

Conception about the Origin of Life among Senior Secondary School Biology Students in Enugu Education Zone

Prof. Ngzika Mbajorgu¹

Enugu State university of Science and Technology
(ESUT) Enugu

Grace Ukamaka Onyia Eze²

Enugu State university of Science and Technology
(ESUT) Enugu

Abstract:- This study investigated the Conception about the Origin of Life among secondary School Biology student's in Enugu Education Zone of Enugu state. Two research questions and Two null hypotheses guided the study. The study adopted ex-post facto design. The population for the study was four thousand six hundred and sixty nine (4669) Senior Secondary School two (SSS 2) students in thirty (30) secondary schools, which comprised twenty (20) co-educational schools, eight (8) female schools and two (2) male schools in Enugu Education Zone for 2017/2018 academic session. The sample of the study was two hundred and forty (240) Senior Secondary School Two (SSS 2) students in the nine (9) coeducation secondary schools in Enugu Education zone for 2017/2018 academic session. The instrument used for data collection was questionnaire. Three specialists in Biology education and Measurement and Evaluation face validated the content of the instrument. Cronbach Alpha formula 20 was used to establish the internal consistency of the instrument and it yielded a coefficient of 0.498. Two hundred and forty comprising 88 male and 152 female students were used as sample for the study. Data collected were analyzed using frequency count and percentages to answer Research Question 1. Research Questions 2 was answered using box plots because it shows the relationship between categorical and ordinal or scale data. Chi square (χ^2) tests were used to test the association of the independent variables on conceptions about the origin of life among secondary school biology students in Enugu education zone at the 0.05 level of significance. It was found that Students preferred creationism/intelligent design over evolution as the explanation of the origin of life; secondly, that both females and urban students endorsed intelligent design over other explanations of the origin of life. Hence, the study recommended that the serving teachers of Biology in Senior Secondary Schools should endeavor to help the students reconcile their conceptions towards biology theories as it regards to the origin of life.

I. INTRODUCTION

The word "biology" has diverse meanings, especially for people from different disciplines. For many (especially in the social sciences, philosophy, and medicine) biology translates as "genetic" or "physiological," and is contrasted

with "psychological," "social," or "cultural." Biology, according to Raven and Johnson, (2009) is the study of living things-the science of life. Its name is derived from the Greek words "bios" (life) and "logos" (study). Biologists study the structure, function, growth, origin, evolution and distribution of living organisms. However, Longman dictionary of contemporary English defines biology as the scientific study of living things. Biology as one of the science subjects is bent in making one to be conversant with the environment in appreciating the meaning of scientific life, to develop unbiased mind and to be intellectually at homes which serve as ideal to the future citizen. Fortunately, it is a fact that Biology is the commonly chosen science subject of most secondary students and is confirmed by the West Africa Examination council (WAEC) record.

Nisbet, (2005) stated that Biology is the science of life. Mbajorgu and Anidu (2012) defined Biology as a natural science and is one of those disciplines where students are confronted with some natural phenomena that call for logical reasoning before some explanation are produced. Neboh (2013) stated that Biology equips the youth with the requisite knowledge for solving personal and societal problems. It is aimed at inculcation of scientific skills, attitudes, competencies, abilities and habits for societal and personal transformation (Mbajorgu and Anidu, 2012, Neboh, (2009). Martins (2018) stated that a sound knowledge of Biology is a prerequisite for entrance into such professions as medicine, pharmacy, agriculture, and nursing. Continuing, it may be the terminal point of science course for most secondary school students who may not wish to continue the study of science at higher level. The knowledge of Biology also helps one to understand sex determination and linkage, natural birth control method and crime detection to mention but few. Biology pervades every field of human endeavour, and plays fundamental roles in science Education advancement.

In finding the origin of life, biologists believe in the theory of Evolution- that is, the idea that human beings evolved from other species of animals, others like religionists believes in creationism which simply means that God created human beings in their present form and that they did not evolved from other species of animals. Pennock, (2007) stated that according to three major world religions (Judaism, Christianity and Islam) both share a common creation story, that God created man in six days

(including the first humans, Adam and Eve) and also in intelligent design: which means that the existence of living things are complex, and the likelihood of this complexity, can be explained only by the existence and the intervention of an intelligent designer. Cleaves, and Toplis, (2007) stated that “some of the characteristics features of living things can best be explained by the intervention of God the supernatural being” which could include a broad spread of views as to the nature and extent of the intervention.

