepts in biology. Also the relative contribution of student factors: motivation ((β = 0.004; t = .304; p>0.05); emotional intelligence ((β = 0.325; t = 7.617; p>0.05); cognitive style (β = -0.080; t = 4.318; p>0.05) were not significant to practices in environmental concepts in biology.

Research question 7A: Which of the biology curriculum content, pedagogical content knowledge and student factors will predict students' achievement in environmental concept in Biology?

Table 4.17 showed the extent of prediction of the independent variables to students' achievement in environmental concept in Biology at diverse ranks and ranks as extracted by the t-values, the prediction strength is as shown: biology curriculum content (t = 2.388; p<0.05) >pedagogical content knowledge (t = 0.178; p>0.05). Biology curriculum content was the factor that predicts students' achievement in environmental concept in Biology.

The prediction equation is given by $Y = -10.666 + 0.507X_1$

Where Y = Students' achievement in environmental concept in Biology

11.640 = Constant

X_1 = Biology curriculum content

Research question 7B: Which of the biology curriculum content, pedagogical content knowledge and student factors will predict students' attitude to environmental concept in Biology?

Table 4.18 showed none of the independent variables of biology curriculum content and pedagogical content knowledge predicted students' attitude to environmental concept in Biology as expressed by the t-values.

Research question 7C: Which of the biology curriculum content, pedagogical content knowledge and student factors will predict students' practices in environmental concept in Biology?

Table 4.19 showed none of the independent variables of Biology curriculum content and pedagogical content knowledge predicted students' practices in environmental concept in Biology as expressed by the t-values.

4.2 **Discussion of findings**

The main target of this study was to investigate the extent to which Biology Curriculum Content, teachers' PCK and student-related factors (motivation, emotional intelligence and cognitive style) would predict students' learning outcomes in environmental concepts in Biology in Ekiti State, Nigeria.

4.2.1 The Level of Students' Attitude, Practices, Emotional Intelligence, Motivation, Cognitive Style, Teachers Biology Curriculum Content Knowledge and Pedagogical Content Knowledge.

The findings of the study revealed that students had a positive attitude to environmental concepts in biology. This is in line with the findings of Akomolafe (2012), Ogundiwin 2014, Oloyede 2015. The study also revealed that the students showed a positive environmental practice. This can be as a result of their positive attitude because there is a correlation between attitude and practices. This is corroborated by Olagunju and Ogundiwin 2015. Furthermore, the study also revealed that the student-related factors emotional intelligence, motivation and cognitive style had a high mean score which had influence on their learning outcomes. In addition, the study revealed that the Biology curriculum content knowledge of the teachers was found to be fair which implies that the teachers do not have adequate knowledge of the content of the curriculum and this has led to poor performance of the students. Also, the study revealed that the pedagogical content knowledge of the teachers was poor. This is asserted by Okebukola (2015) who stated that Nigerian teachers have inadequate pedagogical content knowledge.

4.2.2a Biology Curriculum Content and Students' Achievement in Environmental Concept in Biology.

The findings of this study revealed a positive, moderate significant relationship between Biology curriculum content and students' achievement in environmental concepts in Biology. This indicates that biology curriculum content was related to students' achievement in environmental concepts in Biology. According to Kolawole (2006) curriculum is a significant element in the course of impacting knowledge. Therefore the content in the Biology curriculum

especially the aspect that has to do with environmental concept has a lot to do with the knowledge achieved by students in this area. The moderate significant relationship between the Biology curriculum content and learners learning outcomes (students' achievements) may be the aftermath effect of the organization of the environmental content in the curriculum. There may be need for a reorganization of the content to suitably bring about a higher achievement by learners for a proper use of this knowledge for basic needs later in life.

The findings were consistent with the findings from previous studies by Oluka and Okurot (2008), Verspoor (2008), Kelly (2009), who reported curriculum content has a significant effect on student learning outcomes

4.2.2b Biology Curriculum Content and Students' Attitude to Environmental Concepts in Biology.

The result obtained showed a negative, non-significant relationship between Biology curriculum content and students' attitude to environmental concept in Biology. Since attitude is a theoretical paradigm about an intellectual condition which is deduced from spoken reports and social reflection, the moderate significant relationship between Biology curriculum content and achievement may have in a way affected the attitude imbibed toward the environment. According to Pelstring (2009) environmental attitude is a learned disposition to reply regularly, favourably or unfavourably with reverence to the environs. Therefore the learning should be highly related with achievement for a positive attitude to environmental concept to be observed. Connecting the students with their surroundings enable them to be familiar with the truth about their environment and cultivate a right behaviour towards it.

4.2.2c Biology Curriculum Content and Students' Practices to Environmental Concepts in Biology.

According to the result obtained in this research work, there was a negative, non-significant relationship between Biology curriculum content and students' practices in environmental concept in Biology. According to Oduwaye (2015) introducing the subject matter in a more accurate ways (i.e. disciplinary and other real-world contexts) has turned out to be an essential matter of this present transformation movement in education.

Goldman, (2006) stresses that people who have environmental knowledge have principles, attitudes and talents which they convert into positive attitude and behaviour. The moderate relationship between Biology curriculum content and achievement in this study will

not translate into positive environmental practices. Toili (2007) observed in his research work which was carried out on how to improve the quality of the environment among twenty two secondary schools in Kenya that students possess little knowledge about the environment and this contributed to their lack of motivation in discharging their environmental responsibilities. Therefore, environmental education content infused into the Biology curriculum which aims at promoting environmental achievement and solving environmental problem will be profiting if it has a positive impact on the practices exhibited by students.

4.2.3a Teachers' PCK and Students' Achievement in Environmental Concepts in Biology.

The result revealed that a positive, non-significant relationship existed between teachers' PCK and learners' achievement in environmental concept in Biology. The positive relationship emphasizes that it is a must for teachers to be vast in the PCK of what they are to teach the students in order to acquire greater achievement in environmental concept in biology. This shows that teachers' PCK is important for students achievements; although in this study, the relationship was not significant. This is in line with the result obtained by (Esun 2015). Thus, for environmental education to be effective, qualified teachers with adequate knowledge are needed because if teachers lack adequate environmental knowledge, environmental illiterate students will be produced.

