



**Psychological Factors as Predictors of Senior Secondary Students' Attitude toward Environmental Concepts in Biology in Lagos, Nigeria**

<sup>1</sup> Oladipo, Adenike J., <sup>2</sup> Ogundiwin, Oluyemi Akinleye, and <sup>3</sup>Ngwu, Nora Uche

<sup>1</sup> Biology Unit, Science Education, Distance Learning Institute, University of Lagos Akoka, Lagos. [adeoladipo@unilag.edu.ng](mailto:adeoladipo@unilag.edu.ng)

<sup>2</sup> Department of Science Education, Faculty of Education, National Open University of Nigeria, 14/16 Ahmadu Bello Way, Victoria Island, Lagos.

[oogundiwin@noun.edu.ng](mailto:oogundiwin@noun.edu.ng)

<sup>3</sup> Department of Science Education, Faculty of Education, National Open University of Nigeria. [uchenora@gmail.com](mailto:uchenora@gmail.com)

Submitted October 28th 2019; Revised March, 29, 2020; Accepted June 10, 2020

---

**Abstract**

*Studies have shown that psychological factors such as cognitive style, self-esteem and self-efficacy are influential in determining students' attitude towards certain school subjects but the extent to which these combine to influence students' attitude to biology has not enjoyed much research focus, especially in Nigeria. This study examined students' psychological factors (cognitive style, self-esteem and self-efficacy) as predictors of students' attitude towards environmental concepts in biology in Lagos, Nigeria. The research design adopted was the descriptive survey of correlation type. Fifteen (15) SS2 classes of forty (40) students each drawn from 15 randomly selected schools in the 5 local government areas of Educational Districts II and VI were used; this gave a total of 600 students. Three research questions were raised and answered. Four instruments, including; Students' Biology Attitude Questionnaire, ( $r=0.78$ ), Students' Self-Efficacy Scale ( $r=0.781$ ), Students' Self-Esteem Scale ( $r=0.82$ ) and Cognitive Style Test ( $r=0.89$ ) were used. Data collected were analysed using Pearson Product Moment Correlation to Multiple Regression Analysis. The findings of the study revealed that there was a significant joint effect of self-efficacy, self-esteem and students' cognitive style on students' attitude towards environmental concepts in biology; ( $F(3, 596) = 25.285$ ;  $R = .693$ ,  $R^2 = .480$ ,  $adj. R^2 0.461$ ;  $p < .05$ ). The relative contribution of self-efficacy ( $\beta = .262$ ) and self-esteem ( $\beta = .580$ ) were significant. Based on these findings, self-efficacy and self-esteem must be taken into consideration for improved students' attitude towards environmental concept in biology.*

**Keywords:** Self-efficacy, Self-esteem, Students' Cognitive Style, Students' Attitude, Environmental Concepts, Biology.

## Introduction

Biology is the natural science that is concerned with life and living organisms, their characteristics, forms, functions and relationship with each other and with the environment. Biology is an aggregate of many specialised disciplines which engages students in varied process skills such as observation, clarifying, and interpreting, predicting, designing experiments, organizing information and reporting.

In Nigeria, the curriculum of the Federal Ministry of Education (FME, 2013; pp ii.) states the following objectives for teaching and learning biology:

1. adequate laboratory and field skills in biology;
2. meaningful and relevant knowledge of biology ;
3. ability to apply scientific knowledge to everyday life in matters of personal and community health, and agriculture ;
4. reasonable and functional scientific attitude.

The curriculum is intended to provide a modern biology course as well as meet the needs of the learner and the society through relevant and functional contents, methods, processes and applications. As one of the prerequisite subjects for many courses like medicine, forestry, agriculture, biotechnology and nursing, biology contributes immensely to the technological growth of any nation. Knowledge of ecology is necessary for students' understanding of interactions between living organisms and their physical world. . It is therefore expected that every citizen should be taught biology (Achor, Wade, & Duguryil, 2013). Basic concepts relating to the environment and ecology are referred to as environmental concepts in biology.

