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CONCEPTION ABOUT THE ORIGIN OF LIFE AMONG SENIOR SECONDARY SCHOOL BIOLOGY STUDENTS IN ENUGU EDUCATION ZONE FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS (SDGs)

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ABSTRACT

This study investigated the Conception about the Origin of Life among senior secondary School Biology student's in Enugu Education Zone of Enugu state for achieving sustainable development goals (SDGs). 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. Research Questions were 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 Students' conception about the origin of life is associated with their location; and finally, that Students' acceptance of evolution, creationism and intelligent design were statistically significantly associated with their perception of the relationship between science and religion. 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.

INTRODUCTION

In the explanation of the origin of life, biologists believe in the theory of evolution, that is, the idea that humans evolved from other species of animals. Evolution has, however, remained one of the most controversial concepts in the sciences (Binns & Bloom, 2017). This controversy is largely a result of religious beliefs (Barnes & Brownell, 2016; Southerland & Scharmann, 2013) of many cultures. Many studies clearly demonstrated that religious commitment best explains views on evolution held by individuals (Barnes & Brownell, 2016; Southerland & Scharmann, 2013). It has also been shown that in some cases, rejection of evolution as the explanation to the origin of life can reach 50% of the sample (Rice, Olson & Gilbert, 2010). Many people from indigenous cultures believe in creationism, that is, the idea that humans were created by God in their present form and did not evolve from other species of animals (e.g. Mbajiorgu & Anidu, 2012, 2017; Mbajiorgu & Udeh, 2015). Pennock, (2007) stated that three major world religions (Judaism, Christianity and Islam) share a common creation story in which God created the world in six days (including the first humans, Adam and Eve); and also in intelligent design; the thinking that the complexity of species, and the small probability of evolution producing such complexity, can be explained by the existence and by the power of an intelligent designer. Cleaves, and Toplis, (2007, p.33) stated that "certain features of living things are best explained by the intervention of a supernatural being, e.g. God".

The word evolution connotes change. Dobzhansky, (1973, p. 125) the eminent evolutionist stated that "nothing makes sense in biology except in the light of evolution." Understanding evolution is vital for understanding biology since evolution is the centre for organizing principle of modern biology (Cobern, 1994). Evolution

gives a scientific interpretation for why there are varieties of species of organisms in the world and gives detail information of their similarities and differences as in morphological, physiological, and genetic. It also gives information on the appearance of man on earth and discloses the species' biological links with other living things. Moreover, it provides better understanding of bacteria and viruses and enables the development of effective better ways to protect human against the diseases they cause. Evolution also made it possible to improve the standard of agriculture and medicine in our society and which also can be applied in many fields apart from biology, they include forensics and software engineering; it has shake up the chemists, for example, to use the principles of natural selection for developing new molecules with specific functions.

In the same way, evolution scientists are no longer personalizing their interest in gathering proves to support the fact of evolution. Instead, today they seeks to understand better and more comprehensively the process of evolution. Teaching evolution in Biology is one of the compelling historical narratives that scientists have constructed over the last few years. The history of evolution begins with the formation of the universe, the solar system, and the earth, where conditions occur suitable for life to evolve. There are scientific prove that gives information on how life originated on earth, but none of them has gathered enough supporting evidence to be generally accepted by scientists. Natural selection, discovered by Darwin, (1861) has caused one to believe in the adaptive configuration and function of organisms (for their “design”). Darwin's major contribution to science is not building up evidence by demonstrating the evolution of life, only the discovery of natural selection; that is the process that gives accounts for the design of organisms and their way of adaptations for survival and to reproduce in the environments where they live, including the formation of wings for flying, legs for running, eyes for seeing, and also kidneys that regulate the composition of the blood (Ayala, 2008).

Teaching and learning of evolution has huge significant value that goes beyond understanding the human world. The role of evolution is based on improving the crops, livestock, and farming productions. The knowledge of Natural selection gave rise in the production of pesticide resistance among agricultural pests and brings about the design of new technologies to save crops from insects and diseases. Scientists apply knowledge

from evolution biology to environmental preservation: plants and bacteria are introduced into the environments in order to pollute and replace lost vegetation and to eliminate toxic environments. Species from microorganism to mammals adapt weather change; learning the mechanism and degree of these changes can help bio-conservation scientist to formulate accurate measures to hinder species from going into extinction.