This result corroborates the findings of Festus, (2008) which states that if students are taught by teachers of high content knowledge, they perform better and this has shown even in the students' performance. Collaborating this assertion are Olfos, Goldrine and Estrella (2014) and Popoola (2002) who found strong correlation between teachers' pedagogical content knowledge and students' understanding in learning. Though, environmental concepts is an important concepts in the curriculum but sometimes, it poses challenges for students to learn because of its abstract nature (Ladele, 2013). However, when imparted by educators with good content knowledge, the challenges can be resolvable or reduced. In contrast, Darling-Hammond (2000) stated that students' learning outcomes can be influenced by teachers' attributes such as verbal ability, content knowledge and certification among other variables. The study is also in consonance with the works of Ishola and Udofia (2017); Ogar (2006) who affirmed that teachers' mastery of the subject matter is a component that determines the extent of students' learning and achievement. Contents define the quality of learning activities and thus a teacher with good mastery of the subject area is characterized to have good knowledge of classroom management, use adequately learning materials, maintaining clarity of thought, bold and confident in what he wants to teach and teach effectively and efficiently.

4.2.3b. **Teachers' Pedagogical Content Knowledge and Students' Attitude in Environmental Concepts in Biology**.

The result showed that a negative, non-significant relationship exists between educators' PCK and learners' attitude in environmental concept in Biology. Comprehensive content knowledge and the associated methodology to be used by a teacher for a particular concept in imparting intricate knowledge that will translate into positive attitude are vital. A negative non-significant relationship here is an indication of teachers' low level of preparedness in imparting the right knowledge to students. According to Adesoji (2008), correlation exists between attitude and methods of instruction as well as between attitude and achievement. Raimundo (2014) states that the value of pedagogical content knowledge cannot be over stressed in teachers' preparation for teaching and in professional development as lack of PCK and proper preparedness in the midst of educators may be the main factor causing negative attitude of students to proper environmental sustainable education.

4.2.3c Teachers' PCK and Students' Practices in Environmental Concepts in Biology.

The result obtained showed that a negative, non-significant relationship exists between educators' PCK and learners' practices in environmental concepts in Biology. As environmental issues are turning out to be more complex it becomes necessary to take action. Learners must be fortified with suitable skills which will be of help to them in taking decisions. According to Noziran (2010) educators must undergo training on environmental education as they serve as role models to their students on how to conserve the environment for the future generation. Furthermore, infusing the significance of environmental teaching for ecological growth into the learning and teaching of Biology will be the best. Therefore, it is important that teachers' PCK be well developed to enhance a positive significant relationship to students environmental practices and protection which will lead to sustainable development.

4.2.4a Student-related Factors (Emotional Intelligence, Student Motivation and Cognitive Style) and Students' Achievement in Environmental Concepts in Biology.

The result revealed that a positive, low significant relationship exists between students' motivation and students' achievement in environmental concept in Biology. Little motivation frequently results to underachievement. But when learners are highly motivated and put through by a teacher, they become successful. Evidence documents motivation as a significant determining factor predicting students' achievement (Beal and Stevens, 2007; Zhu and Leung, 2011). Thus, motivation to acquire additional knowledge emphasizes intellectual responses.

Also a positive, weak significant relationship exists between emotional intelligence and learners' achievement in environmental concept in Biology. Students whose emotional intelligence are very high perform very well in the classroom. The result of this research work is supported by the study of (Singh *et al* 2009 and Ogundokun, 2010); but opposed to the findings of Johnson and Spector (2008) who found out that emotional intelligence did not correlate learning results.

Furthermore, a positive, non-significant relationship exists between cognitive styles and learners' achievement in environmental concept in Biology. This result is in line with Altun and Cakan (2006) who found out that cognitive style did not predict learners' achievement and attitude towards Computer Science. This contradicts Tella (2008) who observed that cognitive style predicts students' learning outcomes.

The above results imply that students' emotional intelligence, student motivation and cognitive style are in one way or the other related to students' achievement in environmental concept in Biology. An indication that students are able to think, respond to, and comprehend several ecological circumstances pose to them through emotional signals, various ways of processing information and motivation imbibed in them for problem solving.

4.2.4b Student Factors (Emotional Intelligence, Student Motivation and Cognitive Style) and Students' Attitude in Environmental Concepts in Biology.

Table 4.8 showed that a positive, low significant relationship exists between emotional intelligence, student motivation, cognitive styles and students' attitude to environmental concept in Biology. This is in support of Singh,*et al* (2009).

Also a positive, low significant relationship exists between student motivation and students' attitude to environmental concept in Biology. This is in line with Steward, *et al* (2010), who said that motivation is a propelling force that inspires a person to participate in a job.

In addition, a positive, low significant relationship exists between student's cognitive style and students' attitude to environmental concept in Biology. The way students process the information received during the process of teaching in the classroom affect their behaviour either positively or negatively. Students who received comprehensive information about environmental concept are able to change their attitude from negative to positive. This is supported by Ogundiwin, 2014; Oloyede, 2015 and Altun, 2013).

All these results indicated that emotional intelligence, student motivation and cognitive styles were related to students' attitude to environmental concept in Biology. An indication that students when well-motivated and given the opportunity to process the information given on various environmental problems are able to react positively to and proffer solutions to them.

4.2.4c. Student-related Factors (Emotional Intelligence, Student Motivation and Cognitive Style) and Students' Practices in Environmental Concepts in Biology.

The outcome of the study revealed a positive, low significant relationship between emotional intelligence, student motivation, cognitive styles and students' practices in environmental concepts in Biology. Learners who have learning goals seek to have a comprehensive knowledge of scientific content and are always motivated internally. (Imaobong and Mfonobong 2013). Students who have a high Emotional intelligence are able to give maximum attention to their studies, proffer solutions to difficult issues and develop the way they receive and process information received during teaching and learning (Kattekar 2010). This indicated that Emotional Intelligence, student motivation and cognitive styles were related to students' practices in environmental concept in Biology. Practices involved in environmental issues are tasks requiring the ability in problem solving. This can only be accomplished through the impartation of the correct environmental knowledge.

4.2.5a The Joint Contribution of Biology Curriculum Content, Teachers' PCK and Student-related Factors to Students' Achievement in Environmental Concepts in Biology.