Science educators have agreed that the development of a positive attitude towards science should be an important goal of the school curriculum. Although, there is a wide range of definitions of attitude, it is generally agreed that an attitude is the tendency to think, feel, or act positively or negatively toward objects in our environment. Social psychologists have long viewed attitudes as having three components: the cognitive, the affective, and the behavioural. *Cognitive* component is a set of beliefs about the attributes of an object; it is assessed by using paper-and-pencil tests (questionnaires). *Affective* component refers to feelings about an object. It is assessed using psychological indices like heart rate. Finally, the *behavioural* component, which pertains to the way people act toward an object, is assessed with directly observed behaviours.

Attitude of students toward science have been extensively studied. It is defined as students' predispositions to react in their interpersonal relationships, particularly in interacting with teachers and the students. Attitudes tend to influence behaviour and are an important aspect of education (Nelson, 2011). Consequently, attitudes are acquired through learning and can be changed through persuasion using varieties of techniques. Although attitude changes gradually, people constantly form new attitudes and modify old ones when they are exposed to new information and new experiences (Adeoye,

2011). Attitude towards science is closely related to performance in science (Jegade, 2007, Oladipo & Adeniyi, 2015) as a positive attitude may lead to a higher performance in science. The attitude of teachers, to a large extent, affects the knowledge and attitude of students in science. Adesoji (2008) asserted that a number of factors have been identified as related to students' attitude to science. Such factors include teaching methods, teachers' attitude, and influence of parents

Attitude, like achievement, is an important outcome of teaching science. One of the goals of teaching science, particularly biology, is to help students develop reasonable and functional attitude toward biology and biosocial problems. Researches over the years have established the fact that in spite of efforts geared towards improving the teaching-learning process in biology, students' attitude to the subject still remains negative (Okafor, 2006). Poor performance had been attributed to the indifferent attitude of some students to biology. Okafor, (2006) also noted that when high levels of learning occur, learners feel good about themselves and the materials they are learning especially when teachers use instructional time efficiently. The way teachers interact with students influences their attitude toward school and their academic performance (Maldonado, 2005).

Several research findings have also reported that students in secondary schools have a negative attitude towards science, especially biology (Ogundiwin 2013, Oladipo and Adeniyi, 2015). The deterioration in knowledge and poor attitude have been attributed to inappropriate teaching strategies hence the call for urgent attention to investigate learning methods that can enhance student's positive attitude towards biology.

Cognitive style is a psychological disposition which shows how an individual is inclined to think, learn and process information. According to Ige (2001), student's cognitive styles have been found to mediate learning. Most of the differences encountered in students' learning could be described in terms of different manners in which students perceive and analyse a stimulus configuration (i.e. their cognitive styles). Each individual responds differently when exposed to stimulus. Some act on first impulse, some examine isolated components of what is presented to them before responding while others respond on the basis of contextual or holistic manner (Awolola, 2010). This calls for a better understanding by the teacher in making a choice and usage of teaching strategies. Ogundiwin (2013) concluded that matching a student's cognitive style with the instruction can improve academic achievement and student attitudes toward learning. Various cognitive styles or activities that focus on how students learn best need to be addressed in the classroom Oloyede (2014).

Most science students' thoughts and feelings about themselves are not predictable; they change daily based on their daily experience about themselves. Furthermore, the grade they get in examination and classroom situations can also have a temporary impact on how learners feel about themselves; hence, students' self-esteem comes into play. Student self-esteem, however, is something more fundamental than the normal ups and downs associated with situational changes. According to *Kristen & Harper*, (2011), for students with high self-esteem, normal ups and downs may lead to temporary fluctuations

in how they feel about themselves, but only to a limited extent. In contrast, for students with low self-esteem, these ups and downs drastically impact the way they see themselves. Oladipo and Adeniyi (2015) while studying which psychosocial factors predicted the academic performance of open distance learners (ODL) concluded that self-regulation and high perceived stress predicted ODL academic performance.

Germer, (2009) opined that students with low self-esteem often rely on how they are doing in the present to determine how they feel about themselves. They need positive external experiences (e.g., compliments from friends) to counter the negative feelings and thoughts that constantly plague them. Even then, the good feeling (such as from a good grade or compliment) is usually temporary. High self-esteem is based on the ability to assess oneself accurately and still accept who one is. This means being able to acknowledge one's strengths and weaknesses and at the same time recognize that one is worthy.