However, Biology can best be explained using the theory of evolution. The word evolution is change. The notable evolutionist Doolittle, (2000) noted that Nothing makes sense in biology without evolution. Understanding evolution is critical for understanding biology, evolution is the centre for organizing principles of modern biology (Cobern, 1994). Evolution gives a scientific guide and explanation for and why there are much differences in organisms in the world and gives a detail account of their similarities and differences (morphological, physiological, and genetic). It gives detail information on the appearance of humans in the world and reveals the species' biological links with other living things. Evolution gives a better understanding of the continuous existence of bacteria and viruses and gives idea on how to protect humans against diseases and their causes. Evolution has made it possible to improve in agriculture and medicine and its applications in many fields aside from biology, both in forensics and software engineering; the knowledge of evolution has enable the chemists, for instance, to apply the principles of natural selection in developing new molecules with defined functions.

Darwin and 19th-century biologists, identified prove for biological evolution in the relative study of living organisms, its geographic statistics, and the fossil remains of dead organisms. Long ago during Darwin's period of time, subjects like genetics, biochemistry, ecology, animal behavior, neurobiology and more, molecular biology emerged and had supplied powerful additional information and detailed confirmation.

Similarly, scientist are no longer interested in gathering proves to support the reality of evolution. Instead, current scientist on evolution search to understand more in details how the processes of evolution take place. Many theories seek to account for how life begins on Earth, though no one among them has gathered much prove to be generally accepted by scientists. Natural selection, discovered by Darwin, (1861) which has been truly examined as the process that gives information on the environmental condition, arrangement and function of organisms. Darwin's highest notation to science is not to collection evidence for demonstrating evolution of life, but get to know natural selection, the act of describing the nature and organization of species and how they sustain and reproduce in different communities where they live, taking note of how they use wings to fly, legs to run, eyes to see, and degree their kidneys compose blood (Ayala, 2008).

Teaching and learning evolution has great practical value for better that understanding of the world. The law of evolution have form the base improves crops, livestock, and farming methods. Natural selection explains the growth of the use of pesticide resistance among agricultural pests and paves way for the production of new technologies to protect crops from insects and diseases. The knowledge of evolution helps the Scientists to preserve and conserve the nature within the environment: plants and smaller animals such as bacteria suitable to pollute environments are being used to replace lost plants and to remove chemicals in the environments. Microorganism to mammals adapts to climate change; studies on the mechanism and rate of climate changes can help conservationist to map out proper measures to save species diverging into annihilation.

Despite the importance attached to the teaching and learning of evolution in biology, biology science students enter into the classrooms with different background knowledge and beliefs about life and its diversity. Majority of the students' imagines problem between evolution and their understanding of the world's origin, because they have accepted that God created all things (creationism), and that the universe is ordered as a result of a supreme being (intelligent design).

From the beginning of the world, Human begins have seek to understand how life on earth began. Since the subject of origins has to do with the events that happened in the past, much thinking are involved, and the question of how and when life began is a personal belief structure (Miller et al, 2006). However, there are so many misconceptions and difficulties following how students conceive evolution as the explanation of the origin of life.

Misconception, according to Neboh (2009), occurs when the new concepts or theories are inconsistent with previously learned materials. Misconceptions are alternative conceptions and they tend to be resistant to instruction because learning entails replacing or radically re-organizing students' knowledge. Alternative conceptions often occur when new experiences and new understanding are grafted into prior understandings. Memories in general are retrieved by first recalling the schema and then the associated details. Neboh (2009) noted that there are categories of misconception in science among which are nonscientific beliefs which include views learned by students from sources other than scientific education, such as religious or mythical teachings. For example, some of the students have learned through religious instruction about an abbreviated history of the earth and the scientific evidence for a far more extended pre-history has led to considerable controversy in the teaching of science, and conceptual misunderstanding which arises when students are taught scientific information in a way that does not provoke them to confront paradoxes and conflicts resulting from their own preconceived notions and nonscientific beliefs. To deal with their confusion, students construct faulty models that usually are so weak that the students themselves are insecure about the concepts.