The result revealed that the joint contribution of Biology curriculum content, PCK and student-related factors to students' achievement in environmental concepts in Biology was significant. This indicated that when Biology curriculum content, pedagogical content knowledge and student-related factors were jointly taken together, they did not predict learners' outcomes (students' achievement) in environmental concept in Biology. The R = 0.644 (multiple regression coefficient) and R^2 = 0.317(multiple regression adjusted)implies that 31.7% of the disparity in learners' achievement in environmental concepts in Biology were caused by the combination of the Biology curriculum content, pedagogical content knowledge and student-related factors while the outstanding 68.3% may be due to other factors and residuals not in this model. The scantiness of research work on content knowledge and pedagogy in various fields as a persistent issue in teacher education and subject matter teaching in a different classroom has a problem that needs to be addressedhas obtained explicit focus in the United States and other countries of the world. Numerous administrations started school

change programs in the United States which centred considerably around the training educators in order to become expert. (NPEAT, 2003). Content area teaching specialists likewise look for the best methods of preparing educators of young people to meet the loads peculiar to their discipline (Shanahan and Shanahan, 2008). Therefore a good knowledge of (what) curriculum content and (how) PCK by a professional teacher are germane to bring about great strides in the achievement in environmental concepts.

4.2.5b The Joint Contribution of Biology Curriculum Content, Teachers' PCK and Student-related Factors to Students' Attitude in Environmental Concept in Biology.

The finding of the study shows that the joint contribution of Biology curriculum content, pedagogical content knowledge and Student-related factors to students' attitude to environmental concept in Biology was not significant. This indicates that when biology curriculum content, pedagogical content knowledge and student-related factors were taken together, they did not jointly predict students' attitude to environmental concept in Biology. The improvement of teachers' subject matter is essential for successful activities that take place in the course of teaching and students' education that has been an issue of concern in science education. (Brown, *et al*, 2013; Kind, 2009). According to Kezani and Onwu (2013), the findings of some past research works revealed that there was significant correlation between what teachers know and their methods of teaching. Currently, the number of science students at the Secondary School level is very low and this has been attributed to the way science teachers teach the subject matter which has led to the student exhibiting negative attitude and performing very low. (Barmby, Kind and Jones, 2008; Kazeni and Onwu, 2013). This can be attributed to teachers' incompetence which will definitely lead to students' failure in the sciences.

4.2.5c The Joint Contribution of Biology Curriculum Content, Teachers' PCK and Student Factors to Students' Practices in Environmental Concepts in Biology

The result revealed that the joint contribution of Biology curriculum content, and Student Factors pedagogical content knowledge to students' practices in environmental concept in Biology was not significant. This shows that when Biology curriculum content and pedagogical content knowledge were taken together, they did not jointly predict students' practices in environmental concepts in Biology.

According to Juttner et al. (2013) who theorized PCK as knowledge of stating concepts (dimensions of declarative), established methods and provisional knowledge (procedural and

conditional knowledge). Procedural knowledge designates understanding by what method, which consist of knowledge of how biological methods function and or the techniques for executing something. An indication that curriculum content and teachers' content knowledge of the curriculum and how to give instructions related to practices is germane for students' practices in environmental concept in Biology.

4.2.6a **The Relative Contribution of Biology Curriculum Content, Teachers' PCK and Student-related Factors to Students' Achievement in Environmental Concepts in Biology.**

The result showed that the relative contribution of Biology curriculum content to students' learning outcomes (achievement) in environmental concepts in Biology was significant. This result is in line with Metzler and Woessmann (2010) who ascertain that educators' content knowledge significantly impacts both qualitatively and qualitatively on students' achievement. The study of Fakeye (2012) also found out that educators' deeper knowledge of the subject matter performs a significant role in students' learning outcomes. Therefore the knowledge of curriculum content by a teacher has been observed to be significant for student learning outcomes (achievement). The relative contribution of PCK to students' achievement in environmental concept in Biology was significant. Teachers' PCK is often regarded as an essential requirement for cognitive initiation (Baumert,*et al.,* 2010;). Recognizing that PCK is definitely efficient with respects to student learning there is therefore the need for a teacher to be well vast in both curriculum content and pedagogical content knowledge for effective learning to take place in students.

The study revealed that the relative contributions of motivation, emotional intelligence and cognitive styles to students' achievement in environmental concepts in Biology were not significant. The finding of this study indicated that emotional intelligence had no significant contribution to the achievement of student in environmental concept in Biology. A study by Tamannaifar (2010) establishes that emotional intelligence EI was not a significant predictor of academic achievement. In another study conducted by Punia and Sangwan (2011) it was found out that there was no significant correlation between emotional intelligence and academic achievement. This also further explained that achievement does not depend solely on emotional intelligence. Also cognitive style was found to have no significant contribution to the achievement of students in environmental concepts in Biology.

4.2.6b The Relative Contribution of Biology Curriculum Content, Teachers' PCK and Student-related Factors to Students' Attitude in Environmental Concepts in Biology.

The findings of the study revealed that the relative contributions of Biology curriculum content, pedagogical content knowledge, motivation and cognitive style were not significant to students' attitude to environmental concept in Biology but emotional intelligence was significant on attitude to environmental concepts in biology. A teachers knowledge of Biology curriculum content and knowledge of methodology to make use of in the process of teaching is vital to achievement and attitude of student. Since achievement is related to attitude, according to Adesoji (2008), there is therefore need for teacher's to be well trained in the mastery of content of curriculum and pedagogical content knowledge in order to achieve positive attitude in students especially as related to environmental concept. The result also revealed that motivation and cognitive style did not have significant relationship with students' attitude in environmental concept in Biology. This is supported by the findings of Ipek (2010) who found out that learners with low motivation exhibit negative attitude and this affects their cognitive style of learning.

The result revealed that the relative contribution of emotional intelligence of students' attitude to environmental concepts in Biology was significant. This is in line with Aysem and Fatma (2015).

4.2.6c. **The Relative Contribution of Biology Curriculum Content, Teachers' PCK and Student-related Factors to Students' Practices in Environmental Concepts in Biology.**

The result revealed that the relative contributions of Biology curriculum content, pedagogical content knowledge and student-related factors were not significant to students' practices in environmental concepts in Biology. Environmental practices that will bring about sustainable development can only be achieved by a vast knowledge of the content of the curriculum and pedagogical content knowledge that will develop problem solving skills in learners. Teachers are expected to go through periodic training of current methodology that could be used in teaching skill acquisition. Therefore the non-significant result obtained requires that teachers undergo trainings in order to improve on their pedagogical content knowledge.