Despite the importance attached to the teaching and learning of evolution in biology, biology students enters the classroom with different concepts and beliefs about life's existence and its diversity. Large number of these students experience difficulties in between evolution and their conceptions about the world and its origin, because they believe that God created all things (creationism), and that the universe is ordered as a result of a supreme being (intelligent design).

Human beings ever since the beginning of the world are inquisitive to understand how life began on earth. This is because the subject of the origins has to do with things that happened in the past, much speculations are involved, and the question of How and When of the origins are matters connected with 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.

Randy, (2004), worked on Understanding and acceptance of biological evolution and the nature of science using university faculty. Also Berkman (2008) worked on evolution and creationism in America's classroom. Previous works have 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 (Nehm, Kim & Sheppard, 2009; . 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.

Acceptance can be define as the act of acknowledgement of a theory's validness through rational and systematic evaluation of evidence, whereas belief is considered as the act of acknowledging a theory's validity, using personal belief, opinion, and extra rational criteria (Sutherland and Sinatra, 2003). Barnes and Brownell, (2016, p 3), defined student acceptance of evolution as the extent to which students accepts that

evolution is the best scientific explanation for the diversity of life on earth, and also student understanding of evolution as the extent to which a student has an accurate conception of the tenets and processes of evolutionary theory. Barnes and Brownell noted that understanding evolution is not the same thing as accepting evolution; hence both stated student who understand evolution but do not accept it can not apply evolution thinking when making public decisions related to biology such as wildlife and disease management, which can affect both biodiversity and global human health. They both pointed that student acceptance is quite different from students understanding though this paper only focused on students acceptance.

Recent literature reviews showed that very few studies have focused on students acceptance of evolution, (Binns & Bloom, 2017), and those that did primarily focused on Teacher - Student relations in acceptance of evolution, (Nehn, Kim & Sheppard, 2009), disregarding location only acceptance and willingness to teach the theory. So many teachers simply choose not to teach evolution because of variety of reasons, which include negative attitudes from students, (Binns & Bloom, 2017). Barnes and Brownell noted the following factors as that which influences student acceptance of evolution; First, Students higher level of education positively influence students acceptance of evolution, (Rissler, Duncan & Caruso, 2014), Second, Students level of hypothetico-deductive reasoning positively influence students acceptance of evolution, (Lawson & Worsnop, 1992), Third, Students level of intuitive reasoning negatively influence students acceptance of evolution, (Gervais, 2015). According to research findings, of the many factors that have been shown to influence acceptance of evolution, student's religious commitment is the strongest. Barnes and Brownell pointed out that if student's belief to religion is high, then acceptance of evolution is predicted to be low regardless of other factors that have been shown to be related to acceptance. In this paper all respondent are reported to be Christian religious. Similar to the general opinion, it has been shown that students fight with a sensed conflict between evolution and religion, and some students may escape learning as it regards to evolution, (Sinatra, Sutherland, Conaughy and Demastes, 2003).

Religiosity: the extent by which a person is committed to and observes religion, has a least possible effect on one's understanding of evolution. it is an important variable in the studies of evolution because may teachers are personally struuggeled about the relationship between science and Religion, (Barnes and Brownell, 2016). Barnes and

Brownell stated that there is a conflict between religion and evolution hence suggested potential solution that will reduce students detected war between religion and evolution; Smith 1994 encourage teachers to learn with students how the nature of science means that evolution and religion do not have to be in conflict, more so, in 2013, Sutherland and Scharmann posited that teaching the bounded nature of science in relation to religion can help students be more open to subjects that generally conflict with religious ideas. They argued that engaging student's religious beliefs might be the most important factor to consider when teaching scientific subjects that relate to human origins, additionally, having open discussions about the relationship between religion and science increases student's positive views of science and evolution, (Brickhouse, Dagher, Letts & Shipman, 2000), Also, helping students construct bridges between religious beliefs and evolution may also help students accept evolution, (Manwaring, Jensen, Gill & Bybee, 2015), finally, acknowledging the religious beliefs of the students by teachers and in teachers discuss how religion and evolution can be compatible, (Winslow, Stave & Scharmannm 2011).