Previously, researchers like Odagboyi, (2015), looked into the challenges of effective science teaching in Nigeria secondary schools, their work aimed at highlighting the performance of students in science in Nigeria, and some of the factors that affect performance in science generally. Randy, (2004), worked on Understanding and acceptance of biological evolution and the nature of science; studies on university faculty. Also Berkman (2008) worked on Evolution and creationism in America’s classroom. Previous work has looked at several factors that are related to a person’s knowledge of biological evolution, their acceptance of biological evolution, and their understanding of the nature of science. Yet no one has examined the conception about the origin of life among secondary school students in Enugu Education Zone, taking notice of student’s conceptions and gender. However, many research works on evolution and students have been done outside Nigeria this is why the researcher carried out this work and these are gaps in knowledge that must be filled if the myriad issues surrounding biology evolution must be addressed.

➤ *Research Questions:*

The following research questions guided the study:

- What are the proportions of students that hold evolution, creationism, or intelligent design as the explanation of the origin of life?
- To what extent are senior secondary school biology students’ conception of evolution, creationism and intelligent design associated with students’ gender in Enugu Education zone?

➤ *Null Hypothesis*

The following hypotheses were tested at 0.05 level of significance;

- HO₁ The responses of senior secondary biology students will not be significantly associated with the different conceptions of the origin of life in Enugu Education Zone.
- HO₂ There will be no significant association between students’ conception of evolution, creationism and intelligent design and their gender.

II. METHODOLOGY

The research design for this study was the ex-post facto design. It is also called causal comparative research design. The study was conducted in secondary schools in Enugu Education Zone of Enugu state. Enugu Education Zone has a total of 30 secondary schools located across three local government areas that make up the zone namely:

Enugu East, Enugu North, and Isi-Uzo LGA. The population for this study was four thousand six hundred and sixty nine (4669) Senior Secondary School two (SSS 2) students in all the thirty (30) Senior Secondary Schools, which comprised twenty (20) coeducation schools, eight (8) female schools and two (2) male schools in Enugu Education Zone of Enugu State for 2017/2018 academic session (Post Primary School Management Board, Enugu, 2017). A total of two hundred and seventy (270) senior secondary school class two (SSS 2) students were used for this study. Nine (9) co-education secondary schools were drawn for this study, thirty (30) students from each school. The researcher employed simple random sampling technique. Questionnaire was used for the collection of data. The questionnaire was divided into four sections. Section A consisted of the respondent’s bio data while section B, C and D contained definition of concepts that explains the origin of life that measured student’s conception about the origin of life (evolution, creationism or intelligent design). The responses in sections B, C and D are scaled equally giving a scale of 4 points (to be checked) for each item. The questionnaire was given to one lecturer in Measurement and Evaluations while two lecturers in Biology Education were also given to validate it. To determine the reliability of the instrument, a trial sample of 20 respondents was drawn from a school that is part of the population but not part of the student’s sample, and Cronbach Alpha was used to check the internal consistency of relevant aspects of the instrument. The analysis gave coefficients of: 0.606, 0.310, 0.874 for the clusters under Section C and a coefficient of 0.498 for the whole section. Thirty copies of the questionnaire were given out in each of the schools under study. In analyzing the data, the researcher used frequency count and percentages to answer Research Question 1. Research Questions 2 was answered using box plots because it shows the relationship between categorical and ordinal or scale data. Chi square (χ^2) tests were used to test the association of the independent variables to conceptions about the origin of life among secondary school biology students in Enugu Education Zone. These were tested at the 0.05 level of significance.

III. RESULTS

➤ *Research Question 1:*

- What are the proportions of students that hold evolution, creationism, and intelligent design as explanation of the origin of life?
- The data for this research question were obtained using questionnaire and were calculated using frequency count to arrive at the percentages. Summary is presented in the Table 1 below.

Table 1 Proportions of Students that Hold Evolution, Creationism or Intelligent Design as the Explanation of the Origin of Life

Origin of Life	No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree	Total
Evolution (Man and animal have common ancestor)	3.8%	27.1%	63.5%	5.0%	0.6%	100.0%
Creationism (God created all things)	12.1%	0.4%	8.1%	11.0%	68.3%	100.0%
Intelligent Design (The universe is ordered as a result of a supreme being)	3.3%	2.7%	0.2%	15.4%	78.3%	100.0%

N = 240

In general 90.6% of the students in this sample reject the theory of evolution as the explanation of the origin of life, 3.8% have no opinion about evolution and only 5.0% conceive evolution as the origin of life. On the other hand, 68.3% of the students in this sample conceive creationism and 78.3% intelligent design as the explanation of the origin of life. Whereas 8.1% and 2.7% reject creationism and intelligent design as the origin of life respectively. The result of this study indicates that the responses of the

students are similar for creationism and intelligent design and is in contrast to the responses for evolution.