The study revealed that the relative contribution of emotional intelligence to students' practices in environmental concept in Biology was not significant. The findings of the result revealed that emotional intelligence had no relative contribution to students' practices. The

results are in line with the results of Fallahzadeh (2011) who found that the indicators of emotional intelligence did not have significant correlation with learning results.

4.2.7a. The Predictive Effect of Biology Curriculum Content and Teachers' PCK on Students' Achievement in Environmental Concepts in Biology.

The finding showed the extent of prediction of the independent variables to students' success (achievement) in environmental concepts in Biology. Biology curriculum content was the factor that predicts students' achievement in environmental concept in Biology. The main predictor of student achievement in previous researches has been teachers' pedagogical content knowledge. (Melanie et al, 2017). The highest goal of teaching profession is to improve student learning habit. High-quality teaching has been well-defined as a determined and careful preparation of teaching that results in a comprehensible learning experience for students. For a good teaching experience to take place, a good educator should align the significance and organization of the subject matter with the method of teaching so as to meet the students' needs Gess-Newsome et al (2010). Hence both curriculum content and pedagogical content knowledge are expected to predict the achievement of students in environmental concepts in Biology.

4.2.7b. The Predictive Effect of Biology Curriculum Content and Teachers' PCK on Students' Attitude in Environmental Concepts in Biology.

The result showed that none of the independent variables of Biology curriculum content and pedagogical content knowledge predicted students' attitude to environmental concept in Biology. Kubiatko et al (2017) established in their study that apart from sound knowledge of subject matter, the methods of teaching the subject matter to the learners are significant factors in predicting good teaching. Also, there are two factors influencing learners' view of subjects they offer in the school and their learning outcomes and these are teachers' mastery of the content knowledge and efficient use of teaching strategies. These two aforementioned factors have been found to have significant impacts on the attitude of students.

4.2.7c. The Predictive Effect of Biology Curriculum Content and Teachers' PCK on Students' Practices in Environmental Concepts in Biology.

The findings of the study showed that none of the independent variables of Biology curriculum content and pedagogical content knowledge predicted students' practices in environmental concept in Biology. Research on the impact of teacher knowledge on student

learning outcomes especially that relate to practices in environmental concept is scarce. Few studies that exist focused on pedagogical content knowledge or content knowledge

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of the Study

The summary of the result is as follows:

- The result of the study revealed a positive, moderate significant correlation (relationship) between Biology curriculum content and learners' achievement in environmental concepts in Biology. The result obtained showed that there existed a negative, non-significant correlation (relationship) between Biology curriculum content and students' attitude to and practices of environmental concepts in Biology.

- According to the result, a positive, non-significant relationship exists among teachers' PCK and students' success (achievement) in environmental concept in Biology. Also, a negative, non-significant relationship exists between teachers' PCK and students' attitude and practices in environmental concepts in Biology.

- The findings of the study revealed that the relationship between emotional intelligence and students' achievement in environmental concept in Biology were positive and weak. Also, the relationship between students' motivation and students' achievement in environmental concepts in Biology were positive and low. There was a positive, non-significant correlation between cognitive styles and students' achievement in environmental concepts in Biology. There were positive, low significant relationships between emotional intelligence, students motivation, cognitive styles and students' attitude to and practices of environmental concepts in Biology.

- The result revealed that the joint contribution of Biology curriculum content, PCK and student-related factors to students' achievement in environmental concepts in Biology were significant. It also revealed that the joint contribution of Biology curriculum content, PCK and student-related factors to students' attitude to and practices of environmental concepts in Biology were not significant. .

- The findings of the study revealed that the relative contribution of Biology curriculum content to students' achievement in environmental concepts in Biology was significant but was not significant on attitude and practices. The relative contribution of

pedagogical content knowledge to students' achievement in, attitude to and practices of environmental concepts in Biology were not significant.

- The extent of prediction of the independent variables to students' achievement in environmental concept in Biology revealed that Biology curriculum content was the factor that predicts students' achievement in environmental concept in Biology. None of the independent variables of Biology curriculum content, pedagogical content knowledge and student-related factors predicted students' attitude to and practices of environmental concepts in Biology.

5.2 Conclusion

Students learning outcomes have been observed to be germane to educational sector which determines national development and sustainability. Learning outcomes of students in environmental concept from this study have been found to be predicted by the Biology curriculum content, pedagogical content knowledge of the teacher and student factors (emotional intelligence, student motivation and cognitive style)

A strong pedagogical content knowledge of a teacher enhances the achievement in any area of study.

Based on the results of this study, it was established that emotional intelligence, student motivation and cognitive style predict students' success (achievement) in, attitudes to and practices of environmental concept in Biology. The findings also enabled us to have an insight into the fact that there are other factors that could predict the achievement in, attitude and practices of environmental concept in Biology. Therefore, it is crystal clear that if students are well motivated and are allowed to process their information using their emotional intelligence, they could stand better chance of performing better and developing a positive attitude and proper behavioural practices towards environmental issues and problems presented to them in the course of their study in Biology. Also, a proper organization and presentation of the Biology curriculum content using the appropriate methodology and skills by the teacher will also enhance the achievement, attitude and practices of students in environmental concept in Biology. Hence, attaining the sustainable development goal that has to do with the environment by the year 2030 would be an easy task.

5.3 Recommendation

The following recommendations are made based on the findings of this study:

i. Educational planners should organize orientation programme, seminars, and workshops at building teachers' pedagogical content knowledge especially in Biology so as to bring out the best in the students they are imparting knowledge to. This could be done at regular interval in order to keep them abreast of the current methodology and strategies being practised worldwide.

ii. On the students factors; motivation, emotional intelligence and cognitive style are very important academic tools that can bring about expected learning outcomes. Therefore, the school managers and educators should improve on emotional intelligence, students' motivation and cognitive style to be exhibited by the students,

iii. The curriculum planner should plan the curriculum in such a way that the teacher would be able to comprehend and pass down the information easily and for practical and effective use of their students.

iv. Educational resources should be provided for teachers so that the content of the curriculum can be well dealt with.