Self-efficacy refers to a person's personal belief in his or her capability to achieve a set goal. Wagner (2005) defines self-efficacy as the belief in one's ability to succeed in particular situations. According to Wikipedia (2008), self-efficacy is the belief that one is capable of performing in a certain manner to attain certain goals. Adeoye (2011) defines self-efficacy as one's self judgment of personal capabilities to initiate and successfully perform specific tasks at designed levels, expend greater effort, and persevere in the face of adversity.

Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives (Adeoye, 2011). He further explained that self-efficacy beliefs determine how people feel, think, motivate themselves and behave. The beliefs produce diverse effects through cognitive, motivation, affective and selection processes. A strong sense of self-efficacy enhances accomplishments and personal wellbeing in many ways.

This study hinges on attribution theory which was first proposed by Heider (1958) and further developed by Weiner (1986). It is concerned with how individuals interpret events in relation to their thinking and behaviour. Attribution theorists claim to determine why people do what they do; they attribute causes to human behaviour. A person seeking to understand why another person did something may attribute one or more causes to that behaviour. Attribution theorists state that a three-stage process underlies an attribution: (i) the person must perceive or observe the behaviour, (ii) the person must believe that the behaviour was intentional, and (iii) the person must determine if they believe the other person was forced to perform the behaviour (in which case the cause is attributed to the situation) or not (in which case the cause is attributed to the other person).

Weiner (1974) focused his attribution theory on attitude. He identified ability, effort, task difficulty, and luck as the most important factors affecting attributions for achievement. Attributions are classified along three causal dimensions: locus of control, stability, and controllability. The locus of control dimension has two poles: internal versus external locus of control. The stability dimension captures whether causes change over time or not. For

instance, ability can be classified as a stable, internal cause, and effort as unstable and internal. Controllability contrasts causes one can control, such as skill/efficacy, with causes one cannot control, such as aptitude, mood, others' actions, and luck.

Attribution theory has been widely applied in education, law, clinical psychology, and the mental health domains. Weiner (1980) opined that causal attributions determine affective reactions to success and failure. The theorists stress the relationship between *effort* and academic *achievement*. Attribution theorists state that individuals are considered as active beings that seek to understand and master themselves and their environment (Elliott, Neil. Hufton, Wayne & Leonid, 2005). Based on this assumption, it is argued that the outcome of individuals' behaviour can be determined by both external and internal attributions. Li (2012) described external attributions as those factors that individuals are unable to control (e.g. difficulty of the task) while internal attributions refer to those factors that individuals are able to control (e.g. the amount of time students spend on homework). Elliot et al. (2005) posited that both internal and external attributions play a role in affecting individuals' subsequent behaviour, like task engagement and persistence. However, some researchers argued that internal attributions played a more influential role than external attributions.

Attribution theory provides a strong foundation for this study as the study attempts to investigate the extent to which internal attributions (cognitive style and self-efficacy) and external attribution (self-esteem) would predict students' attitude to biology. Students who have high self-efficacy and positive attitude tend to attribute success in biology to internal factors while those with high self-esteem tend to attribute success in biology to the external factor of self-efficacy.

### **Statement of the Problem**

Biology is one of the science subjects offered in senior secondary schools because of its numerous values. In spite of the importance of the subject, results from schools and public examination bodies reveal that students' attitude to the subject is not encouraging due to the fact that students are unable to tackle some of the prevailing biological problems. They find it difficult to explore the problem solving situation and reflect on their experiences; this is in addition to their poor knowledge of ecological concepts. Gallagher (2000) as cited by Oladipo (2009) affirmed that only a small percentage of students who studied science, particularly biology, in secondary schools come out with any degree of understanding or 'love' of science. It becomes more worrisome because majority of senior secondary school students offer biology as their only science subject and may not encounter science again in life. Poor handling of ecological concepts by teachers who do not consider students' psychological factors, such as cognitive style, self-esteem and self-efficacy, has also aggravated the problem of mastery of biological concepts. Studies have shown that the psychological factors influence students' attitude toward school subjects but the extent to which they could combine to influence students'

attitude to biology has not enjoyed much research focus in Nigeria. This study seeks to examine students' psychological factors as predictors of students' attitude towards environmental concepts in biology.

### **Research Questions**

Based on the stated problem, the following questions were raised to guide the study:

1. What is the relationship between students' psychological factors (self-efficacy, self-esteem and cognitive style) and students' attitude toward environmental concepts in biology in Lagos, Nigeria?
2. What is the composite contribution of students' psychological factors on students' attitude toward environmental concepts in biology in Lagos, Nigeria?
3. What are the relative contributions of students' psychological factors on students' attitude towards environmental concepts in biology in Lagos, Nigeria?

