Quest Journals
Journal of Research in Humanities and Social Science
Volume 3 ~ Issue 10 (2015) pp:33-41
ISSN(Online) : 2321-9467
www.questjournals.org

Research Paper

Biology Students' Perceptions towards Evolution: Case of Teaching Techniques and Its Influence On Learning In Kakamega Central Sub-County, Kenya

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Received 11 October, 2015; **A**ccepted 20 October, 2015 © The author(s) 2015. Published with open access at **www.questjournals.org**

ABSTRACT:- The learning of evolution topic in biology has posed challenges in secondary schools, Kenya. This study explored secondary school students' perceptions on some teaching techniques as well as the influence of perceptions on performance as relates to evolution in Kakamega Central Sub-County. The objectives of the study were: (1) to determine the students' perceptions on some of the techniques used in teaching evolution and, (2) to establish the extent to which students' perceptions on selected sub-concepts of evolution influence learning. Two hundred and ten form four biology students were asked to complete a questionnaire addressing (1) the demographic data, (2) their perceptions on selected teaching techniques, (3) their perceptions on selected sub-concepts of evolution. Students also attempted an achievement test on evolution. The instruments were piloted to establish their validity and reliability. Descriptive statistics consisted of frequencies and percentages presented in tables to organize the samples' characteristics. Inferential statistics Chi-Square test of independence at a critical level of p=0.05 was used to test for association of variables, students' perceptions and learning of evolution. The findings showed that student-centered teaching techniques were favoured by most students though some were rarely used and that there was an association between students' perception and learning of evolution.

Key: Evolution, Learning, Student Perceptions, Teaching techniques

I. INTRODUCTION

Taylor, Green and Stout (2012) define evolution as the development and eventually emergency of differentiated organisms from pre-existing less differentiated organisms over a long period of time. They further assert that evolution is the critical foundation of all biological thought because it explains the origins of life and origin of species, their modifications and even extinction. This is besides accounting for variability, adaptations and distribution of organisms. It also gives reasonable explanations for the many peculiarities in organisms and body structures. It is against this background that the quality of science education is compromised when the topic of evolution is omitted, mitigated or marginalized.

All over the world, the learning of evolution as a branch of science has been a challenge to scholars. This is because the study of science is expected to involve evidence-based process of exploring the integrity of science studies (Hokayem and Boujaoude, 2008). This integrity is challenged in the study of evolution due to the application of non-empirical evidence like pseudoscience, paranormal and religious explanations as a legitimate alternative to evidence-based explanations.

Unlike other biology topics, evolution is a topic that generates a sociopolitical response that frequently interferes with the effectiveness of teaching and learning processes (Forbes, 2001). This is because teaching evolution requires that teachers effect a change in the conceptual thinking of students prior to beginning instruction. At the same time, the teachers must recognize and respect the students' current belief systems concerning the origins of life and evolution (Nieswandt and Bellomo, 2009). This means that the teachers of evolution need to understand the students' perception of evolution and the basis of their belief system.

A lot of research delving into the effectiveness of teaching techniques has been conducted by educationists. The results of these studies have been varied. For instance the findings by de Caprariis, Barman,

and Magee (2001) suggested that lecture method leads to the ability to recall facts, but discussion produced higher level of comprehension. Further, research on group-orientated discussion methods has shown that student-led discussions not only produced favorable student performance outcomes, but also foster greater participation, self-confidence and leadership ability (Albert, Osman and Yungungu, 2014;Yoder and Hochevar, 2005). Hunt, Haidet, Coverdale and Richards (2003) examined student performance in team learning methods and found positive learning outcomes as compared to lecture-based methods. In contrast to these findings, Barnes and Blevins (2003) suggested that discussion-based methods were inferior to lecture-based method.
Students' preferences for teaching methods have also been examined. A study by Qualters (2001) found that students do not favor active learning methods because of the time taken by the activities and fear of not covering all the material in the course. In contrast, Casado (2000) examined perceptions across six teaching methods: lecture/discussion, laboratory work, in-class exercises, guest speakers, projects and oral presentations. Students most preferred lecture/discussion method. Laboratory work, oral presentations and projects were also favorably regarded.