5.4 Limitation to the Study

This research work has certain limitations. It was conducted in Ekiti State using three LGAs (Local Government Areas) in the State. There is need to carry out the research work in order geo-political zones using more state in order to generalize the result. Also the study was also limited to fifteen schools which are owned by the government and excluded private Secondary Schools in the state. In addition, the study was conducted using teachers teaching SSS II only; but those teaching other classes were not included.

5.5 Suggestions for further studies

The following suggestions for further studies are that:

1. A repetition of this research work utilizing many Secondary Schools in the geo-political areas of Nigeria is required to have a generalized conclusion.

2. Aside curriculum content identified in this study, curriculum evaluation implementation and quality can also be used for further studies.

5.6 Contribution to Knowledge

1. Motivation, emotional intelligence and cognitive style are among the variables that contributed to the achievement, positive attitude and practices of students in environmental concepts in Biology.
2. Biology curriculum content effectively predicts students' success (achievement) in environmental concepts in Biology
3. Pedagogical content knowledge of the teacher also predicts learners' success (achievement) in environmental concepts in Biology as no education can be above the quality of the teachers.
4. The study has formed empirical evidence for subsequent researches in the field of biology education hoping to determine the Secondary School students' success (achievement) in and attitude to and practices in environmental concepts in Biology.
5. Emotional intelligence of the student can be improve upon through active participation in the classroom.

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APPENDIX I

BIOLOGY STUDENTS' ENVIRONMENTAL ACHIEVEMENT TEST (BSEAT)

INTRODUCTION: This instrument seeks to find out your knowledge of environmental education concepts in Biology.

SEGMENT A: Personal Data

School Name:----------

Gender: Male ( ) Female ( )

SEGMENT B

Underneath are specific questions on environmental problems and issues. Choose the answer that you consider correct for each question. Circle boldly one answer as your choice.

1. A component of the exhaust gases from cars which cause severe air contamination is

(a) Water vapour

(b) Carbon dioxide

(c) Carbon monoxide

(d) Oxygen

(e) Ozone

2. Which of the following step would not be taken to protect or conserve fishing grounds from over exploitation?

(a) Use of nets with all sizes of mesh

(b) Use of net with a particular mesh size

(c) Ban on harvesting of some species

(d) Regulating the size of ships allowed into the fishing ground

(e) Limiting the period of fishing in the water

3. Which of the following is not part of the objective of conservation of natural resources

(a) To eliminate wild animals in order to enable other plants and animals to survive

(b) To use our resources on sustained yield basis

(c) To guard against indiscriminate killing of plants and animals

(d) To guard against the extinction and exhaustion of natural resources

(e) To protect the environment

4. The preservation of natural resources can be realisedthrough the following apart from

(a) Establishment of natural botanical gardens

(b) Creation of preservation society

(c) Creation of game reserve

(d) deregulated reaping

(e) Making laws on conservation

5. Which of the following may not contribute to environmental pollution?

(A) Smog

(b) Solar energy

(c) Waste disposal

(d) Smoke

(e) Nuclear power plant

6. The cutting down of trees without planting another is known as

(a) Loss of vegetation

(b) Deforestation

(c) Erosion

(d) Pollution.

7. Which of the following agricultural activities has the least harmful effect on the environment?

(a) Application of fertilizers

(b) Practicing crop rotation

(c) Spraying herbicides

(d) Spraying pesticides.

8. Malaria which is a common disease in Nigeria is caused by _____

(a) A clean and Healthy environment

(b) Lack of proper use of nets.

(c) A dirty environment

(d) Improper dumping of solid wastes.

9. Oil spillage at sea resulting from the transportation of crude oil causes

(a) Death of marine life

(b) Coloration of the sea water

(c) Hindrance in the movement of ships

d. river blindness

(e) All of the above

10. The throwing of dirty things into the rivers and streams is called…

(a) Loss of vegetation

(b) Water pollution

(c) Floods

(d) Erosion.

e. Land pollution

11. The following are useful measures for conserving forests except

(a) Preventing and controlling accidental forest fire

(b) Encouraging the use of charcoal for industrial and domestic purpose

(c) Combating and preventing plant disease

(d) Reforestation of depleted forest

(e) Protection of young growing trees

12. The following are the effect of overgrazing except

(a) Depletion of useful fodder crop

(b) Soil and wind erosion

(c) Epidemic of cattle disease

(d) Migration of herdsmen

(e) Scarcity of good pasture

13. The following are conservation agencies in Nigeria except

(a) Forest department

(b) Nigeria conservation society

(c) Game reserve authority

(d) Nigeria Red Cross Society

(e) Ministry of agriculture and conservation

14. Air contamination can be abridge through the following meansapart from

(a) Construction of highplant chimneys

(b) bypassing excess gases through sieves and absorbers

(c) Using led free petrol cars

(d) Recycling tin, cans and bottles

15. The major pollutant around air-port residential area is

(a) Oil spillage

(b) Soot

(c) Noise

(d) Dust

16. An efficient control of ecological resources to make sure they yield continually involves all of these apart from

(a) Defence of wild life

(b) Avoidance of habitation damage

(c) The use of natural enemies to control pest

(d) Dumping of dirt into the flowing waters

17. Wild life preservation is improved by

(a) Passing law to inspire killing

(b) Preventing eradication of scarce species

(c) Inspiring establishment of settlement shooting division

(d) Overpowering the actions of wildlife preservation organizations

18. Forest conservation includes the following except

(a) Prevention of bush fire

(b) Extensive felling of trees

(c) Replacing of harvested trees by planting seedlings

(d) Selective, exploitation of forest trees

19. Renewable resources are formed by

(a) Animals that produce sexually

(b) Organisms confined to forest reserves

(c) Organisms that are constantly regenerating themselves

(d) Plants and animals that can reproduce sexually

20. Which of the following is not a pollution control measure?

(a) Penalizing those who dump refuse on water or land

(b) Controlling the emission of smoke from automobiles and industries

(c) Ensuring that their no spillage of oil

(d) Establishing government agencies like federal environmental protection agencies (FEPA)
(e) encouraging bush burning.

21. Which of the following does not add to the biomass in an ecosystem?

a. Green plant

b. Food chain

c. Consumers

d. Tiny animals

e. Saprophytes

22. An association between living organisms in which one lives on and feeds at the expense of other organism is called

a. Parasitism

b. Commensalism

c. Mutualism

d. Symbiosis

e. Predation

23. The effective control of natural resources by man is called

a. Preservation

b. Utilization

c. Economics

d. Growth

e. Conservation

24. The methods of controlling air contamination are these except?

a. Siting industries far away from where people are residing

b. Constructing tall plant pipes

c. Bypassing excess gas into tanks

d. using of petrol which does not contain lead

e. reprocessing containers, plastic and flasks

25. Which of the following may not contribute to environmental pollution?

a. solar energy radiation

b. industrial waste

c. waste disposal

d. smoke

e. nuclear power plant

26. Which of the following is not a structural adaptation of desert plants for water conservation?

a. tiny leaves

b. sunken stomata in leaves

c. stems and leaves with heavy cuticles

d. broad leaves with numerous stomata

e. scale leaves

27. All these are not air pollutant except?

a. oxygen

b. water vapour

c. carbon monoxide

d. nitrogen

e. hydrogen

28. Which of the following water pollutants may contain organisms that cause dysentery?

a. Pesticides

b. Sewage

c. Industrial wastes

d. Fertilizers

e. Crude oil

29. Acclimatisation of floras or animals to desert environment is not?

a. Well-developed tap root system

b. Small leaves with thick epidermis

c. Stems with spike-like leaves

d. Metabolic waste in the form of uric acid in some animals

e. Broad leaves for storage

30. Conservable natural resources is not?

a. Water

b. Sunlight

c. Forest

d. Soil

e. Minerals

31. The following practices are aim at soil conservation except?

a. Contour ridging

b. Application of manures

c. Strip cropping

d. Bush clearing

e. Crop rotation

32. Non-renewable resources is ----------?

a. Livestock

b. Minerals

c. Forest

d. Soil

e. Air

33. Which of the following is not a way of conserving natural resources?

a. Adopting good farm practices

b. Establishing forest reserves

c. Establishing of game reserve

d. Encouraging poaching

e. Protecting the endangered species

34. Improper sewage disposal could be dangerous for the following reasons except?

a. The smell of carelessly disposed sewage is most undesirable

b. The spread of gastro-intestinal diseases are enhanced

c. Resultant out-break of water-borne diseases

d. There would be little space for disposal of wastes

e. It can lead to death

35. The major pollutant around airport residential areas is

a. Oil spillage

b. Soot

c. Noise

d. Dust

e. Smoke

36. The effect of chlorofluorocarbon is

a. Reduction of oxygen concentration in the atmosphere

b. Depletion of the ozone layer

c. Screening of ultra violet rays

d. Increase in carbon dioxide concentration

e. Greenhouse effect

37. Soil erosion could be prevented by

a. Flooding a farmland

b. Cover cropping

c. Deforestation

d. Leaving the soil bare

e. Bush burning

38. The air pollutant which combines with the hemoglobin in blood and prevents oxygen from combining is termed

a. Oxides of oxygen

b. Soot

c. Smoke

d. Carbon monoxide

e. Hydrogen

39. Water conservation techniques can be used to control pollution through the following except

a. Adequate control and use of ground water.

b.Encouraging Research centers on adequate form of recycling water and sewages

c. Water should not be allowed to spill all over the towns e.g. burst water pipe.

d. Oil spillage on water bodies to control mosquitoes

e. water treatment

40. Ways of assessing the effect of air pollution on the environment are as follows expect

a. Measuring the irritation that air pollutant can cause on eye and nose

b. Judging the lead poisoning effect on children's intelligence quotient (IQ)

c. Indicating the rate of which Nitrogen oxides irritate the lungs

d. The use of lead free fuels.

APPENDIX 1B

ANSWERS TO THE BIOLOGY STUDENTS ENVIRONMENTAL ACHIEVEMENT TEST

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

APPENDIX II

BIOLOGY STUDENTS' ENVIRONMENTAL ATTITUDE SCALE (BSEAS)

INTRODUCTION: This instrument seeks to find out your attitude to environmental problems as expressed in the environmental education concepts in Biology.

SEGMENT A: Individual Information(personal data)

School Name:_____

Sex: Male ( ) Female ( )

Local Government area: _____

SEGMENT B

The following statements are developed to measure student's attitude to environmental issues and problems. Please tick (✓) the appropriate options that best reflect your agreement or disagreement.

S/N	STATEMENT	SA	S	DA	SD
1	I think it will be difficult to make our illiterate populace understand air pollution.				
2	I think air pollution is only a problem that affects female gender but not everybody.				
3	I feel field investigation of causes of air pollution could help in research work to eradicate air pollution.				
4	I prefer group efforts to be used in combating the causes of air pollution.				
5	I feel the objective report made on previous air pollution effect will serve as unforgettable experience.				
6	It is preferable to visit the source of water before purification method will be applied.				
7	It is interesting and enjoyable to see groups working together to prevent water pollution.				

8	I feel waste water does not constitute nuisance.				
9	I feel soak away constructed near source of water cannot pollute water				
10	It is desirable to kill fish with chemicals				
11	I like to work with people who make discoveries on treatment of solid waste				
12	It is interesting to see boys and girls keeping their environment clean				
13	I prefer having first hand field experience than finding out from experts the causes and effects of land pollution.				
14	I feel that I gain nothing in learning environmental pollution on land since my environment is clean.				
15	I like learning land pollution because of its effect on environment.				
16	I dislike learning conservation techniques because it cannot supply all the answers to our question about useful living.				
17	I feel there could be misconception of conservation ideas hence it may not be necessary.				
18	I will like boys and girls to learn conservation of resources in Biology.				
19	It is enjoyable see groups and corporate bodies participating in conservation of resources.				
20	I hate field work exercise used for conversation of our natural resources.				
21	I always find a way of reducing environmental pollution				
22	I feel burning of refuse is a harmless way of disposing of our garbage				
23	I boil water before drinking is hygienic				

APPENDIX III

STUDENTS ENVIRONMENTAL PRACTICES SCALE (SEPS)

INTRODUCTION: This Scale intends to investigate your practice towards environmental pollution and conservation techniques.

SECTION A

1. School Name: ……

-

2. Sex: Male ( ) Female ( )

SECTION B

These are certain assertion about practices of students towards environmental pollution and conservation techniques. Please mark (X) in the box provided that matches the extent of our practices with each statement. The letters stands for the following:-

VO - Very Often

O - Often

S - Seldom

N - Never

S/N	How often do you do the following?	VO	O	S	N
1.	Sleep in a room immediately after spraying insecticides.				
2.	See people smoking along the streets without being cautioned.				
3.	Control Bush burning not to produce smoke that will disturb people.				
4.	Purify the air around by using air purifier like Air Fresheners				
5.	Stay away from unpleasant odour in the environment.				
6.	Treat your well/borehole				

7.	Drink water when it is treated.				
8.	Educate fishermen on the danger of continuous fishing on water bodies without permission from the necessary authority.				
9.	Read newspaper articles alerting people on the threats posed on our health by using polluted water				
10.	Allow people to get away with tapping petroleum products illegally without reporting to the necessary authority concerned.				
11.	Provide dust bin for refuse disposal.				
12.	Sweep a dusty sandy place after wetting the soil.				
13.	Stay very close to heavy heaps of refuse in the environment.				
14.	Pick waste on the floor when I have the time.				
15.	Observing environmental sanitation exercise.				
16.	Dig of holes during extraction without covering the holes after the extraction.				
17.	Leave people dumping wastes into the drainage systems during rainfall without correcting their actions.				
18.	Educate people on conservation techniques.				
19.	Educate hunters on the danger of poaching.				
20.	Empty soak away/ septic tank on rivers and streams as a Conservation techniques				

APPENDIX IV

TEACHER'S PCK RATING SCALE

Segment A:

Demographic Facts

Name of School: _____

Lesson examined: _____

Subject matter: _____

Time and Period: _____

Gender: male ( ), female ( )

Teaching experience: 1-5( ) 6-10( ), 11-15( ), 16-20 ( ), 20 and above ( )

Teaching qualification: NCE ( ), B.SC ( ), B.ED&B.SC(ED) ( ), M.ED ( )

Section B: The Rating Scale

Key: 1=Poor 2=Fair 3= Good 4=Very Good 5= Excellent

S/N	Items	A	B	C	D	E
1	Teachers use suitable set of introduction at the commencement of the class.					
2	Teachers manage time efficiently during teaching					
3	Teachers make use of appropriate learning and teaching materials					
4	Teachers efficiently use ability to speak in the lesson.					
5	Teachers correct learner's mistakes in accord with their responses.					
6	Teachers shows sufficient understanding of the right method of					

	teaching					
7	Teachers present lesson logically					
8	Teachers put his or her emotions under control during teaching.					
9	Teachers use questioning methods when teaching.					
10	Teachers teach topics using models and charts.					
11	Teachers' note of lesson contains significant topics to be taught.					
12	Teachers make use of incentive, punishment and motivation appropriately.					
13	Teachers make use of appropriate evaluation to sustain learning.					
14	Teachers make use of suitable methods of teaching.					
15	Teachers give sufficient assignment to the students.					
16	Teachers illustrate the topics with the daily experience of the students.					
17	Teachers use simple English in teaching the students.					
18	Teachers make provision for peculiar variances among learners.					
19	Teacher's move from abstract to concrete and from easy to difficult topics.					
20	Teachers appraise prior topic before proceeding to the new concepts.					
21	Teachers occupies learners enthusiastically					
22	Teachers links what has been taught					

	before (prior knowledge) to what he or she is about to teach (present learning).					
23	Teachers demonstrate familiarity and use of innumerable evaluation methods.					
24	Teachers use different teaching aids strategies in teaching.					
25	Teachers uses prizes and chastisement properly					

APPENDIX V

STUDENTS MOTIVATION QUESTIONNAIRE.

INTRODUCTION: This questionnaire intends to investigate your motivation toward biology.

SECTION A

SEX:_____

SCHOOL:_____

CLASS:_____

SECTION B

Information on motivation of the students

Please indicate your response to each of the statement in the form of

S.A = Strongly Agree

A = Agree

D = Disagree

S.D = Strongly Disagree

S/N	DESCRIPTION	SA	A	SD	D
1	I partake more when class work includes intriguing undertakings				
2	In a unit of study like this I lean toward course material that truly challenges me so I can adapt new things				
3	I need to do well in biology since it is essential to demonstrate my capacity to my family, companions, boss, or others.				
4	I will partake in biology class on the grounds that the educator utilizes an different of instructing techniques				
5	The major reason while I attend biology class is to enable me obtain practical skill				
6	I'm self-confident I have the ability to learn the basic facts taught in this study				

7	I partake willingly in the lesson because the contents is exciting and changeable				
8	Whenever I am opportune I pick assignment that will boost my knowledge even if it will not earn me good marks.				
9	The most important goal I want to achieve in environmental studies is to make me ready for my chosen career				
10	I am eager to take part in the practical aspect of environmental concepts since it is interesting				
11	I enjoy environmental concepts in the biology curriculum				
12	I'm convinced I can become proficient in the know-how being taught in environmental concept				
13	I expect to do well in environmental topics.				
14	I have the impression that every environmental concept is greatly stimulating once I get involved in it				
15	I think I will be able to apply what I learn in this unit of study in my community.				
16	Having a high score in environmental concepts is what satisfies me the most.				
17	Bearing in mind the complexity of the topics, I believe I will perform excellently well in my study with the help of my teacher, and my skills.				
18	I work hard at my studies because I find the contents interesting				
19	What satisfies me most in environmental concepts is having adequate knowledge of the topics comprehensively.				
20	I have confidence in having a high score in environmental topics as this will boost my result.				
21	Learning science is pertinent to my life				
22	I like to have a higher grade than my classmate whenever test is been conducted in biology.				
23	Learning science is interesting				
24	I put an adequate amount of effort into studying science				
25	I apply different method in studying science (environmental concepts in biology).				

26	Studying science will assist me in getting a desired job.				
27	It is essential that I have distinction in my science subject most especially biology				
28	I have assurance that I will pass excellently in biology tests.				
29	Having a comprehensive knowledge of biology gives me career advantage.				
30	I devote quality time to studying biology				
31	Studying biology add meaning to my life.				
32	Comprehending biology will benefits my career				
33	I have self-assurance that I will perform excellently in practical and projects.				
34	I have confidence in mastering biology knowledge and competence				
35	I get ready well for biology tests and practical				
36	I am inquisitive about innovations in biology				
37	I enjoy learning science				
38	I reflect on the score I will get in biology				
39	My career will involve science				
40	I will use science problem-solving skills in my career				

APPENDIX VI

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

EMOTIONAL INTELLIGENCE SCALE (EIS)

INTRODUCTION: This Scale intends to investigate your academic emotional intelligence.

SECTION A

SEX:_____

SCHOOL:_____

CLASS:_____

SECTION B

Information on emotional intelligence of the students

Please indicate your response to each of the statement in the form of

S.A = Strongly Agree

A = Agree

D = Disagree

S.D = Strongly Disagree

S/N	ITEM	SA	A	D	SD
1	Most often I feel that I am bad.				
2	It is easy for me to solve problems whenever I am in a positive mood.				
3	I am able to come up with new ideas in environmental concepts when I am in positive mood.				
4	I have control over my emotion				
5	I motivate myself by imagining a good outcome to the question I take				

	on in Environmental concepts				
6	I give up whenever I am faced with a question in biology, because I believe I will fail				
7	Generally, I am satisfied with myself				
8	I know that I possessed numerous good qualities which will help me to do well in biology				
9	I have the ability to solve problem as well as most of my classmate.				
10	I feel I do not have much to be proud of				
11	I indeed think that I am incompetent most of the time in solving environmental problems.				
12	I feel that I am a person of worth, at least the equal of others.				
13	I hold a right attitude to myself				
14	I wish I could have more respect for myself				
15	I know when to speak about my personal problems to others.				

APPENDIX VII

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

COGNITIVE STYLE QUESTIONNAIRE

INTRODUCTION: This Scale intends to investigate your cognitive learning style.

SECTION A

SEX:_____

SCHOOL:_____

CLASS:_____

Instructions: Instructions to learners:

Check one box in each item that best describes you. Boxes A and E would indicate that the statement is very much like you. Boxes B and D would indicate that the sentence is more or less like you. Box C would indicate that you have no particular inclination one way or the other.

S/N	ITEMS	A	B	C	D	E
1	I possess the ability to read when students are making noise and shouting in the classroom.					
2	I like to personally analyse the topics taught so that I can understand it better.					
3	I sense it is necessity to comprehend every-thing I read and listen to in every subject in class					
4	I felt personal study brings about adequate understanding of the topic					
5	I like personal studying than studying in group.					
6	Getting response from my classmate certainly doesn't disturb my studying at all.					
7	I seek clarifications to the difficulties I encountered during studying by pondering and using my abilities and proficiencies.					

8	I love studying my books even when my peers are usually playing on the sport ground.					
9	I hate when other event disturbed my reading timetable.					
10	I pay adequate attention to my book when am reading in a noiseless surroundings.					
11	I discover it is wearisome and uninteresting to explore the topic content and important matters					
12	I don't mind reading or listening to subject teaching without understanding every single word as long as I 'catch' the main idea.					
13	I felt efficient studying of the topic is enhanced by group discussion.					
14	In fact I love working with my friends and others					
15	I discover that responses are beneficial as it enable me to comprehend areas where I have problems.					
16	Knowing how people cope with related problem and proffer solution to it is of interest to me.					
17	I assimilate very well when my mates are also reading and concentrating on their book.					
18	I like it when I’m exposed to various activities in between my learning timetable to break the monotony of continuous studying					

APPENDIX VIII

UNIVERSITY OF IBADAN

DEPARTMENT OF TEACHER EDUCATION

BIOLOGY CURRICULUM CONTENT RATING SCALE (BCCRS)

Introduction:

The purpose of this instrument is to collect information on your assessment of the adequacy, suitability and relevance of Biology curriculum environmental content, objectives, learning activities and evaluation. The instrument is divided into two sections. Section A is on teachers' biodata and section B which contains 20 items. Any information you supply, shall be used strictly for research purpose.

SECTION A (TEACHER'S BIODATA)

1. Name of Town:…….

2. Name of school:……

3. Teacher's Qualification:NCE☐,ND,HNDB.EDM.M☐.HD ☐ ☐ ☐

5. Teaching Experience: (a) 0 – 5years (b) 6 – 10 years(c) 10 years and above

SECTION B:

Introduction: PLEASE TICK (✔) WHICHEVER IS APPLICABLE

Instruction: Please tick ( ) as appropriate of Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD)

S/N	ITEMS	SA	A	D	SD
1	The objectives of the Environmental Concept in Biology Curriculum are adequate				
2	The learning activities provided in the curriculum are not adequate.				
3	The Environmental content of the Topics in Biology Curriculum is easy to understand.				
4	The Environmental contents of the Concept in Biology curriculum are too shallow.				

5	Majority of the learning materials listed in the curriculum are not easily accessible				
6	Some Environmental contents of the curriculum are outdated.				
7	Some of the Environmental content in the curriculum is too loaded for senior secondary school level				
8	Some aspect of the curriculum are better treated in the tertiary institutions				
9	The objectives in the curriculum are well stated.				
10	Concept in Biology curriculum is more meaningful and significant to students and can improve their environmental practices, achievement in and attitude to Biology.				
11	The various concepts and principles of the Environmental Concept in Biology curriculum are well understood.				
12	Teachers find it problematic to teach the subject matter of the Concepts in Biology curriculum.				
13	The Environmental contents in Biology curriculum are well conceptualized and relevant to the students' socio-cultural needs.				
14	Students find it difficult to understand the Environmental content ofConcepts in Biology curriculum.				
15	Students are always ready to learn the subject content of the Biology curriculum.				
16	Government policy changes often affect Biology Curriculum				
17	Concept in Biology curriculum is more meaningful and significant to students and can improve their environmental achievement				
18	Concept in Biology curriculum is more meaningful and significant to students and can improve their environmental attitude to Biology.				
19	The outdoor activities in the environmental concept in the curriculum are not adequate				
20	The indoor activities in the curriculum are not practicable				