➤ *Research Question 2:*

To what extent are senior secondary school biology students' conception of evolution, creationism and intelligent design associated with students' gender in Enugu Education zone?

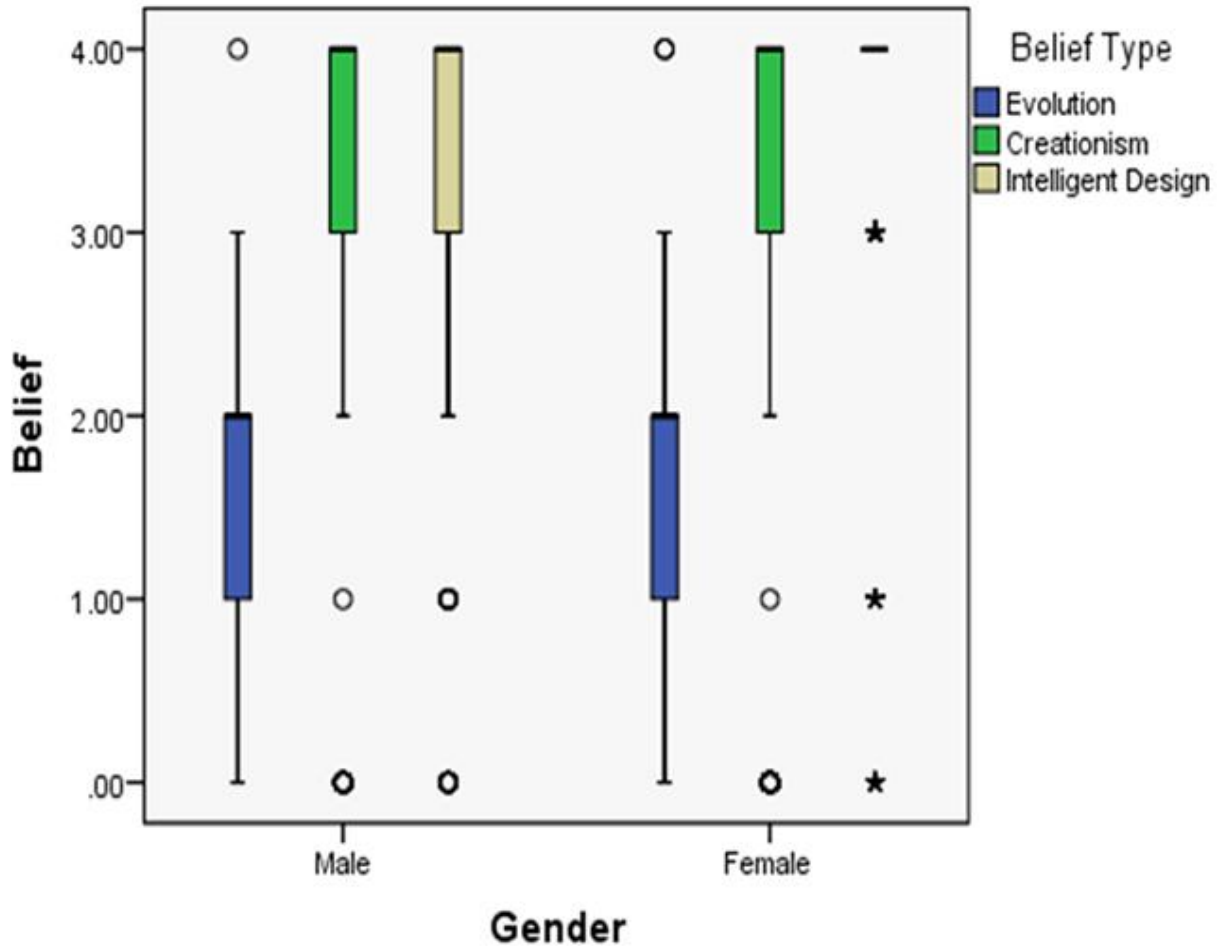


Fig 1 Boxplot of Distribution of Male and Female Students on Explanation of Origin of Life

