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# Assessment of Secondary School Students' Perception of Evolution and Creationism: Implications for Learning and Performance

**Noma V. David-Egbenusi & Christiana N. Omoifo**
Department of Curriculum and Instructional Technology
Faculty of Education,
University of Benin, Benin City.
Corresponding author: Dr N. V. David-Egbenusi, Email: noma.davidegbenusi@uniben.edu

**Abstract**

This study assessed Secondary School Student's perception of the concept of evolution and creationism in Biology. Considering the central position that the subject of biology occupies among other science subjects, it became necessary to cast a look into students' perception of the concept of evolution and creationism, its implication on learning and performance. The study adopted the survey research design. The population of the study consisted of students in all the public schools in Edo North and Edo South Senatorial Districts of Edo State. The stratified random sampling technique was used to distribute the population into subgroups of Muslim and Christian schools. The purposive random sampling technique was used in selecting four hundred and twenty students (420) from both Muslim and Christian schools so as to obtain a considerable number of Muslim students. Two instruments were used for data collection. The first is a 14-item questionnaire called Views on Evolution while the second is a 10-item achievement test on evolution which the students responded to. Data collected were analyzed using Chi-Square test and a one-way Analysis of Variance. The findings from the study revealed that the student's religious beliefs did influenced their perceptions of the concept of evolution. However, there was no significant difference in the performance on the test of evolution by students of different religious groups and Christian sect with different views of evolution/creationism. Based on the findings, it was therefore recommended that, the topic should be taught in a way that it will not conflict with the students' religious belief as well as encourage instructors teaching evolution and other controversial science topics to address students concerns and prior attitudes in a constructive and empathetic manner.

*Keywords*: Evolution, Religious Beliefs, Perceptions and Performance

## Introduction

Biology is one of the science subjects taught in secondary schools in Nigeria. The importance of Biology among the sciences and as a core subject is far reaching for the students who intend to pursue further studies in the future and in their career. Therefore, meaningful and relevant knowledge in biology and ability to apply scientific knowledge to everyday life and personal matters is sacrosanct to the science students in the senior secondary school three. The concept of evolution has been described as one of

the most consistent and unifying theoretical entities in Biology, capable of explaining a large number of natural phenomena at different scales and with different types of evidence (Coyne, 2010 and Futuyma, 2009). For example, they are able to understand certain illnesses of our time, explain human behaviour, or comprehend why some types of species are more at threat of becoming extinct. Therefore, knowledge of evolution is indispensable for scientific literacy (Glaze & Goldston, 2015).

However, evolution as a concept in Biology contradicts the religious beliefs of divine creation account stated in the Bible (Genesis Chapter 1 Verse 1). Also, Koran maintains that Allah (God) creates what he wills, for verily Allah has power over all things (Surah An – Nur Aya 4-5). Issues on creationism arise where the Bible and Koran state's that a supernatural being (God) created everything. At the end, students seem not convinced, or they are burdened with misconceptions and are confused about the changes that occur as a result of evolution as taught in the classroom. Nigeria as a multi-religion country is made up of different religious sects. Each of these sects have its own dogma and doctrine with adherent followers. Some of these Biology teachers and students who are expected to teach and learn these theories respectively belong to these religious groups. Some of these teachers are Pastors and Mallams and some of the students are Pastors and Mallams' children. Students who are neither Christians nor Muslims perhaps Pagans also have their own belief about creation passed down to them from their parents and generations. Therefore, students often graduate with misconceptions, such as the notion that evolution is the activity of an organism's internal forces and that these change out of necessity and in response to the environment (Cofré, Vergara, Santibáñez, & Jiménez, 2013; Kampourakis & Zogza, 2007). Furthermore, students' personal beliefs define the manner in which they view the world and potentially influence the quality of their learning experience (Cavallo & McCall, 2014). Such personal beliefs affect not only student's understanding of the concept of evolution but also their acceptance of it.

Nonetheless, studies conducted with secondary school students revealed that many of them have little or no knowledge concerning evolution. In learning evaluations, students tend to retain only the information that is necessary to pass examinations and then return to their old beliefs (Nehm & Schonfeld, 2007). Furthermore, students' personal beliefs define the manner in which they view the world and potentially influence the quality of their learning experience (Cavallo & McCall, 2014). Additionally, there is ample evidence that Biology teachers also have difficulty accepting evolutionary knowledge as valid (Kim & Nehm, 2011). There is a large amount of evidence suggesting that problems pertaining to the acceptance and understanding of the concept of evolution in classrooms are directly related to the beliefs, limitations, and insecurities of the Biology teachers themselves (Glaze & Goldston, 2015; Romine, Barnett, Friedrichsen, & Sickel, 2014; Sickel & Friedrichsen, 2013). For example, Griffith and Brem (2004) describe situations in which teachers restrict content and choose the aspects of evolution that they will impart to students because this strategy allows them to remain in their comfort zone and avoid questions that they do not feel capable of answering. Such display by the teachers have also been discovered to adverse effects on students' perceptions and performances is evolution examinations. Lawson (1983) found a negative relationship between acceptance of evolution and later achievement in a college-level, nonmajors' Biology course with a laboratory focus. He suggested that cognitive dispositions interfered with subsequent learning, and thus, that teachers should attend to students' beliefs and attitudes. Lawson's results were also confirmed by McKeachie, Lin, and Strayer (2002). As these authors rightly stated, ''...we do not know how students who enter college Biology classes believing in creationism will fare'' (McKeachie et al., 2002, p. 189).

This study therefore assessed secondary school Biology students' perception of the theory of evolution and inferred the implications of such views on learning and performance in Biology in secondary schools.

*Statement of Problem*

The resistance to the concept of evolution has been very well characterized, as has our knowledge of students' understanding of evolution and alternative conceptions they hold. This is further evident from experiences in the classroom which shows that students seemed confused and appears to have conflicting ideas when the teacher presents the topics on evolution. These conflicting ideas are usually revealed when they ask several questions which bother on culture and religion such as;

a. Do my ancestors originate from Apes?
b. Are my ancestors related to Monkeys or Frogs or Fishes?
c. Is it not God that created everything on earth?
d. When will the next big bang theory occur again?
e. Will another Ape evolve into human again?

The exhibition of confusion and conflict that the students express in the classroom are not surprising, the reason being that Nigeria as a multi-religion country is made up of different religions, religious beliefs and religious sects. Each of these religions and religious sects have its own dogma and doctrine with adherent followers. Some of the biology teachers and students who are expected to teach and learn these theories respectively belong to these different religious groups. In the study of Rice, Olson & Colbert (2011), they discovered in their experience, that many people assume that all (or most) students earning degrees in biology (or related fields) have attitudes/theistic positions that are evolutionist in nature. They noted that the assertion was not supported by either their study or previous work (Ingram and Nelson 2006; Moore and Kraemer 2005; Verhey 2005; Brem et al. 2003; Barnes, Keilholtz, & Alberstadt 2009; Losh & Nzekwe 2010). Because an accurate understanding of the nature of science is prerequisite to understanding why scientists use evolutionary theory and how scientists can also hold theistic positions in their private lives, it becomes pertinent to investigate student's perception of the concept of evolution. Can student's religious beliefs have an influence on the way they view evolution?

Over the years, reports on the performances of students who enrolled in the West African Examination Council (WAEC) and National Examination Council (NECO) have been poor. Omoifo (2012), revealed that more than fifty percent (50%) of the students who sat for biology failed in the years 1995 to 1997 and 2000. In particular, WAEC Chief Examiner's report (1998) identified the area of evolution as the worse hit during examination. The report indicated that majority of the students completely avoided answering questions on evolution. The highest percentage of students at the credit level (1-6) was 31.52%. This is not too interesting considering the fact that for any further schooling, students require credits/pass in Biology. The report also identified that even among those who answered questions on evolution, majority of them performed poorly. What could be responsible? Could it be the students' perception of the concept of evolution?

*Research Hypotheses*

The following hypotheses were formulated and tested at 0.05 level of significance.

$H_{o1}$: There is no significant difference in the views of evolution or creationism held by students of different religious beliefs.

$H_{o2}$: There is no significant difference in performance on the test of evolution by students of different religious groups with different views of evolution or creationism.

$H_{o3}$: There is no significant difference in performance on the test of evolution by students of different religious Christian sects with different views of evolution or creationism.

## Methods

This study adopted the survey research design. It involves obtaining data from respondents with the aid of questionnaire to assess secondary school Biology students' perceptions of the concept of evolution in Edo State.

The population of the study consisted of students in public schools in Edo North and Edo South senatorial districts of Edo state. The stratified

random and purposive sampling techniques were used to select the sample for the study. The population was systemically stratified into subgroups of Muslims and Christians. For the purpose of the study, to elicit responses from both groups (Muslims and Christians), purposive sampling technique was employed. This decision was based on the few Muslim schools, which were also clustered in a particular area of Edo State (Auchi). All the Muslim schools in that area were picked so as to gain an equal representation of Christian and Muslim students. Tables 1 and 2 respectively are a summary of the distribution of the sample by Student's Religion and Christian Religious Sects. Three hundred and thirty-six (336 or 80%) of the sample were Christians and seventy-six (76 or 18.1%) were Muslims, making a total of four hundred and twenty students (420) used for the study. The sample was also categorized by Religious Sects from the sample of Christians. One hundred and twenty-four (29.5%) are Roman Catholic one hundred and eighty-three (43.6%) are Pentecostals and eleven (2.6%) are protestants. The graphical representation of sample by student's religion and Christian religious sects are shown on figures 1 and 2 respectively in the findings and discussion of results.

This study made use of two instruments divided into sections A, B and C: Section A consists of students' background data such as gender, religion and religious sects. Section B is a closed ended questionnaire made up of 14 statements on evolution called "Views on Evolution", adapted from Ingram, E.L. & Nelson, C.E. (2005). The 14 statements will require a 4-point Likert scale with response ranging from strongly agree to strongly disagree. A positive response was scored as "strongly agree" 4, "agree" 3 "disagree"2, and "strongly disagree"1. Section C is an achievement test, made up of 10 test items from past WAEC examination questions which covered different areas (topics) on evolution, origin of life and natural selections.

To determine the reliability of the instrument, Cronbach alpha method of reliability was employed for the questionnaire in Section B. The reliability coefficient of the instrument of 14 items was calculated and was found to be 0.7321. Kuder – Richardson 20 method was employed to determine the reliability of the ten test items in Section C, reliability coefficient was calculated and found to be 0.7000.

In the administration of the instrument, the researcher employed two assistants. The researcher trained and instructed the research assistants to request permission from each school authority, precisely the principal. They were to administer instruments to students during Biology class periods. After the training of assistants, the researcher allocated some of the selected secondary school in Etsako to each research assistants, while the researcher covered Oredo and Ikpoba Local Government Area of Edo state. On reaching each school and seeking permission, instruments were administered. In different occasions, the researcher and assistants had to visit some schools twice because in their previous visits to such schools, the students were all not available and in other occasions the class period for Biology had to be rescheduled, so all students could participate. Researchers administered the instruments to each student and they were collected by the researcher in all the centers visited. The whole process of instrument administration and data collection lasted for three weeks.

Data were analyzed using different statistical statistics. The research questions were answered using descriptive statistics such as mean and standard deviation. However, the hypotheses were tested using a Two-way Analysis of Variance determine whether there are any statistically significant differences between the means of two or more independent groups and Chi-square statistics was used to tests for independence of variables. All hypotheses were tested at, 0.05 level of significance.

## Results

*Presentation of Results based on Student's Religious Groups*

A graphical representation of participants by religion is shown in figure 1.

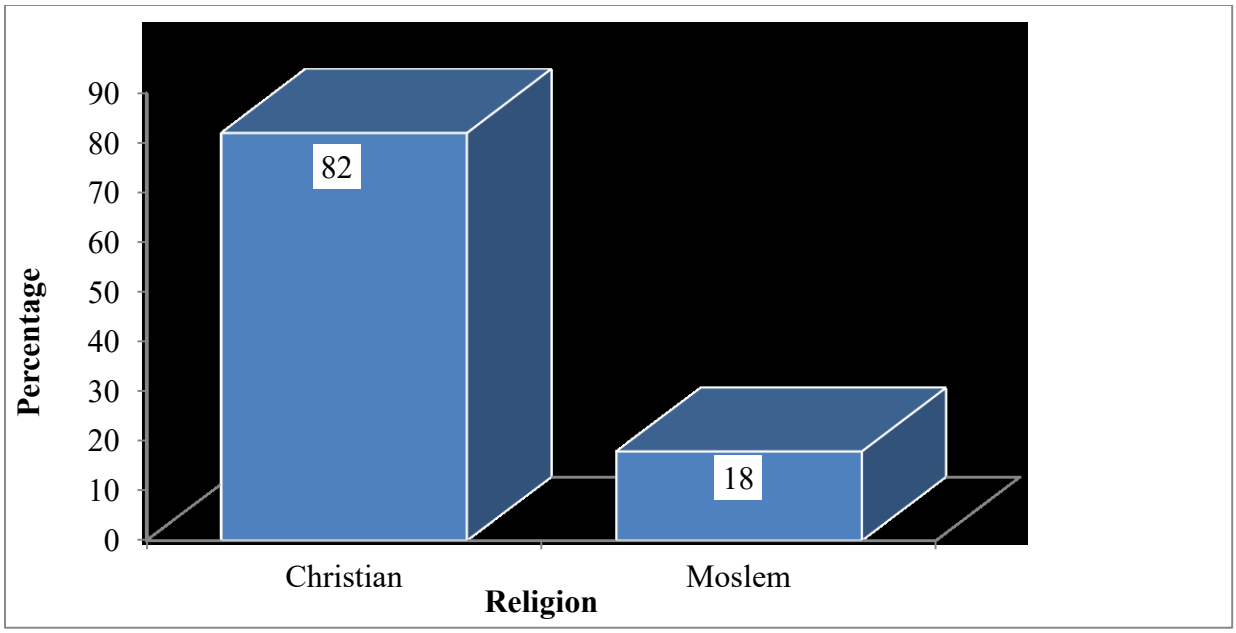


Figure 1: Pictorial presentation of the sample by religion.

$H_{o1}$: There is no significant difference in the views of evolution or creationism held by students of different religious beliefs.

To answer the questions on the student's perceptions of the concept of evolution and creationism, the following guidelines were adopted for the items on section B which is the questionnaire. An item on the questionnaire is either on evolution or creationism. If an item is on evolution, and a student Strongly Agree or Agree, such a student is considered to have positive view of evolution and in the contrary negative view of creationism. Similarly, for an item which is specifically on creationism, a student who Strongly Agree or Agree is said to have positive view of creationism and in the contrary negative view of evolution. Students were thus categorized as having positive, negative or neutral views.

The results of the data collected showing participants views of evolution and creationism based on religious beliefs is presented in the table 2.

*Table 2: Respondents views of Evolution and Creationism based on religious beliefs*

| | | Creationism | | Evolution | |
|---|---|---|---|---|---|
| **Views** | **Religion** | **Frequency** | **Percent** | **Frequency** | **Percent** |
| Positive | Christian | 194 | 47.20 | 118 | 28.70 |
| | Muslim | 51 | 12.40 | 16 | 3.90 |
| Negative | Christian | 118 | 28.70 | 194 | 47.20 |
| | Muslim | 16 | 3.90 | 51 | 12.40 |
| Neutral | Christian | 23 | 5.60 | 23 | 5.60 |
| | Muslim | 9 | 2.20 | 9 | 2.20 |

Results from table 2 show that more Christian and Muslim students (194 or 47.2% and 51 or 12.4% respectively) hold positive view of creationism than evolution (118 or 28.75 and 16 or 3.9% respectively). By implication more Christian and Muslim students hold negative view of evolution than creationism.

To test if the views of Christian and Muslim students on creationism and evolution are significantly different, Chi-square test for independent statistics was carried out. The results of the analysis are summarized on table 3.

*Table 3: Chi-Square test for hypothesis one based on religious belief*

| | **Value** | **df** | **Asymp. sig (2 sided)** |
|---|---|---|---|
| Pearson chi-square | 6.665 | 2 | 0.36 |
| Likelihood Ratio | 6.862 | 2 | 0.032 |
| Linear – by- linear Association | 6.862 | 1 | 0.010 |
| N of valid cases | 411 | | |

Result on table 3 show a Pearson Chi-square of 6.67, significant at 0.036. Since 0.036 is smaller than 0.05, the result is significant. Therefore, the hypothesis of no significant difference is not retained. This means that there is a significant difference in the proportion of students of different religious groups with positive views of evolution or creationism. From the descriptive statistics results, the proportion of Christian student with positive view of creationism or negative view of evolution is higher than the Muslim students.

$H_{o2}$: There is no significant difference in performance on the test of evolution by students of different religious groups with different views of evolution or creationism.

Similarly, the performances of students of different religions groups were analyzed and a summary of the performance is presented in Table 4.

*Table 4: Performances of students of different views of evolution, by religious group. Dependent Variable: Achievement Score*

| **View Evolution** | **Religion** | **Mean** | **Std. Deviation** | **N** |
|---|---|---|---|---|
| Positive view | Christian | 4.28 | 2.525 | 118 |
| | Muslim | 6.00 | 2.852 | 16 |
| | Total | 4.49 | 2.615 | 134 |
| Negative View | Christian | 3.75 | 2.675 | 194 |
| | Muslim | 5.18 | 2.447 | 51 |
| | Total | 4.04 | 2.688 | 245 |
| Neutral View | Christian | 4.04 | 2.286 | 23 |

| | | | | |
|---|---|---|---|---|
| | Muslim | 4.11 | 1.691 | 9 |
| | Total | 4.06 | 2.109 | 32 |
| Total | Christian | 3.96 | 2.603 | 335 |
| | Muslim | 5.22 | 2.491 | 76 |
| | Total | 4.19 | 2.626 | 411 |

Table 4 shows that in general, the views of the Muslim students in the different groups seem to have performed better with mean score of 6.00 than the Christian students with mean score of 4.28 in the positive view of evolution. Attempt was then made to determine if the impact of the views of evolution on the students of the two religious groups was significant. A summary of the result of the analysis is presented on table 5.

*Table 5: ANOVA Summary on Hypothesis 2 based on religious group. Dependent Variable: Achievement Score*

| **Source** | **Type III Sum of Squares** | **Df** | **Mean square** | **F** | **Sig.** |
|---|---|---|---|---|---|
| Corrected model | 141.545[b] | 5 | 28.306 | 4.269 | 0.001 |
| Intercept | 2989.968 | 1 | 2989.968 | 450.891 | 0 |
| View of Religion | 26.452 | 2 | 13.226 | 1.995 | 137 |
| Gender | 41.343 | 1 | 41.343 | 6.235 | 0.013 |
| Views of Evolution/Religion | 12.822 | 2 | 6.411 | 0.967 | 0.381 |
| Error | 2685.652 | 405 | 6.631 | | |
| **Total** | **10042** | **411** | | | |
| Corrected Total | 2830.852 | 410 | | | |

Results from table 5 revealed a statistically significant mean effect for religion F (1, 405) = 6.235; p = 0.013; however, the effect size was small (partial eta square = .015. The mean scores for Moslem students were higher than those for Christian students. The mean effect of view of evolution F (2, 405) – 1.995; p = 0.137 and the interaction effect F (2, 405) = 0.967; p = 0.381 did not reach statistical significance. Hence there is no significant difference in the performance on the test of evolution by students of different religious groups with different views of evolution/creationism. Therefore, the hypothesis of no significant difference is retained.

*Presentation of Results based on Student's Christian Religious Sects*

Today in Nigeria, there are many different Christian religious groups. Consequently, it was necessary to consider the views and performances of students from different Christian Sects.

The graphical representation of participants by Christian religious sects is shown on figure 2.

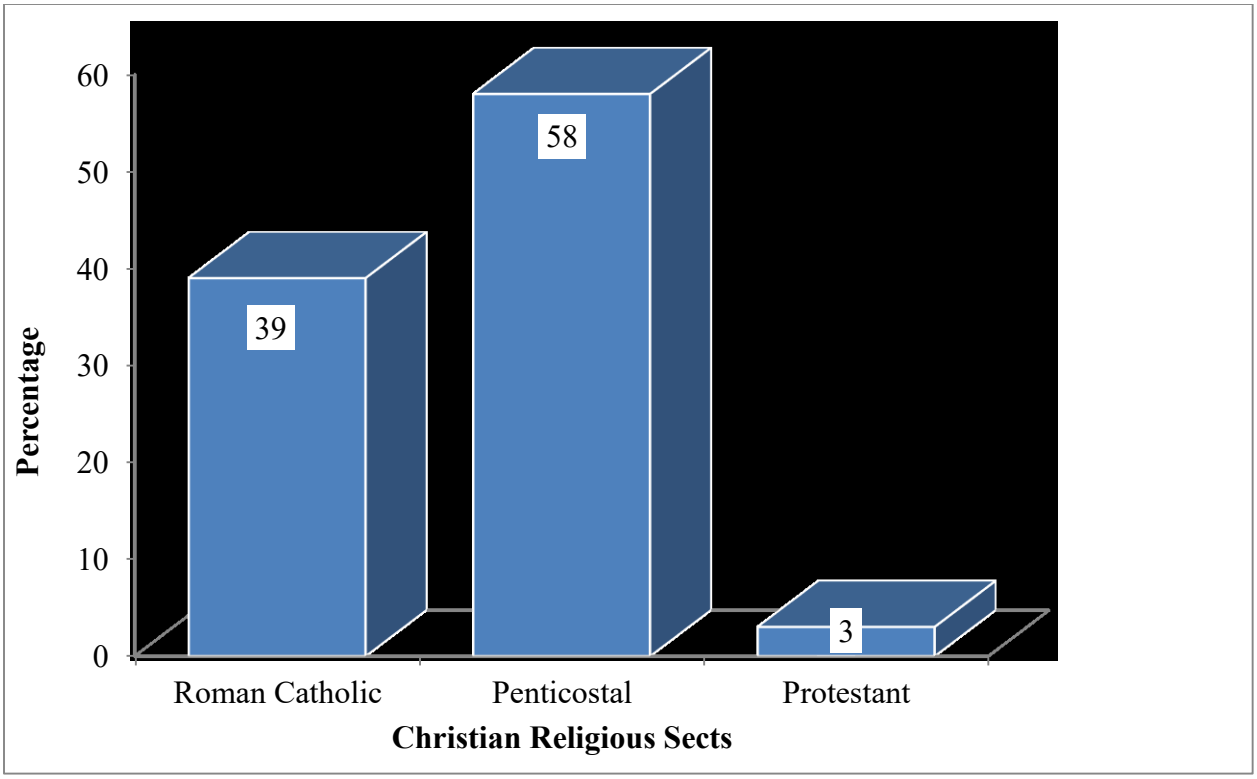


Figure: 2: Pictorial distribution of student Christian Religious sect.

$H_{o3}$: There is no significant difference in performance on the test of evolution by students of different religious Christian sects with different views of evolution or creationism.

The performances of students of different religions sects were analyzed and a summary of the performance is represented in Table 7.

*Table 7: Performance of Students of different views of evolution, based on religious sect. Dependent Variable: Achievement Score*

| **Views of Evolution**<br>**Christian Religious Sect** | **Mean** | **Std. Deviation** | **N** |
|---|---|---|---|
| **Positive View** | | | |
| Roman Catholic | 3.81 | 2.736 | 43 |
| Pentecostal | 4.72 | 2.44 | 64 |
| Protestant | 4.33 | 0.577 | 3 |
| Total | 4.35 | 2.554 | 110 |
| **Negative View** | | | |
| Roman Catholic | 3.26 | 2.506 | 73 |
| Pentecostal | 4.13 | 2.781 | 105 |
| Protestant | 3.14 | 2.116 | 7 |
| Total | 3.75 | 2.677 | 185 |
| **Neutral View** | | | |
| Roman Catholic | 4.13 | 2.416 | 8 |
| Pentecostal | 3.69 | 2.323 | 13 |
| Protestant | 6 | | 1 |
| Total | 3.95 | 2.299 | 22 |
| **Total** | | | |
| Roman Catholic | 3.51 | 2.58 | 124 |
| Pentecostal | 4.31 | 2.641 | 182 |
| Protestant | 3.73 | 1.902 | 11 |
| **Total** | 3.97 | 2.618 | 317 |

Results from table 7 seems to support the fact that Pentecostal (4.33) with different views performed better than Roman Catholic (3.81) and Protestants (4.33) except for Protestants with neutral view of evolution. The impact of the views of evolution and religious sects on students' performance was determined through a two-way between-groups analysis of variance. The summary of the results is shown in table 8.

*Table 8: ANOVA Summary on Student' Performance on view of Evolution.*
*Dependent Variable: Achievement Score*

| Source | Type III Sum of Squares | Df | Mean square | F | Sig. |
|---|---|---|---|---|---|
| Corrected model | 89.993[b] | 8 | 10.874 | 1.611 | 0.121 |
| Intercept | 796.058 | 1 | 796.058 | 117.946 | 0 |
| View of Evolution | 15.067 | 2 | 7.533 | 1.116 | 0.329 |
| Sect | 8.223 | 2 | 4.112 | 0.609 | 0.544 |
| View of view of Evolution/Sect | 14.738 | 4 | 3.685 | 0.546 | 0.702 |
| Error | 2078.805 | 308 | 6.749 | | |
| **Total** | **7174** | **317** | | | |
| Corrected Total | 2165.798 | 316 | | | |

The mean effect of view of evolution from table 10 show that F (2,308) = 1.116; p = 0.329; religious sect F (2,308) = 0.609; p = 0.544 and the interaction effect F (4, 308) = 0.702 did not reach statistical significance. Therefore, there is no significant impact of views of evolution on Roman Catholics, Pentecostals and protestant Christian students' performance achievement in test on evolution. Christian students of different religious sects have higher positive views of creationism than evolution. However, the Pentecostal Christian religious sects have the highest positive views (23.0%) of creationism, more than the Roman Catholic (23.0%) and protestant (2.2%). Results from Pearson Chi-square test show a value of 0.984 which is not significant at 0.05. Though this study established no significant difference in the performances of the Christian students in the different religious sects, it is however fundamental to emphasize that the student's perception can influence their attitude negatively toward the concept of evolution.

## Discussion

The proportion of Christian student (194 or 118) with positive perceptions of creationism or negative perception of evolution is higher than the Muslim students (51 or 16) with positive view of creationism or negative perception of evolution. The Chi-square test for independent statistics, showed a significant difference of 0.036, in the perceptions of students of different religious beliefs on evolution and creationism. These means that, religious beliefs can determine student's perceptions of evolution and creationism. This result reveals that religion (Christian/Muslim) play a very important role in learning the concept of evolution. The significant difference recorded in the high proportion of students of different religions groups on evolution/creationism is an indication that student's religion cannot be ignored. This result is consistent with the findings of Ingram & Nelson (2005) who said that "students and others may believe that accepting evolution necessarily means that they reject God. The majority of

participants in our study report religions identification; they might resist evolutionary thinking for fear renouncing their religious beliefs." The point is therefore evident that, the religion of an individual (student), determine their perception of the concept of evolution.

It was observed that Moslem students performed better than the Christian students in the test items as revealed in the analysis. Statistically, the difference is significant for religion but effects size is small. However, the main effect of perception of evolution did not reach statistical significance. Similarly, Pentecostal Christian students seemed to perform better than Roman Catholic and Protestants students. The two-way between groups ANOVA revealed no significant difference. Therefore, there is no significant differences in the performance on the test of evolution by students of different religious groups and Christian sects with different views of evolution or creation. This mean that student's religion and Christian religious sect with different views of evolution and creationism does not determine their performance on tests of evolution.

The non-significant difference recorded in the analysis result is consistent with Ingram & Nelson (2005), who stated that, student's initial acceptance or rejection of evolution and of various tenets of evolution does not strongly influence achievement. In other words, student can succeed in an evolution course even if they enter the course rejecting its content as in Lawson (1983) and Mc Keachie et al (2002). They stated that; students must experience cognitive dissonance in a course that challenges their fundamental beliefs or attitudes, possibly resulting in lower achievement. For students not experiencing conflict regarding evolution, whether they accept or reject the theory, their acceptance maybe rote or influenced by an authority figure, rather than carefully reasoned or fully developed (Jackson et al, 1995; Lawson & Weser 1990). Combining these results, we suggest that student's acceptance of evolution only slightly affects their achievement and the effect is not significant. Ingram & Nelson (2005) where disappointed to find that student's acceptance of evolution sometimes shifted toward greater acceptance of evolution even in students eventually earning low final grades. These results confirming the reported disconnection between acceptance of evolution and understanding of evolution (achievement) (Bishop & Anderson, 1990; Lord & Marino, 1993). Acceptance or rejection of evolution does not have to be a significant influence on student's achievement in evolution.

*Conclusion*

This study was designed to assess secondary school biology student's perception of the concepts of evolution; Implication for learning and achievement. This study based on data collected and analyzed has found the following conclusion:

- ✓ The proportion of Christian student with positive perceptions of creationism or negative view of evolution was higher than the Muslim students with positive view of creationism or negative view of evolution. However, the results show that more Christian and Muslim students hold positive perceptions of creationism than evolution. By implication more Christian and Muslim students hold negative perception of evolution than creationism.
- ✓ It is observed that Muslims performed better than the Christian students in the test items as revealed in the analysis. The two-way between groups ANOVA revealed no significant difference. Therefore, there was no significant difference in the performance on the test of evolution by students of different religious groups.
- ✓ Though the Pentecostal students performed better than the Roman Catholic and Protestant students in the test on evolution, the two-way ANOVA results also showed that the differences were not significant. Therefore, there was no significant difference in the performance on the test of evolution by students of different Christian religious sect with different views of evolution or creation. This means that students' Christian religious sects with different perceptions of evolution and creationism does not determine their performance on tests of evolution.

*Recommendations*

Evolution presents one of the most socially controversial topics in the college of science curriculum. Students may come to topics containing evolution with negative attitudes toward the theory, and the instructors may believe that such attitudes will be detrimental to learning. Yet initial negative attitudes toward evolution, particularly rejecting evolution need not automatically lower achievement.

Evolution will be a good topic in the agenda of science teachers' workshop, and seminars, where teachers can be taught how they should encourage student to examine beliefs, attitudes, encourage critical thinking and knowledge in light of both evidence for evolution and consequences of accepting evolution. Teachers should help students to construct well-supported explanations for issues they encounter in the topic.

Finally, the teacher should understand that the important thing is for the student to understand evolution than accepting evolution. Students should be encouraged to strive for understanding prior to making decision regarding acceptance of any theory regardless of individual attitudes. Students who understand evolutionary principles often will make more appropriate choice in biological questionable situations than those who accept evolution but do not understand it.

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