Hermann, (2011), agreed that there is a gab between teaching of evolution and students acceptance. Hermann, proposed that teaching evolution from elementary school will increase students understanding and acceptance of evolution so also Emmons & Kelemen, (2015) who suggested that including evolution education at the elementary level may lead to greater acceptance of evolution by adults, (Beardsley, Bloom & Wise, 2012).

However, several studies reported that participants felt that when evolution is taught, should also include Creationism, (Levesque & Guillaume, 2010). The result of the findings by Binns & Bloom, (2017), shows that participants prefer when teaching evolution that Creationism and ID should mentioned in the science classroom for better understanding and acceptance.

On the other hand, despite all efforts made in bridging the gab between students religion and students acceptance of evolution, (Sutherland & Scharmann, 2013, Winslow et all, 2011) there are still barriers to addressing religious beliefs in the classroom. Barnes and Brownell stated the following Barriers that are associated to reducing students perceived conflict between religion and evolution; first, teachers lack experience in teaching the nature of science in relation to religion and this may cause

students to feel unprepared to engaged in the discussion about evolution and religion, (Southerland & Scharmann, 2013), Secondly some biology teachers do not want to discuss religion, because their own beliefs systems may be different from student's belief system, (Ecklund & Scheitle, 2007). Thirdly there is a long history of attempts by certain religious groups to legislate the teaching Creationism as a valid alternative to the theory of evolution, (Numbers, 2006). Finally, some biology teachers may perceive that presenting evolution without making reference to religion can alienate religious students, (Hermann, 2012), therefore they neglect the relationships between evolution and religion in the classroom.

Research Question

The following research questions guided the study:

1. To what extent are senior secondary school biology students' conception of evolution, creationism and intelligent design associated with school location in Enugu Education zone?
2. To what extent are senior secondary school biology students' conception of evolution, creationism and intelligent design associated with students' perception of relationship between science and religion in Enugu Education zone?

Null Hypothesis

The following hypothesis was tested at 0.05 level of significance:

HO_1 Students' conception of evolution, creationism and intelligent design will not be significantly independent of their location.

HO_2. Students' conception of evolution, creationism and intelligent design as the origin of life will not be significantly independent of their perception of the relationship between science and religion in Enugu Education Zone.

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. A total of two hundred and seventy (270) students were randomly constituted from the entire population of four thousand six hundred and sixty nine (4669) Senior Secondary School Class Two (SSS 2) students in all the thirty (30) Senior Secondary Schools in Enugu Education zone. (Post Primary School Management Board, Enugu, 2017). 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. 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. In analyzing the data, the Research Question was answered using box plots because it shows the relationship between categorical and ordinal or scale data. Chi square (χ^2) test was used to test the association of the independent variable with conceptions about the origin of life among secondary school biology students in Enugu Education Zone. This was tested at the 0.05 level of significance.

RESULTS

Research Question 1:

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

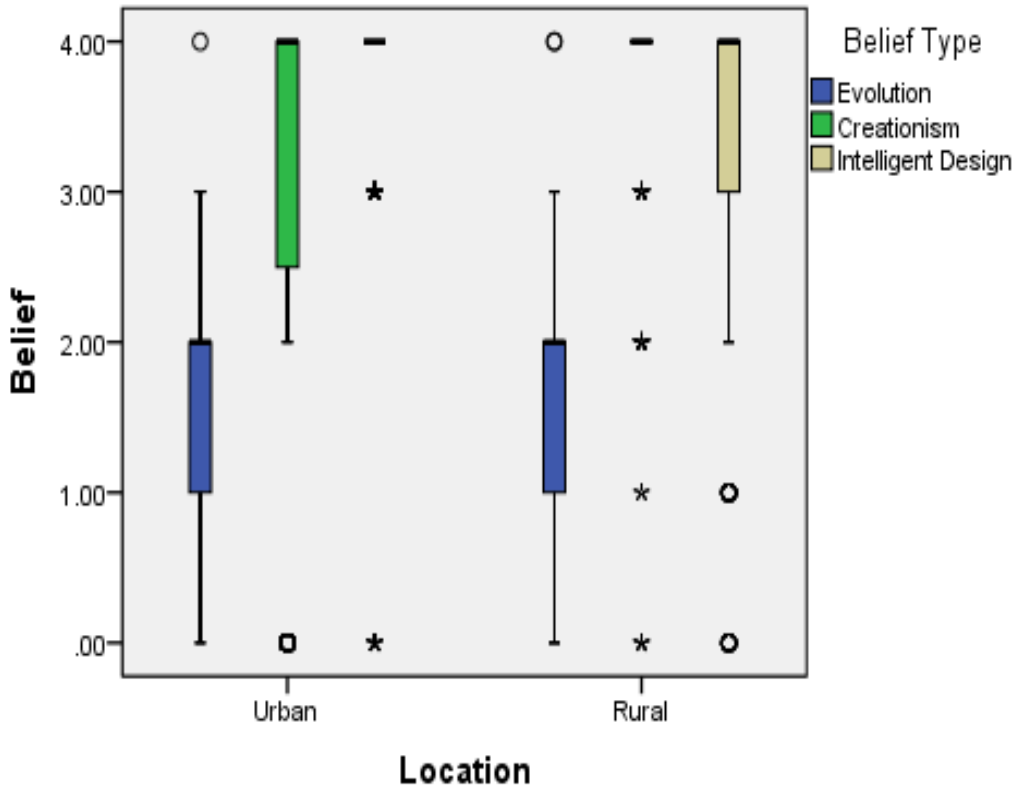

Fig.1 Boxplot of distribution of urban and rural students on explanation of origin of life.

Figure 1 shows the distribution of the responses of urban and rural senior secondary school students on the conception of evolution, creationism and intelligent design as the explanation of origin of life in Enugu education zone. The distribution for evolution is similar for both urban and rural students (50% of both distributions were between '2' and '1') but different from that of creationism and intelligent design. The median rating for both urban and rural students on evolution is '2' whereas for creationism and intelligent design it is '4' for both urban and rural students. It also shows that 64.1% of the samples from urban are for creationism while 81.9% for intelligent design fall below the rating of '4' for both creationism and intelligent design. Moreover all the urban students rated '4' embloc for intelligent design whereas the rating for their rural counterparts is between '4' and '3'. The reverse is the case for creationism, where the rural students rated '4' whereas the distribution of 50% of the urban students were between '4' and '3.5'. Hence, the boxplot indicates that there are similarities in the conception of evolution, by both urban and rural students but this is quite different from

the conception of creationism and intelligent design by the two groups of respondents, although greater proportion of the urban respondents endorsed the more rational conception of intelligent design.

Research Question 2:

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

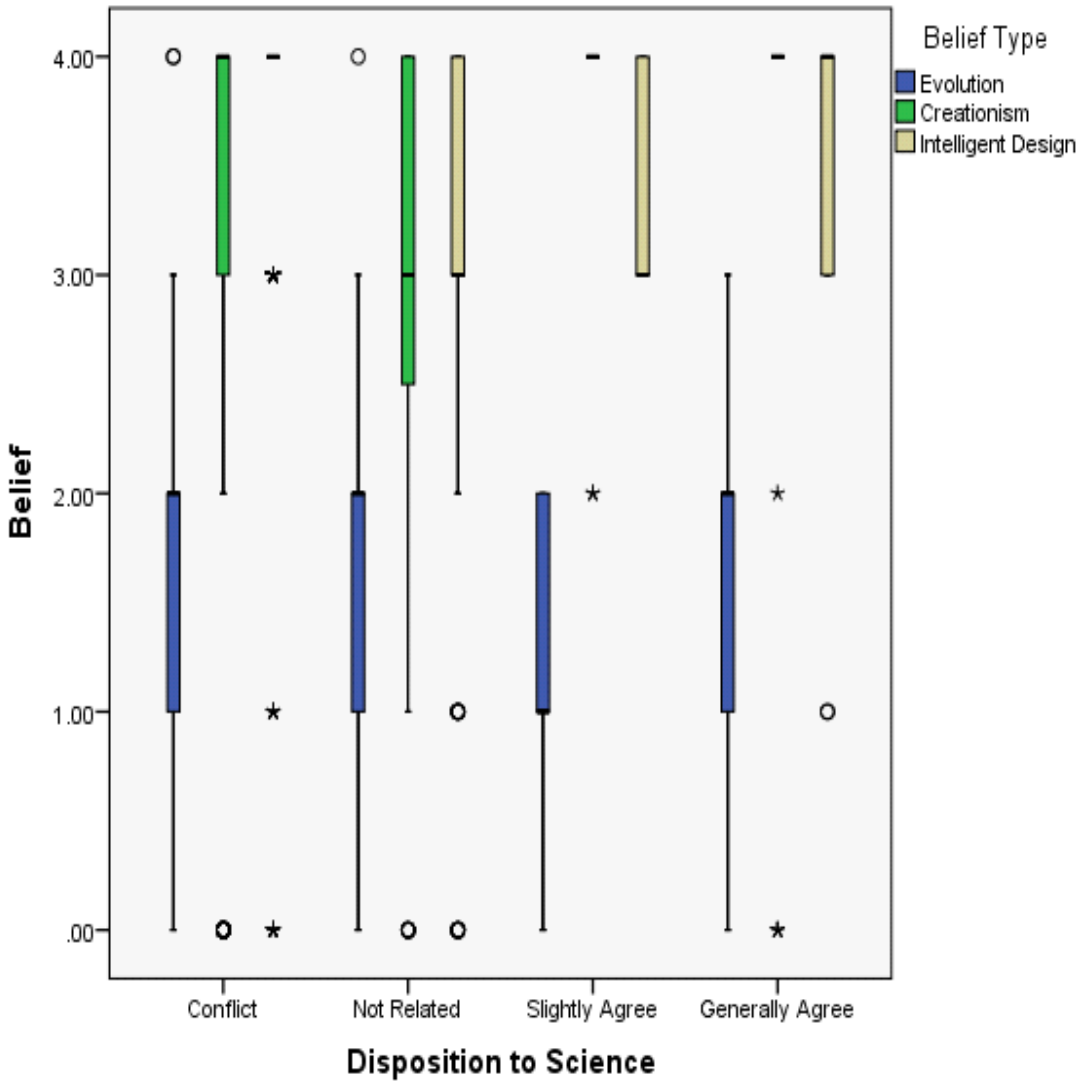

Fig.2 Boxplot of the relationship between science and religion disposition

Figure 2 reveal the perception of relationship between science and religion and students' responses. The responses of students show that the distribution for evolution is similar for the four categories, and quite different from the distribution for creationism and intelligent design. All the students who perceive religion to conflict with science do not accept evolution as the explanation of the origin of life (with 50% of the students' rating between '2' and '1'). For creationism, the distribution of 50% of this group of students is between '4' and '3', whereas the distribution of the remaining 50% was between '3' and '2'.All students in this category rated '4' for intelligent design with just one extreme rating.

The median rating for students who are not passionate about the differences was '3' for both creationism and intelligent design. The differences between creationism and intelligent design for this group of students were in the wide distribution for creationism and lesser variability for intelligent design. Students who perceive science to be related to religion conceived creationism embloc as the explanation of the origin of life with only two outliers. The rating of 100% of the distribution of this category of students were, however, between '4' and '3', an indication of a high level of acceptance.

HO$_1$ Student's conception of evolution, creationism and intelligent design will not be significantly independent of their location.

Table 1: Chi square analysis of students' location and their conception of evolution, creationism and intelligent design.

		No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree	Total
Evolution	Urban	16	85	209	9	1	320
Count		5.0%	26.6%	65.3%	2.8%	0.3%	100%
% within total Location							
	Rural	2	45	96	15	2	160
Count		1.2%	28.1%	60.0%	9.4%	1.2%	100%
% within total Location							
Total	Count	18	130	305	24	3	480

% within to Location	3.8%	27.1%	63.5%	5.0%	0.6%	100%
Creationism Urban Count	54	0	26	35	205	320
% within total Location	16.9%	0.0%	8.1%	10.9%	64.1%	100%
Rural Count	4	2	13	18	123	160
% within total Location	2.5%	1.2%	8.1%	11.2%	76.9%	100%
Total Count	58	2	39	53	328	480
% within total Location	12.1%	0.4%	8.1%	11.0%	68.3%	100%
Intelligent Design Urban Count	6	0	0	52	262	320
% within total Location	1.9%	0.0%	0.0%	16.2%	81.9%	100%
Rural Count	10	13	1	22	114	160
% within total Location	6.2%	8.1%	0.6%	13.8%	71.2%	100%
Total Count	16	13	1	74	376	480
% within total Location	3.3%	2.7%	0.2%	15.4%	78.3%	100%
Total Location Urban Count	76	86	232	96	468	960
% within total Location	7.9%	8.9%	24.5%	10.0%	48.8%	100%
Rural Count	16	60	110	55	239	480
% within total Location	3.3%	12.5%	22.9%	11.5%	49.8%	100%

Total Count % within total Location	92 6.4%	145 10.1%	345 24.0%	151 10.5%	707 49.1%	1440 100%

$\chi^2 = 15.792, df = 4, p = .003$

The chi square analysis gave a χ^2value of 15.792 which was significant at .003 level of significance. The obtained probability value .003 was less than the set value 0.05. This shows that the null hypothesis of no association was rejected. It therefore, states that Student's conception of evolution, creationism and intelligent design was significantly dependent of their location.

HO2 Student's conception of evolution, creationism and intelligent design as the origin of life will not be significantly independent of their perception of the relationship between science and religion in Enugu Educational Zone.

Table 2: Chi square analysis of Student's conception of evolution, creationism and intelligent design as the origin of life with disposition to science and religion.

	No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree	Total
Evolution Disposition to Science Conflict Count % within total disposition to science	12 3.1%	93 24.2%	264 68.8%	13 3..4%	2 0.5%	384 100%
Not related Count % within total disposition to science	3 4.4%	26 38.2%	29 42.6%	9 13.2%	1 1.5%	68 100%
Slightly Agree Count % within total disposition to science	1 10.0%	5 50.0%	4 40.0%	0 0.0%	0 0.0%	10 100%

Generally Agree Count % within total disposition to Science	2 11.1%	6 33.3%	8 44.4%	2 11.1%	0 0.0%	18 100%
Total Count % within to disposition to science	18 3.8%	130 27.1%	305 63.5%	24 5.0%	3 0.6%	480 100%
Creationism Disposition to Science Conflict Count % within total disposition to science	49 12.8%	0 0.0%	27 7.0%	35 9.1%	273 71.1%	384 100%
Not related Count % within total disposition to science	6 8.8%	2 2.9%	9 13.2%	18 26.5%	33 48.5%	68 100%
Slightly Agree Count % within total disposition to science	0 0.0%	0 0.0%	2 20.0%	0 0.0%	8 80.0%	10 100%
Generally Agree Count % within total disposition to Science	3 16.7%	0 0.0%	1 5.6%	0 0.0%	14 77.8%	18 100%
Total Count % within total disposition to Science	58 12.1%	2 0.4%	39 8.1%	53 11.0%	328 68.3%	480 100%
Intelligent Design Disposition to Science Conflict Count % within total disposition to science	8 2.1%	5 1..3%	0 0.0%	43 11.2%	328 85.4%	384 100%

Not related Count	8	6	1	22	31	68
% within total disposition to science	11.8%	8.8%	1.5%	32.4%	45.6%	100%
Slightly Agree Count	0	0	0	6	4	10
% within total disposition to science	0.0%	0.0%	0.0%	60.0%	40.0%	100%
Generally Agree Count	0	2	0	3	13	18
% within total disposition to Science	0.0%	11.1%	0.0%	16.7%	72.2%	100%
Total Count	16	13	1	74	376	480
% within total disposition to Science	3.3%	2.7%	0.2%	15.4%	78.3%	100%
Total Disposition to Science						
Conflict Count	69	98	291	91	603	1152
% within total disposition to science	6.0%	8.5%	25.3%	7.9%	52.3%	100%
Not related Count	17	34	39	49	65	204
% within total disposition to science	8.3%	16.7%	19.1%	24.0%	31.9%	100%
Slightly Agree Count	1	5	6	6	12	30
% within total disposition to science	3.3%	16.7%	20.0%	20.0%	40.0%	100%
Generally Agree Count	5	8	9	5	27	54
% within total disposition to Science	9.3%	14.8%	16.7%	9.3%	50.0%	100%
Total Count	92	145	345	151	707	1440
% within total disposition to Science	6.4%	10.1%	24.0%	10.5%	49.1%	100%

$\chi^2 = 81.929, df = 12, p = .000$

The 2x5 chi square analysis gave a χ^2value of 81.929 which was significant at .000. This shows that there are statistically significant associations in student's

conception of evolution, creationism and intelligent design as the origin of life with their perception of the relationship between science and religion in Enugu Education Zone. The null hypothesis of no association was, therefore, rejected as stated. Student's conception was associated with their perception of the relationship between science and religion.

Discussion of the Findings

Association of Location and students' preferred Explanation of the Origin of Life

Students in urban areas showed more interest on creationism/intelligent design as the explanation of the origin of life than students in rural areas who accepted the theory of evolution as the best explanation of the origin of life. The differences noticed were also statistically significant. It has been found that school location affects the students' conceptions. This is because according to Martin (2003), location of the schools that the students attend makes the students to hold a different experience for a course of study. In other words, the students in the urban schools enjoyed access to internet through their phones and computers, had access to online news and information, well qualified teachers that were practically oriented, well equipped laboratories and many more amenities that made many more amenities that made learning possible and easy unlike their counterparts in the rural schools. This finding is very important to government, parents and classroom teachers as the study revealed that students in urban areas are more exposed than students in rural areas, therefore government should organize a regular seminar to both teachers in urban and rural areas so they aid students reconcile their new knowledge with the previous knowledge for better conception in biology.

Students' conceptions about the origin of Life and their perception of the relationship between science and religion.

Result of analysis showed that students' conception of evolution, creationism and intelligent design were statistically significantly associated with their perception of the relationship between science and religion. This is because, if a person's commitment to religion is high, then his or her conception of evolution is predicted to be low regardless of other factors that have been shown to be related to misconception of evolution (Scott,

2005). Religion is a way of life. Religion is one's belief and worship of a supernatural controlling power, especially a personal god or gods. The vast majority of students in Enugu Education zone reported being religious making religious belief prevalent potential barrier to students' acceptance of evolution. Further, similar to the general public, it has been shown that students struggle with a perceived conflict between evolution and their religious beliefs, and some students may resist learning about evolution (Scott, 2005).

Religiosity, the extent to which one is committed to and practices religion, has effect on one's understanding of evolution, and this might lead teachers to conclude they do not need to address religious concerns when teaching evolutionary theory. However, studies have shown that, if a student has an accurate understanding of evolution, this does not necessarily mean he or she is more likely to accept evolution (Sinatra et al., 2003; Lloyd-Strovas & Bernal, 2012). Therefore, government should map out a way to reconcile the effect of religion to students' conception of evolution, hence evolution will not make sense with the light of religion.

Conclusion

This study investigated the conception about the origin of life among senior secondary school biology students' in Enugu Educational zone for achieving sustainable development goals (SDGs) and was guided by two (2) research questions and two (2) null hypotheses. It was found that students' conception about the origin of life is associated with their location. Rural area students who endorsed evolution were greater in number than students leaving in urban areas who preferred intelligent design/creationism as the explanation of the origin of life. Finally, the study discovered that students' acceptance of evolution, creationism and intelligent design were statistically significantly associated with their perception of the relationship between science and religion. It was observed that all students in this study were Christians and majority of them believed that man originated from God the Supreme Being. These findings led to the conclusion that students do not know and belief in evolution leady to their poor conceptions on evolution. Based on the above findings of the study, the researchers recommend that, the serving teachers of Biology in Senior Secondary Schools endevour to help the students reconcile their conceptions of the origin of life with their religious beliefs and avoid the influence of Religion in the teaching of science theories.

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