### **Methodology**

The research design adopted for this study was the descriptive survey of correlation type.

The population for the study comprised senior secondary class II students in Lagos State, Nigeria. Multi-stage sampling technique was employed because there were more than one secondary sampling unit (Educational district level, local government level, and school level). From the six education districts (EDs) in Lagos State, Education Districts II and VI were purposively selected based on the criterion that they were far enough from each other to avoid the problem of contamination. The two EDs were stratified into five (5) local government areas: Kosofe, Somolu, Oshodi-Isolo, Ikeja and Mushin. At the first stage of sampling, simple random sampling technique was used to select twenty five (25) schools = five (5) senior secondary schools from each local government area. This was later reduced to three (3) randomly selected schools to give a total of fifteen (15) schools for the research. From each of the selected schools, one (1) intact class of forty (40) SS2 students was selected to make a total of fifteen (15) intact classes. In all, a total of six hundred (600) SS2 students were involved in the study.

Four instruments designed by the researchers were used for data collection. They are Students Biology Attitude Questionnaire. (SBAQ), Students Self-Efficacy Scale (SSES), Students' Self-Esteem Scale (SSES), and Cognitive Style Test (CST).

Students' Biology Attitude Questionnaire (SABQ) was designed by the researcher to measure students' attitude to biology. The questionnaire consists of two sections. Section A contains the personal data of the respondent, gender, school type, name of school, while Section B assesses students' attitude towards biology. SBAQ consists of 25 items on a five Likert-type response. The items were rated on 5-Likert type ordinal scale ranging from Strongly Agree (SA), Agree (A), Neutral (N), Disagree (DA), and Strongly Disagree (SD). It comprised of 5 items on interest toward biology, 10 items on future career in biology, 3 items on the biology teacher, 4 items on difficulty and 3 items on equipment.

The face and content validity of SBAQ were done by showing the 25 items to three (3) science educators to determine their suitability in terms of clarity of ideas, language of presentation, class level, coverage, relevance, and application to the study. Cronbach Alpha was used to obtain the reliability index of the instrument at 0.78.

A general self-efficacy questionnaire was adopted from Ukoh (2012) and modified by the researcher to measure students self-efficacy in biology. It consists of ten (10) items that were graded based on four Likert scale ranging from Strongly Agree, Agree, Strongly Disagree, and Disagree. Using Cronbach's alpha, the reliability and internal consistency value obtained was 0.781. The student self-esteem scale (SSES) was designed and modified by the researcher to measure the students' self-esteem in biology for the purpose of this study. . This instrument consists of twenty (20) graded items based on a four point scale ranging from Strongly Agree, Agree, Disagree to Strongly Disagree. The positive statements were graded 4,3,2,1, respectively while the reverse was the case for the negative statements. The reliability coefficient of the instrument was calculated using the Cronbach alpha and the value obtained was 0.82.

Cognitive Style Test (CST) refers to the preferred way an individual processes information. Styles describe a person's typical mode of thinking, remembering or problem solving. A number of cognitive styles have been identified and studied over the years. The cognitive style that was adapted in this study is in line with Kirton's model (1976; 2003) of cognitive style test which suggests that some human beings, called adaptors, tend to use what is given to solve problems through time-honoured techniques. Alternatively, innovators look beyond what is given to solve problems with the aid of innovative technologies. Kirton suggests that while adaptors prefer to do well within a given paradigm, innovators would rather do differently, thereby striving to transcend existing paradigms. In this study, the problem was presented to the students and their response was used to classify them into adaptors or innovators based on the characteristics of each group as presented by Kirton. CST was validated using the split half reliability method and a reliability of 0.89 was obtained.

### **Procedure for Data Collection**

The researcher collected a letter of introduction from the Department of Science Education, University of Lagos to the schools used for the research in order to administer all the instruments constructed for the study. The researcher visited the schools, discussed with the principals, and obtained their consent and that of the class teachers. The researcher trained eight research assistants (who are also biology teachers) on the techniques to use in administering the research instruments. Thus, the researcher along with the trained research assistants numbered the instruments before administering them in all the sampled schools.

Data collection lasted five (5) weeks in the selected local government areas in Lagos, Nigeria. The instruments were given to some secondary school biology teachers as well as their senior secondary II students (SS II). One week was spent on familiarisation visits to the schools and four weeks on training the research assistants who administered the students' based test.

Data collected was analysed using Pearson Product Moment Correlation and Multiple Regression Analysis to determine the measure of relationship between independent and dependent variables. Multiple Regression was used to determine the joint contribution of independent and dependent variables as well determine which of the variables predicted students' attitude to biology.

**Results**

**Research Question 1:** What is the relationship among students' psychological factors (self-efficacy, self-esteem and cognitive style) and students' attitude towards environmental concepts in biology in Lagos, Nigeria?

**Table 1: Correlation Matrix Showing Relationship between Independent Variables and Dependent Variables**

Variables	Student Attitude to Environmental concepts (SAEC)	Self-efficacy	Self -esteem	Cognitive style
SAEC	1			
Self-efficacy	.411**	1		
Self -esteem	.641**	.259**	1	
Cognitive style	.025	.140	.046	1
Mean	33.8000	28.9550	28.4600	5.5150
S.D	5.9672	3.2490	7.0217	1.9670

\*\*Sig at 0.01 Level\*Sig at 0.05 Level

The result from Table 1 shows significant correlation among independent variables and dependent variables. There is a positive significant relationship between student attitude to environmental concepts in biology and self-efficacy ( $r= .411$ ); student attitude to environmental concepts in biology and self-esteem ( $r= .641$ ); student attitude to environmental concepts in biology and cognitive style ( $r= -.022$ ). The mean and standard deviation scores suggest that as self- efficacy and self-esteem levels improve, attitude towards environmental concepts, especially the ecological concepts in biology, improves.

**Research Questions 2:** What is the composite contribution of students' psychological factors on students' attitude towards environmental concepts in biology in Lagos, Nigeria?



**Table 2: Summary of Regression Analysis Showing Composite Contribution of Combined Independent Variables to Dependent Variables**

Source variation	Sum of squares	Df	Mean square	F	Sig
Regression	3398.948	3	485.564		
Residual	3687.052	596	19.203	25.285	.000
Total	7086.000	599			

$$R = .693 R^2 = .480 \text{ Adj } R^2 = .461$$

The joint effect of the three students' psychological factors (self-efficacy, self-esteem and cognitive style) on students' attitude towards environmental concepts in biology in Lagos, Nigeria was significant ( $F(3, 596) = 25.285$ ;  $R = .693$ ,  $R^2 = .480$ ,  $\text{adj. } R^2 = 0.461$ ;  $p < .05$ ). About 46% of the variation in students' attitude towards environmental concepts in biology in Lagos, Nigeria was accounted for by the independent variables.

**Research Question 3:** What are the relative contributions of students' psychological factors on students' attitude towards environmental concepts in biology in Lagos, Nigeria?

**Table 3: Multiple Regression Analysis Showing Contribution of the Independent Variables to the Dependent Variables**

	Unstandardized Co-efficient		Standardized Co-efficient Beta	T.	Sig.
	B	Std Error	B		
Constant	9.830	5.746		1.711	.089
Self-efficacy	.480	.103	.262	4.660	.000
self-esteem	.493	.049	.580	10.156	.000
Cognitive style	-.148	.166	-.049	-.897	.371

Table 3 reveals the relative contribution of each of the independent variables to the dependent variable as follows: self-efficacy ( $\beta = .262$ ,  $P < .05$ ); self-esteem ( $\beta = .580$ ,  $P < .05$ ); cognitive style ( $\beta = -.049$ ,  $P < .05$ ); on students' attitude towards environmental concepts in biology in Lagos, Nigeria. While self-efficacy and self-esteem were significant, cognitive style was not.

## Discussion

Self-esteem had positive relationship with students' attitude towards environmental concepts in biology in Lagos, Nigeria. This finding is consistent with that of *Germer*, (2009) who established that the self-esteem of the teacher positively affects the attitude of the student. *Rehman & Haider* (2013) found that self-esteem is directly related to the classroom behaviour of students. Self-esteem, according to *Ukoh* (2012), is an individual's own capacity, positive or negative judgements about himself. This means that self-esteem

is not a function of skills; it is the belief about having the ability to put skills into use. Self-esteem belief has an important effect on providing quality education.