Figure 1 shows the distribution of the responses of the students in the sample for the three conceptions of the origin of life, namely, evolution, creationism and intelligent design. The distribution for evolution is similar for both males and females, and quite different from the distribution for creationism and intelligent design. The median rating for both males and females on evolution is '2' whereas for creationism and intelligent design it is '4' for both males and females. It also shows 75% of the sample to fall below the rating of '2' for evolution and between the ratings of '4' and '3' for creationism for both genders. However, all the females rated '4' embloc for intelligent design whereas the rating for their male counterparts is also between '4' and '3'. There is one outlier for each of the male and female distributions on evolution, two for each of the male and

female distribution on creationism and two for the male distribution on intelligent design. Only the distribution for females on intelligent design has extreme scores. The boxplot, therefore, indicates that there are similarities in the conception evolution, creationism and intelligent design by both males and females among the sample of students in this study, although a greater proportion of females endorsed the more rational conception of intelligent design.

➤ *Null Hypotheses:*

- H_{01} The responses of senior secondary biology students will not be significantly associated with the different conceptions of the origin of life in Enugu Education Zone.

Table 2 Chi Square Analysis of differences between Actual and Expected Counts of Responses for the different Conceptions

		No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree	Total	
Conception	Evolution	Count	18	130	305	24	3	480
		Expected Count	30.7	48.3	115.0	50.3	235.7	480.0
		% within Conception	3.8%	27.1%	63.5%	5.0%	0.6%	100.0%
		Adjusted Residual	-2.9	15.2	24.9	-4.8	-26.0	
	Creationism	Count	58	2	39	53	328	480
		Expected Count	30.7	48.3	115.0	50.3	235.7	480.0
		% within Conception	12.1%	0.4%	8.1%	11.0%	68.3%	100.0%
		Adjusted Residual	6.2	-8.6	-10.0	.5	10.3	
	Intelligent Design	Count	16	13	1	74	376	480
		Expected Count	30.7	48.3	115.0	50.3	235.7	480.0
		% within Conception	3.3%	2.7%	0.2%	15.4%	78.3%	100.0%
		Adjusted Residual	-3.4	-6.6	-14.9	4.3	15.7	

$$\chi^2 = 1096.48, df = 8, p = .000$$

The 3x5 chi square analysis gave a χ^2 value of 1096.48 which was significant at .000 level of significance. This shows that there are statistically significant differences in the actual and expected number of students who conceived the different explanations of the origin of life among senior secondary biology students in Enugu Education Zone. The null hypothesis of no association was, therefore, rejected as stated. Student’s conception was associated with the type of conception of the origin of life proffered. The adjusted residuals (0.5), however, show that there was no significant difference between the actual and expected counts for the students who conceive creationism to be the explanation to the origin of life among this sample of students.

IV. SUMMARY OF FINDINGS

➤ *This Study Recorded the following Findings:*

- Students’ preferred creationism/intelligent design over evolution as the explanation of the origin of life.
- There is no significant association between gender and students’ conception of evolution, creationism and Intelligent design as the explanation of the origin of life.

➤ *Discussion of the Findings:*

This study examined the conception about the origin of life among senior secondary school biology students in Enugu Education zone. The study was guided by two (2) research questions and two (2) null hypotheses. Both the research questions and null hypotheses are presented in Tables 2 to 3 respectively. Hence, discussions of the findings were done under the following sub-headings:

- Students’ preference of the explanation to the origin of life
- Students’ Conception about the origin of life and their gender.

✓ *Students’ Preference of the Explanation to the Origin of Life:*

Result of analysis showed that students preferred creationism and intelligent design as the explanation of the

origin of life. In addition, the result showed that there are statistically significant differences in students’ acceptance of the different explanations of the origin of life among senior secondary biology students in Enugu Education Zone. The cohort of students used in this work believes in the existence of a deity. This could have influenced their preference for creationism and intelligent design over evolution.

The result is in consonant with that of Bowman (2007) who recorded a significant difference in the mean level of students who accepted creationism/intelligent design instead of evolution to be taught as the explanation of the origin of life in their senior secondary school biology course.

✓ *Students’ Conception about the Origin of Life and their Gender:*

Result of the study indicated that there was no significant difference in male and female students’ conceptions of evolution, creationism and intelligent design as the explanation of the origin of life. This result is in tandem with that of Miller et al. (2006) who recorded no significant difference in the gender of student’s acceptance on evolution and creationism in America’s biology classroom. This is because according to Miller et al. (2006), student’s genders are not a barrier to their reasoning. Gender refers to the socially culturally constructed characteristics and roles which are ascribed to males and females in any society. This means that one’s gender do not affect his/her reasoning.

This finding is very important to the classroom biology teachers who should not pay attention to a particular gender. This implies that the biology teacher in the mixed setting must ensure male and female students collaborate among themselves for better interaction in biology class.

H₀₂ There will be no significant association between students’ conception of evolution, creationism and intelligent design and their gender.

Table 3 2x4 χ^2 of the Association between Gender and Students' Conception of Evolution, Creationism and Intelligent Design

	No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree	Total
Evolution						
Male Count	8	44	112	11	1	176
% within total Gender	4.5%	25.0%	63.6%	6.2%	0.6%	100%
Female Count	10	86	193	13	2	304
% within total Gender	3.3%	28.3%	63.5%	4.3%	0.7%	100%
Total Count	18	130	193	24	3	480
% within to Gender	3.8%	27.1%	63.5%	5.0%	0.6%	100%
Creationism						
Male Count	21	1	17	21	116	176
% within total Gender	11.9%	0.6%	9.7%	11.9%	65.9%	100%
Female Count	37	1	22	32	212	304
% within total Gender	12.2%	0.3%	7.2%	10.5%	69.7%	100%
Total Count	58	2	39	53	328	480
% within total Gender	12.1%	0.4%	8.1%	11.0%	68.3%	100%
Intelligent Design						
Male Count	9	6	1	32	128	178
% within total Gender	5.1%	3.4%	0.6%	18.2%	72.7%	100%
Female Count	7	7	0	42	248	304
% within total Gender	2.3%	2.3%	0.0%	13.8%	81.6%	100%
Total Count	16	13	1	74	376	480
% within total Gender	3.3%	2.7%	0.2%	15.4%	78.3%	100%
Total Gender Male Count	38	51	130	64	245	528
% within total Gender	7.2%	9.7%	24.6%	12.1%	46.4%	100%
Female Count	54	94	215	87	462	912
% within total Gender	5.9%	10.3%	23.6%	9.5%	50.7%	100%
Total Count	92	145	345	151	707	1440
% within total Gender	6.4%	10.1%	24.0%	10.5%	49.1%	100%

$$\chi^2 = 4.504, df = 4, p = .342$$

The 2x4 chi square analysis gave a χ^2 value of 4.504 which was significant at .342 level of significance. This reveals that there is no significant association between students' conception of evolution, creationism and intelligent design and their gender. The null hypothesis of no association was, therefore, not rejected as stated: There was no significant association between students' acceptance of evolution creationism and intelligent design and their gender.

RECOMMENDATION

Based on the above findings of the study, the researchers recommend that; The serving teachers of Biology in Senior Secondary Schools should endeavour to help the students' reconcile their conceptions towards biology theories as it regards to the origin of life.

V. CONCLUSION

This study investigated the conception about the origin of life among senior secondary school biology students' in Enugu Educational zone. This study was guided by two (2) research questions and two (2) null hypotheses. It was found that Students' preferred creationism/intelligent design over evolution as the explanation of the origin of life, and that both females and urban students endorsed intelligent design over other explanations of the origin of life, also there is no significant association between gender and students'

acceptance of evolution, creationism and Intelligent design as the explanation of the origin of life. These findings led to the conclusion that students do not know and belief in evolution lead to their poor conceptions on evolution.