Teaching about evolution in high school biology poses a pedagogical predicament to teachers. This has resulted in the use some teaching techniques that have had a profound effect on understanding of evolution. KNEC (2008) indicated that the current instructional techniques have contributed to students' poor performance and have reduced the interest in secondary school biology. Several researchers have observed that employment of ineffective teaching techniques contributed to lack of conducive environment that will enable the students to have mastery of the scientific concepts (Kossack, 2008; Catley, 2006). Wekesa, Kiboss and Ndirangu, (2006) singled out expository teaching techniques as the ones commonly used in Kenya for science instruction. The expository techniques involve the teacher spending most of the time giving verbal explanation in form of talk and chalk while the students listen and write notes from the chalkboard. Obviously, such inadequate and limited teaching techniques tend to negatively affect the learners views of scientific concepts (Kiboss and Ogunniyi, 2003;Wabuke, Barmao and Jepkorir, 2013).Thus good teaching methods motivates students and enhances positive attitude hence improved performance while poor teaching methods have the opposite effect (ibid).

In teaching and learning the topic of evolution, a number of active learning strategies that can enhance students' cognitive understanding of evolutionary theory have been suggested by various researchers. In another study carried out by Demastes, Settlage and Good (1995) they determined that students were able to understand and apply evolutionary concepts in situations where teachers emphasized an inquiry model of instruction. Jensen and Finley (1996) concluded that student understanding of evolution was enhanced through use of a paired problem-solving instructional strategy. Passmore and Stewart (2002) recommended modeling approach to teaching of evolutionary biology in high school based on content-specific and embedded inquiry activities. Banet and Ayuso (2003*)* observed an improvement in secondary school students' conceptions of biological evolution through implementing teaching program which used constructivist approach in learning. While these approaches are promising, they have shown varied and sometimes conflicting results.

There are various teaching techniques employed in teaching biology. However, not every technique is appropriate for all topics because of lack of requisite science infrastructure, resources and over enrolled classes (Ali, Toriman, and Gasim, 2014; Ngesu, Gungu, Wachira and Kaluku, 2014). Most research on teaching techniques has been conducted in more developed countries like United States of America, United Kingdom and Japan. Because of differences in the level of technological development, it may difficult to use same techniques and achieve similar results in developing countries like Kenya.

In Kenya, on the other hand research has concentrated on teaching techniques on a group of subjects like sciences (SMASSE, 2008) or an individual subjects like biology, physics, Kiswahili, English, chemistry, Mathematics and Business studies (Muraya and Kimamo, 2011; Kang'ahi, Indoshi, Okwach, and Osodo, 2012; Odundo, 2013 and Wabuke, 2013). Little research has been conducted on the techniques of teaching the topic of evolution in Kenya and none in Kakamega central Sub-county in particular. Given the fact that the performance in questions on evolution among form four students in the sub-county has been poor (KNEC, 2008, 2009, 2012, 2013), there was need to conduct this research.

Some studies that deal with student understanding of evolutionary concepts have been conducted. Lawson and Thompson (1988) determined that reasoning ability was the only variable related to the number of misconceptions held by students with respect to genetics and natural selection. In a related study, Lawson and Weser (1990) were able to confirm that less skilled reasoners were more likely to hold nonscientific beliefs and less likely to change those beliefs. Demastes *et al* (1995) asserted that prior conceptions and overall view of the biological world were some of the critical aspects of students' conceptual ecologies that were related to the learning of evolution

Several authors have reported on student related characteristics like interest in the subject, ambition, attitude towards subject and whether or not they influences performance in the particular subject (Njuguna, 1998; Owiti, 2001; Wabuke, 2013). The conclusion from these studies has been that these factors indeed influence performance. This is in line with findings of earlier studies that asserted that students have individual

characteristics that influence how they learn. Duffy and Jonassen (1992) and Marra and Jonassen (1993) recognizes that students bring their existing knowledge and abilities to their study. Students also bring with them a range of ways of thinking (Gardner, 1993) and have varying levels of emotional maturity (Goleman, 1998). All these influence their perception and the way they learn concepts. Since the topic of evolution attracts a wide range of perceptions, this study sought to examine some of the perceptions versus learning of sub-concepts of evolution in Kakamega Central Sub-County where studies on perceptions of students on evolution are lacking. A baseline survey by SMASSE in the larger Kakamega district (the current Navakholo, Kakamega Central, East, North and South sub-counties) identified evolution as a difficult topic to learn and teach (Wekesa *et al*, 2006). Some of the reasons advanced for this scenario were abstractness of the topic, incompetence and attitude of the teachers. The perceptions of the learners were not investigated hence this study.

II. METHODOLOGY

The study adopted a cross-sectional descriptive survey research design. According to Frankael and Wallen (2000), this design facilitates collection of information from a sample drawn from a predetermined population at a particular point in time after the events being investigated have already occurred, although the researcher may not be able to analyze the direction of causal relationship. Sarvela and McDermott (1993) indicate "by taking a cross-section of sample of the individuals from the population to which we would like to make inferences, we can obtain a great deal of information, and learn much about the characteristics of the group" (p. 119).The design was appropriate for the study because it facilitated coverage of a large section of the target population and study area.

The participants for this study consisted of 210 form four students 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.

Since there only 3 county boys' schools and one had been used in the pilot study, the remaining two were included in study due to their high form four biology students. Similarly one county girls' school was selected because the other one had been included in the pilot study. 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. The admission numbers of form four biology students formed the sampling frame for each school from which the required number of respondents was picked.

Data was collected through utilizing questionnaire and an achievement test. The questionnaire was developed by the researchers using the Kenya Institute of Education and Kenya National Examinations Council biology syllabi while the required content materials for the topic of evolution was extracted from Kenyan secondary school biology textbooks. It consisted three 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 had 8 items that were intended to elicit students' perception of the effectiveness of some teaching/learning techniques on a scale of true or false. Part III had 5 items on student perception of the subject matter of evolution based on the 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 and 9 open-ended items on different sub-concepts of evolution adapted from Cotter (2007).

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 analysed using Pearson product moment of correlation to determine the reliability coefficient. Internal consistency was examined using Cronbach's alpha values.

The researchers sought permission from the relevant authorities to conduct research and proceeded to administer the data collecting tools to the participants who were given 40 minutes to complete. 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 critical level of $p=0.05$ (5%) was used to test for association between the variables.

III. RESULTS

3.1. Students' Perceptions of Techniques of Teaching Evolution

The proportion in percentages of the students who found each of the selected techniques effective in facilitating the learning of different sub-concepts of evolution was determined. The results are shown in table 3.1 below.

Table 3.1: Students' perceptions of teaching and learning techniques

Teaching /learning techniques	True	False
1. I understood better when group discussion method was used to teach the topic of evolution	168(80%)	42(20%)
2. I understood better when the teacher taught some sub-topics of evolution using demonstration(s)	146 (69.5%)	64(30.5%)
3. I understood better when some sub-topics of evolution were covered by answering written questions and the teacher marking	131(62.4%)	79(37.6%)
4. I understood better when the teacher used only textbooks for teaching and learning of evolution	112(53.3%)	98(46.7%)
5. I learned better when lecture method was used to teach the topic of evolution	102(48.6%)	108(51.4%)
6. I learned better when we did some practical on evolution	61(21.9 %)	164(78.1 %)
7. I understood better when we did project work on a sub-topic of evolution	37(17.6%)	173(82.4%)
8. I understood better when we went for a field trip to learn evolution	29 (13.8%)	181(86.2%)

The findings as shown in Table 3.1 indicate that majority (80 %) of the students learnt evolution better when group discussion was used in teaching. This was closely followed by use of demonstration at 69.5%. Use of question and answer completes the top three effective teaching and learning techniques among the students sampled. On the other hand field trip at 13.8% was ranked the least effective teaching technique, this was followed by use of project work at 17.6% and finally only 21.9% of the students indicated that they learnt better when a practical sessions were used during teaching and learning of evolution.

3.2. Influence of Perceptions on Learning of Evolution

Students responded to some statements on evolution to elicit their perception. They were supposed to indicate their perception level choosing from strongly disagree to strongly agree. The results are shown in table 3.2 below.

Table 3.2: Students' perception of evolution

	Perception Level				
Survey Item	**SD**	**D**	**UD**	**A**	**SA**
Terms used in evolution are difficult	25(12%)	52(25%)	13(6%)	72(36%)	44(21%)
Evolution is a theory	11(6%)	11(6%)	2(1%)	97(46%)	85(41%)
There is evidence for evolution	10(5%)	5(3%)	1(1%)	73(35%)	119(56%)
Evolution and creation are the same	88(42%)	66(32%)	13(7%)	28(13%)	12(6%)
Evolution stopped taking place	72(35%)	58(28%)	19(9%)	37(18%)	27(10%)

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

The findings from Table 3.2 indicate that most (57%) students agreed that terms used in evolution were difficult as compared to 37% who disagreed. In terms of evolution as theory majority (87%) of the students agreed that evolution was a theory as compared to 12% who disagreed. Majority (91%) of the students agreed that there was evidence to support evolution as compared to 8% who disagreed. A high (74%) proportion of the students sampled in this study disagreed with the statement that evolution and creation were same. On the other hand 19% of the students agreed that evolution and creation were the same. In terms of evolution continuing 63% of the students disagreed that evolution stopped taking place millions of years ago as opposed to 28% who agreed that evolution stopped taking place millions of years ago. There was need for the study to establish any association between students' perception and understanding of evolution. This was done using the students' perceptions. This was done using the students' rating against those who were either successful or unsuccessful in questions in the achievement test on each sub-concept against those who were either successful or unsuccessful in questions in the achievement test on each sub-concept. Chi-square tests were performed and the results are as shown in table 3.3.

Table 3.3: Association between students' perception and understanding of evolution

Chi-Square	dfAsymp.	Sig.
15.524[a]	**4**	**0.000**

Findings from Tables 3.3 show that the test yielded significant results. These are for the variables; student's perception of selected sub-concepts and understanding of the topic. The results show that the Chi-Square value was 15.524[a] with significance value of 0.000 which is significant at 5% level. In general, the Chi-Square statistics revealed that the results were significant for the two variables at 5% confidence level, and therefore there is an association between perception of selected sub-concepts and understanding of the topic.

IV. DISCUSSION

Teaching and learning are two sides of a coin. The most accepted criterion for measuring good teaching is the amount of student learning that occurs. Centra (1993) define an effective teaching technique as "that which produces beneficial and purposeful student learning through use of appropriate procedures". Effective teaching techniques therefore should produce favorable student performance outcomes. Though students often have little expertise in knowing if the technique selected by an individual teacher was the best teaching technique. Research has shown that students are the most qualified to report on the extent to which the learning experience was productive, informative, satisfying or worthwhile (Theall and Franklin, 2001).This is not new phenomenon since research on student evaluation of teaching concludes that student rating tend to be reliable, valid, relatively unbiased and useful. In fact it has been used extensively by universities to help faculty members further develop and improve the teaching skills and also assist administrators with respect to personnel decisions (Ory, 2000).

Teaching and learning of science in schools can only be effective if appropriate techniques are used to help students master the concepts of evolution. The study findings suggest that effective techniques are those that put great emphasis on student participation. Effective techniques in this study were student group discussion, demonstration as well as use of question and answers to test understanding of evolution concepts. This finding concurs with those of Kossack (2008), Cartley (2006), Passmore and Steward (2002), Woods and Scharmann (2001) who concluded that group discussions improves students' understanding of evolutionary theory because it helps them develop and share their personal perceptions and scientific explanations with peers. This can be attributed to the fact that during group discussions students get an opportunity to share a wide range of relevant knowledge. This could have been because each student in the group prepared and presented a specific aspect or sub-topic of evolution during the discussion session. During group discussion students listen to other's opinion and express their opinion.

Demonstrations were the second most effective technique. