



Biology Students' Religious Beliefs: A Hidden Variable Learning of Evolution.

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ABSTRACT:- This paper focuses on the influence of biology students' religious beliefs on the learning of the topic of evolution in selected secondary schools from Kakamega Central Sub-County, Kakamega County, Kenya. The study adopted a cross-sectional descriptive survey research design. The target population was 210 form four biology students. Proportionate stratified random sampling was used to select 10 schools; the number of respondents per school was selected proportionately while individual participants from each school were sampled by systematic random sampling. Pilot study was conducted in three secondary schools. Data was collected using a questionnaire and an achievement test. Data analysis was done using both descriptive and inferential statistics using SSPS program. Results revealed that beliefs that are of religious nature have a big influence on the way students learn evolution due the fact that both religion and evolution attempt to explain the origin and diversity of life. The study recommends that biology teachers should strive to establish students' religious backgrounds prior to commencing instruction of evolution so as to help them learn evolution without infringing on their religious orientations. Further, students need to be made to understand what science is capable of addressing as well as the limitations of science.

(Keywords:- Evolution, Religious beliefs, Influence learning, Biology)

I. INTRODUCTION

Beliefs refer to a subjective way of knowing since they are not based on evaluation of evidence. As such, they are considered as personal truths as opposed to knowledge which is used to refer to justified "true" belief (Siegel, 1998) [1]. Thus, to qualify knowledge, a proposition must be thought to have some sort of correspondence to reality and there must be valid reasons that justify that proposition (Smith, Siegel and McLnerney, 1995) [2]. Beliefs are the best indicators of decisions people make in their lives (Mansour, 2008) [3]. They also help develop value system of the person that guides his life behaviours (Ajzen, 1985) [4]. Haury (1998) [5] established that belief systems of students and even adults are usually the result of several sources or origins of knowledge while Dagher and Boujaoude (2005) [6] established that the notable sources of high school student beliefs are: innate knowledge which is gained from inner feeling of knowing what is absolutely true; revelation or epiphany, a process which involves gaining knowledge through a sudden awakening of the truth; mysticism which concerns beliefs gained through some mystical sources; and more notably empiricism, which concerns gaining knowledge through practical experiences and observations.

This implies that beliefs are not context-free. Calderhead (1996) [7] notes that teachers' beliefs and the context in which their beliefs are developed and used should be taken into considerations in order to have a better understanding of how teaching and learning occurs in classrooms and thus can be enhanced. The same argument can be extended to students with a view of understanding how learning occurs and therefore how it can be enhanced. This means we have to take into account the contextual factors that have shaped and formed certain beliefs. There is evidence that personal-religious experience is one of the most influential social factors on how science teachers gain new experience or even interpret these experiences [3]. Distinguishing between individual religious beliefs based on the 'Holy scripture and the sayings of God's Prophet' and personal religious beliefs which the individual forms through his life experience is vital [3]. These findings concur with those of earlier studies on student alternative conceptions and conceptual change which contributed to the realization that the rationality commonly ascribed to inquiry in science learning is subject to other factors that determine how humans integrate knowledge from different sources into their conceptual framework. These

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factors are not necessarily rational but are rooted in a “cluster of prior ideas , beliefs, values, and emotions that serves as the initial set of interpretive categories and it is the potential match between these existing cognitive commitments and the new information which determines how a the student will respond to the instructional inputs” (Dagher and Boujaoude, 1997) [8].

Many topics included in science education are acknowledged as controversial, for example, evolution, cloning, abortion and genetic engineering [3]. Evolution in particular has long been a controversial topic in schools because of its intersection with religious beliefs and not being appropriately addressed in instruction (Kose, 2010) [9]. A study in USA [5] citing Demastes, Settlege, and Good, (1995) [10] reported that whether one surveys high school students, college students, teachers or school administrators, findings revealed many misunderstanding regarding evolution and substantial acceptance of pseudoscientific ideas. Forbes (2001) [11] asserted that the topic of evolution in USA generates socio-political response which makes many teachers afraid to teach scientific evolution in high school. These results indicated that many high school students lacked adequate exposure to or understanding of evolution. Other studies by Sadler (2005) [12] and Moore (2005) [13] indicate that entering college students carry many misconceptions about evolution with them from previous schooling. It is therefore reasonable to presume that if college students are confused about the theory, the majority of high school students are equally ignorant of the details of evolution.

Students must graduate from schools with better understanding of science and how it proceeds (Loving and Foster, 2000) [14]. At the same time, students should have values, morals and ethics so that they can use this science for the benefit of their societies [3]. This is because religion has become the keeper of values that translate into the building blocks of secular society. Science, for its part has removed many unknowns and the unknowable and has pushed back the frontiers of knowledge in ways that challenge the mystery in many religious explanations, (Katz, 2002) [15]. Given the fact that evolutionary theory is central to and a unifying theme of the discipline of biology, the controversial intersection with religious beliefs is a good content area in the study of influence on learning.

A lot of research delving into topic evolution and religious beliefs has been conducted. A study carried by Lawson and Worsnop (1992) [16] revealed that the degree of students' religious commitment is negatively correlated with their belief in evolution. Study investigated students' conceptual ecologies as they related to learning of evolutionary theory and identified religious orientations as one of the critical conceptual ecology [10]. Research has shown that students expressed their objections to the theory of evolution in terms of one or more of the following types of arguments involving: conceptual difficulties, extra-scientific explanations and interpretations of the nature of religion [8]. Downie and Barron (2000) [17] observed that students' rejection of evolution correlated strongly with their religious beliefs. Similarly, Sinatra, Southland and McConaughy (2003) [18] found that students who perceived conflict with their religious beliefs were more likely to express resistance to the conclusions of evolution. Reports indicate there was hesitancy of students to accept the theory of evolution due to religious beliefs [13]. Pazza, Pierre and Karine (2009) [19] observed that students used religious beliefs to reject the theory of evolution. These studies demonstrate that the learning or acceptance of evolution is influenced by the students' religious beliefs.

In contrast, other studies have indicated that the relation between knowledge and belief is less clear-cut than it appeared. Dole, Sinatra, and Reynolds (1991) [20] found no relation between students' stated belief in creationism and their ability to understand a text on evolution. Lord and Marino (1993) [21], and Bishop and Anderson (1990) [22] [10, 18] found no relation between students' stated acceptance of some statements that had a religious dimension and their understanding of biological evolution. These points of view warrant further investigations.

This paper, therefore, focused on how Kenyan biology students respond to these viewpoints and/or debate in regard to the topic of evolution given that most of these studies on science and religion have been carried out in united states of America and European countries [3]. This past researches focused on the religious beliefs and acceptance or rejection of evolution theory. Most of the Kenyan population belongs to either Christianity (80%) or Islam (10%) religions (Kenya-patheos) [23]. Both religions and evolution attempt to explain the origin and diversity of life. It is instructive to note that students join high school with some form of religious explanations about the origin of life. Given this kind of scenario it is important to investigate the role of religious beliefs on learning of evolution.

II. METHODOLOGY

2.1. Research Design

The study adopted a cross-sectional descriptive survey research design. The design was appropriate for the study because it facilitated coverage of a large section of the target population and study area.

2.2. Sample and Sampling Procedures

This survey was carried out on form four students (n=210) studying evolution which is covered as a section of biology at high school level. This was because the topic of evolution is covered within the fourth year of the secondary school education. The sample comprised 105 boys and 105 girls from 10 schools out of 42 schools different status (public or private), categories (county or sub-county) and types (boys, girls or mixed) . Proportionate stratified random sampling was used to select the schools. Simple random sampling was applied to select one sub-county girl's, 5 sub-counties mixed and one private school from each of their sub-groups. The number of respondents per school was selected proportionately in line with the numerical strength of the form four biology students in each of the sampled schools. Individual participants from each school were sampled by systematic random sampling.

2.3. Data Gathering Tools

The instruments were piloted to establish their validity and reliability. Three experts were consulted to assess the validity of the tools while the split half method was used to collect data to ascertain the reliability. The results were analyzed using Pearson product moment of correlation to determine the reliability coefficient. Internal consistency was examined using Cronbach's alpha values.

Data was collected through utilizing a questionnaire and an achievement test. The questionnaire consisted of two parts: Part I gathered demographic information of the students. Respondents were required to tick in the appropriate box indicating their gender, school type and religion; Part II consisted of 7 survey items to gauge the students' religious orientations in relation to evolution. They were based on a Likert scale of "strongly disagree" with a score of 1 to "strongly agree" with a score of 5. The achievement test had 20 multiple choice items on evolution adapted from Cotter (2007) [24].

2.4. Data Analysis

The data collected was the analyzed using both descriptive and inferential statistics. Descriptive statistics consisted of frequencies and percentages. Chi-Square test of independence at a critical level of $p=0.05$ (5%) was used to test for association between the variables.

III. RESULTS

The respondents' demographic information included their gender, school type and religion. Table 1 summarizes the demographic characteristics of the students sampled in the study in terms of gender, religion and type of school.

Table 1. Demographic profile of respondents

Gender	(N)	(%)	Religion	(N)	(%)	Type of School	(N)	(%)
Male	105	50	Christian	190	90.5	Mixed	5	50
Female	105	50	Muslim	20	9.5	Boys	2	20
						Girls	3	30
Total	210	100		210	100		10	100

Tables 1 indicate that the students sampled in this study were equal in terms of gender (50% female and 50% male). In terms of religion, majority of the students were Christians (90.5%) and only 9.5% were Muslims. Most of the schools in the sample were co-educational schools. This is because 50% of the schools sampled were mixed schools while 30% and 20% were girls' and boys' schools respectively.

Students were given several religious propositions and they were asked to indicate their attitudes towards the statements by choosing from strongly disagree to strongly agree scale. Table 2 shows the perception of students and their religion status on different aspects of evolution.

Table 2: Students' perception of religious beliefs on evolution.

Survey Item	SD	D	UD	A	SA	N=100
	%	%	%	%	%	%
1. Evolution is God's way of diverse making organisms	17	22	5	27	29	100
2. Teaching evolution is an attempt to remove God from our society	11	14	5	20	50	100
3. Evolution conflicts with my religious belief of origin of man.	9	13	3	39	36	100

4. God created the universe and living things as is in the Bible/ Quran	4	2	4	28	62	100
5 God made all living things, but has allowed some small scale evolution to take place.	23	17	10	27	23	100
6. Religious teachings are the principal source of my views on the of life on development earth.	6	16	8	32	38	100
7. Someone can accept the validity of the theory of evolution and also believe in God.	8	10	6	40	36	100

SD=Strongly Disagree, D=Disagree, UD=Undecided, A=Agree, SA= Strongly Agree

The findings from Table 2 show that 56% of the students perceived that evolution was not God's way of making diverse organisms. Majority (70%) of students did perceive that teaching evolution was an attempt to remove God from society while 75% indicated that evolution conflicted with their religious beliefs on the origin of man. An overwhelming proportion (90%) of the students were in agreement that it was God who created the universe and all living things as is written in the Bible/ Quran. However, Students who agreed and those who disagreed with the perception that God made all living things, including humans, but had allowed some small scale evolution to take place were almost equal; 50% and 40% respectively. Religious teachings were accepted by most (70%) of the students to be the principal source of their views on the development of life on earth. Most (76%) of the students were in agreement that someone could accept the validity of the theory of evolution and also believe in God at the same time.

There was need to establish whether there was any association between students' religious beliefs and learning of evolution. Chi-square tests were performed and the findings are as indicated in Table 3.

Table 3: Association between students' religious beliefs and learning of evolution

Chi-Square	df	Asymp. Sig.
24.133^a	6	0.000

The findings in Table 3 show that the test yielded significant results. The large Chi-Square value 24.133^a and its small associated significance value 0.000 indicate that the variables are not independent. In general, the large chi-square value and its associated small significance level 0.000 revealed that the results were significant at 5% level and which implies that religious beliefs had a significant influence on students' understanding of evolution.

IV. DISCUSSION

According to the findings in Table 2 the students who held the view that evolution was God's way of making diverse organisms and those with contrary views were almost equal (56% and 44% respectively). This could be accounted for by the fact that this religious belief is like a two-edged sword that appreciates God on one side and on the other side explains or accounts for biodiversity. Therefore this belief is a meeting point between religious perception and the process of evolution as observed or viewed through biodiversity across the world. According to National Academy of Sciences (NAS, 1998) [25], many people believed that God works through the process of evolution. Thus God has created a world that is ever changing and a mechanism through which creatures adapt to environmental changes over time.

The findings in Table 2 indicated that a majority (70%) of the students thought that teaching evolution was an attempt to delink the society from God. This could be explained by the fact that most of the information or knowledge as expressed in the study of evolution is contradictory to that found in most religious textbooks like the Bible and the Koran. This might have made most students to be discouraged from learning what seems to be against the holy writings as contained in the holy books of God. Hence the students could have developed the fear that learning evolution might eventually make them to slide away from God. This is in line with study findings of Blackwell, Powell and Dukes (2003) [26] who reported that some religious conservatives held the notion that teaching of evolution is associated with a decline in moral values in the society.

Up to 75% of the students believed that evolution as a topic conflicted with their religious beliefs and this belief might have had a negative influence on their willingness to learn evolution. This could be accounted

for by the fact that most of the academic materials covered in evolution were not in line with religious beliefs as portrayed by the writings from the holy books like the Bible and Quran. While it is expected that students possess incoherent or alternative conceptions about almost any science topic, it is documented that students who perceive conflict with their religious beliefs are more likely to express higher resistance to the assumptions and conclusions of evolution theory [18].

An overwhelming number of students (90%) held the belief that God made all living things as was written in the Bible/Quran. This could be accounted for by the fact that a majority of students absolutely believed in the theory of special creation which does not support any other ideas about creation covered during the study of evolution as expressed in the biology. This was further accounted for by the fact the Bible and the Quran are some of the earliest sources of knowledge in the students' life. This made most students to hold more strongly on religious teachings at the expense of other sources like the study of evolution as specified in the biology syllabus. This is in line with the findings that religious orientations influence the students' perception on the origin of life at an early age [10]. Researchers [6, 17, 18] further noted that students used religious beliefs to reject the theory of evolution since they believed that creation of God was all perfect and did not spontaneously evolve.

Only 50% of the students indicated agreement with the assertion that God made all living things, including humans, but has allowed some small scale evolution to take place. This could be because students thought one belief should support the other otherwise they should not believe in it. This is consistent with the views of Lawson and Weser (1990) [27] who found that religious beliefs which were counter to scientifically accepted theories were difficult to alter and many students did not have the reasoning skills needed for complex evidences and arguments presented by evolutionary theorists.

Religious teachings were accepted by most (70%) of the students to be the principal source of their views on the development of life on earth. Given the fact that students in this study were either Muslims or Christians they were exposed to religious teachings on creation at an early age and this had formed the basis of their knowledge on the origin and diversity of life. This concurs with the findings that religious orientations influence the students' perception on the origin of life at an early age [6, 18]. Evolution is taught at form four levels when the students' conceptual ecology for origin of life has been formed based on religious orientations [10].

A high proportion of students (76%) felt that someone could accept the validity of the theory of evolution and also believe in God. These students can be described as gradual creationists and progressive evolutionists who hold a dualist view of evolutionary theory. This is an attempt to bridge religious beliefs with their knowledge of the logic of science. In taking this step the students gain the ability to examine two seemingly opposing views, evolution and religious beliefs, gain knowledge about one without rejecting the other. This is consistent with the views expressed by Smith and Scharmann (1999) [28]; Scharmann and Block (1992) [29]; and Nelson (1986) [30].

V. CONCLUSION

Therefore, on the basis of these findings, it can be concluded that religious beliefs has an effect on how the students perceive evolution. Beliefs that are of religious nature have a big influence on the way students learn evolution due the fact that both religion and evolution attempt to explain the origin and diversity of life. Several conflicts exist in students' perception of the theory of evolution as result from differences in their perceptions of the relationships between science and religion.

In science, evolution has been determined to be the best explanation of what we observe in our biological world. However no other topic challenges the belief paradigms of our students as does evolution [11]. This is because evolution has long been known to be a controversial topic in schools because of its intersection with religious beliefs. It is incumbent upon science educators to ensure that their teaching is true to the nature of science so that students have an adequate understanding of evolution.

Religious beliefs does shape the ways students perceive things around them. From this study it is evident that it also had an effect on the learning of evolution. This requires consideration to be made while teaching evolution in classroom because religious beliefs held by students will in one way or another affect their understanding of evolution. Teachers must recognize and respect the students' current belief systems concerning the origins of life and evolution. This is because teaching evolution requires that teachers effect a change in the conceptual thinking of students prior to beginning instruction.

Biology teachers should strive to establish students' religious backgrounds prior to commencing instruction of evolution. This will help the teacher to make students learn without infringing on their religious

orientations. Further, students need to be made to understand what science is capable of addressing as well as the limitations of science. They must understand and recognize that science is but one valuable form of human inquiry as is theology. There does not need to be any conflict between these domains; science is a human process and religion explains what keeps and makes us human [15]. This will lead to expansion of their belief systems since it is possible to understand evolution without significant incorporation into one's belief.

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