REFERENCES

- [1]. Abe, T.O. and Gbenro, S.O. (2014). A Comparison of students' attitudinal variables towards mathematics between private and public senior secondary schools. *Journal of Educational Policy and Entrepreneurial Research*, 1(1), 32-39.
- [2]. Abdu-Raheem (2012). Gender Differences and Students' Academic Achievement and Retention in Biology among Senior Secondary Schools in Ekiti State. *European Journal of education Studies* 4(1):45-58.
- [3]. Ayala, A.F. (2008). *Evolution of sex: Why do organisms shuffle their Genotypes?*. Current Biology. Cambridge, MA; Cell Press: Cambridge.
- [4]. Avise, J.C and Ayla, F.J. (2010). *In the light of evolution IV The human Condition*. Proc. Natl. Acad. Sci. U.S.A. Washington, D.C: National Academy of sciences 107 (suppl.): 8897-8901.
- [5]. Bube, R. H. (2014). Man Come of Age: Bonhoeffer's Response to the God-of-the Gab. *Journal of the Evangelical Theological Society*. Louisville. KY: *Evangelical Theological Society*. 14(4): 203-220.

- [6]. Barlow, N. (2009). *Darwin's Ornithological Notes*". *Bulletin of the British Museum (Natural History) Historical Series*. London; Trustees of the British Museum. 2(7): 201-278.
- [7]. Berkman, M.B.; Pacheco, J.S and Platzer. (2008). Evolution and Creationism in Americans' Classrooms. A National portrait. *PLOS bio*. 6(5): e124. [dio.org/10.1371/journal.pbio.006024](https://doi.org/10.1371/journal.pbio.006024).
- [8]. Bowman, K. L. (2007). *An Empirical study of Evolution, Creationism and Intelligent design instruction in Public school*. Michigan: Michigan State University Publication.
- [9]. Branch, G. (2007). Understanding Creationism after kitzmiller. *BioScience*. Oxford: Oxford University press on behalf of the American Institute of Biological Science. 57 (3): 278-284.
- [10]. Cleaves, A. and Toplis, R. (2007). In the shadow of Intelligent Design: the teaching of Evolution. *Journal of Biological Education*. 42, 1. pp.30-35.
- [11]. Doolittle, W. F. (2000). *Uprooting the Tree of life*. Scientific American Stuttgart: American. Georg von Holtzbrinck Publishing Group.
- [12]. Draper, P. R. (2005). God, Science, and Naturalism. In. Wainwright, William J. *The Oxford Handbook of Philosophy of Religion*. New York: Oxford University Press.
- [13]. Ezeudu, S.A. (2003). Classroom environment as correlate of students' cognitive achievement in senior secondary school geography. *The Journal of WCCI Nigeria chapter 4*(2): 65-73.
- [14]. Martins, J.L. (2003). What is Field Theory? *American Journal of Sociology* 109(1) 1-40
- [15]. Mbajorgu, N. M and Anidu, C. I. (2012). Understanding the bases of Students' Explanations of Biological phenomena: Theory of knowledge-In-Piece Vs Theory *Journal of Science and Computer Education (JOSCED)*, 2 (1).
- [16]. Mbajorgu, N.M. and Anolue, R.E. (2000). Students' Perceptions about the Epistemology of Science: A Comparison of some Nigerian and Canadian Students. *African Journal of Research in Mathematics, Science and Technology Education* 4(1):57-69.
- [17]. Miller, J. D., Scott, E. C and Okamoto, S. (2006). Public Acceptance of Evolution. *Science*. Washington, D.C.: *American Association for the Advancement of Science*. 313(5788):765-766.
- [18]. Neboh, O.I. (2009). *Issues in Science Education*. Enugu: Cheston Agency Press Ltd.
- [19]. Nisbet, M. (2005). *Polling About Evolution: Low Information Public Underscores Importance of communication Strategy*. www.csicop.org/list/listarchive/msq004.html
- [20]. Odagboyi, I.A. (2015). The Effect of Gender on the Achievement of Students in Biology using the Jigsaw Method. *Journal of education and Practice* 6(170): 14-18.
- [21]. Pennock, R. T. (2007). How not to teach the controversy about creationism. In L. S. Jones and M. J. Reiss, eds. *Teaching about scientific origins: taking account of creationism*. pp.59-74. New York: Peter Lang Publishing.
- [22]. Piaget, J. (1964). Development and Learning. *Journal of Research in science Teaching*, 2, 176-186.
- [23]. Randy, M. (2004). *The Evolution-Creationism Continuum in College Biology Classrooms*. Minneapolis Minnesota: University of Minnesota Publication.
- [24]. Raven, P.H. and Johnson, G. B. (2009). *Biology*. (6th edition). New York: Boston, MA; McGraw- Hill Companies, Inc.