That self-efficacy had positive relationship with students' attitude towards environmental concepts in biology supports Pajares (2006) assertion that students with a strong sense of efficacy are more likely to challenge themselves with difficult tasks and be intrinsically motivated. Such students will put up a high degree of effort in order to meet their commitments, and attribute failure to things which are in their control rather than blaming external factors. Self-efficacious students also recover quickly from setbacks, and ultimately are likely to achieve their personal goals. They attribute failure to insufficient effort or deficient knowledge and skills which are acquirable. Students with low self-efficacy believe they cannot be successful and these are less likely to make any concerted, extended effort. Elsevier (2009) investigated the structural relations among self-efficacy, academic aspirations, and delinquency on the academic achievements 935 students, aged 11-18 years, from ten schools in Australia and found that academic and self-regulatory efficacy had effect on academic achievement. Academic and social self-efficacy had positive and negative relationships respectively with academic aspirations and academic achievement.

However, while self-efficacy and self-esteem were significant, having positive relative contributions to students' attitude to environmental concepts, cognitive style was not. This contradicts the findings of Ellah & Achor (2015) whose study indicates that high cognitive ability level students have positive attitude toward science and high variation in students' attitude towards science is as a result of the variation in their cognitive style.

### **Conclusion**

The findings of this study show that self-efficacy, self-esteem and students' cognitive style are important in the teaching and learning of biology in Lagos State. The variables must be adequately taken into consideration for improved students' attitude towards environmental concepts in biology in Lagos, Nigeria.

### **Recommendations**

1. Students' self-efficacy and self-esteem need to be taken into consideration by biology teachers before dealing with the attitude of students towards environmental concepts in biology.
2. To achieve number 1 above, teachers should be given regular training, workshops, seminars and lectures on the influence of psychological factors, especially self-efficacy and self-esteem of students, on their affective or psychological skills in the teaching-learning process.

3. Teacher training education should be enhanced with more practical studies on psychological factors especially self-efficacy and self-esteem of students on their cognitive styles.
4. Government and state ministries of education should consider self-efficacy and self-esteem level of individual grades of students during curriculum reform and implementation in the nation's institutions.

### References

- Achor, E. E., Wade, M. & Duguryil, Z.P. (2013). Do cooperative learning strategies have the potentials to eliminate gender differences in students' achievement in biology? The effect of STAD and Jig Saw cooperative strategies. *Journal of science, technology, mathematics and education (JOSTMED)* 10(1) pp. 135- 146.
- Adeoye, T.O. (2011). Effects of pictorial and written advance organizers on students' achievement in and attitude to biology in selected senior secondary schools in Ibadan, Nigeria. *Unpublished M.Ed. Thesis, Department of Teacher Education, University of Ibadan.*
- Adesoji, F. A. (2008). Science and curriculum development. *Unpublished Lecture Notes, University of Ibadan.*
- Ajayi, D. O. (2005). Assessment of teacher's effectiveness in teaching biology: Essential ingredient for the 21st century biology educators. *Journal of Ekiti State Science Teacher's Association of Nigeria*, 1, 19 – 18
- Awolola, S.A. (2010). Impact of brain-based instructional strategy on students' learning outcomes in senior secondary school mathematics in selected local government areas in Oyo State, Nigeria. *An Unpublished Ph.D Thesis, Department of Teacher Education. University of Ibadan.*
- Ellah, B. & Achor, E. E. (2015). Cognitive styles and attitude to science of senior secondary school science students of high cognitive ability level. *International Centre for Science, Humanities and Education Research Journal (ICSHER Journal)* 1(3) 10-26
- Elliott J. G., Neil R. H., Wayne W., & Leonid I. (2005). Motivation, engagement and educational performance international perspectives on the contexts for learning. Retrieved from [www.atmos-chem-phys.net/acv-16-1](http://www.atmos-chem-phys.net/acv-16-1)
- Elsevier, B.V. (2009). Self-efficiency and academic achievement in Australia. *Science Direct Journal of Adolescence* 23(4), 797–817.
- Federal Ministry of Education (2013). *Senior Secondary School Curriculum: Biology for senior secondary school*. Nigerian Educational Research and Development Council (NERDC). Abuja.
- Heider, F. (1958). *The Psychology of Interpersonal Relations*. New York: Wiley.
- Germer J.C. (2009). Statistics method, self-esteem and inequality. Psychological journal guidelines and explanations. *American Psychologist*. 54, 594-604

- Ige, T. A. (2001). Concept mapping and problem solving teaching strategies as determinants of achievement in secondary school ecology. *Journal of Educational Studies* 5(1) 41.
- Jegede, O. (2007). The knowledge base for learning in science and technology education. *African science and technology education in the new millennium: practice, policy, and Priorities*. Kenwyl: Juta and Co. Ltd. 151 -176.
- Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology* 61(5), 622–629.
- Kirton, M.J. (1978). Field dependence and adaptation innovation theories. *Perceptual and Motor Skills*, 47:1239- 1245.
- Kirton, M.J. (2003). *Adaptation and innovation in the context of diversity and change*. Routledge, London, 2003, 392
- Krapp, A. (2002). Structural and dynamic constructs of interests' development, theoretical consideration from an ontogenetic perspective. *Learning and Instruction* 12, (4) 383 - 409.
- Kristen Léonard & Harper Loh (2011). Structural and dynamic constructs of interest development, theoretical consideration from an ontogenetic perspective learning and instruction. *12(4)*, 383-409
- Li, L. (2012). Application of concept maps-based anchored instruction Compu in programming. *Computer and information Technology (CIT)*, 2010 IEEE 10th International Conference in Bradford.
- Maldonado, M. (2005). *Model for development using and Evaluating Puzzles for Teaching: A Pathetically Neglected, Commonly Available Resource for Children* 51(4).
- Nelson, B. (2011). *Puzzles for Education*. Retrieved from <http://searchwarp.com/swa68008.puzzlefor-education.htm>.
- Ogundiwin O.A. (2013). Effect of pre-theoretic intuition quiz and puzzle-based critical thinking motivation strategies on students learning outcomes in selected environment related concepts50 in biology. Unpublished Ph.D Thesis, University of Ibadan. (38-40).
- Okafor, N. (2006). *Instructionalization of eyes clubs in Nigerian primary schools: panacea for scientific and technological skills acquisition*. In Okafor, N. Ed. Enhancing the status of science education. *A proceedings of EYES Workshops*, Lagos: Mukugamu and Brothers Enterprises. 6-10.
- Oladipo, A.J. (2009). Enhancing senior secondary school students' cognitive achievement in selected biology concepts using Mercedes Model with Embedded Assessment Strategy. Unpublished Ph.D Thesis, University of Lagos. (9).
- Oladipo, A.J. and Adeniyi, C.O. (2015). Psychosocial factors (PSFs) as predictors of academic performance among distance learning students in a dual mode

- institution. *Ife Journal of Theory and Research in Education, Obafemi Awolowo University, Ile Ife*, 106-119
- Oloyede, O.O. (2014). Effect of outdoor activities on selected Oyo state secondary school students' environmental knowledge attitude and problem solving skills in biology. M.Ed. Project, Department of Teacher Education University of Ibadan.
- Pajares, F. (2006). *Adolescence and education self-efficiency of adolescents*. Greenwich C.T. information Age Publishing: New York. 24-27.
- Rehman, A., & Haider K. (2013). The Impact of motivation on learning of secondary school students in Karachi: An Analytical study. *Educational Research International*. 2, 139-147
- Tannenhaus, M., & Woolfolk H. A. (1996). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education*, 17, 783–805.
- Ukoh, E. E. (2012). Effects of problem-based learning instructional strategy and interactive invention strategy on pre-service NCE students' achievement and acquisition of science process skills in physics. Unpublished Ph.D Thesis, University of Ibadan.
- Wagner, K.V. (2005). Self-efficiency psychology definition of the week. Retrieved from <https://www.psychologypress.com>
- Weiner, B. (1974). *Achievement motivation and attribution theory*. Morristown, N.J.: General Learning Press.
- Weiner, B. (1980). *Human Motivation*. NY: Holt, Rinehart & Winston.
- Weiner, B. (1986). *An attributional theory of motivation and emotion*. New York: Springer-Verlag.
- Wikipedia: The free online encyclopaedia 2008. Retrieved July 15, 2019 from <http://en.wikipedia.org/human trafficking>.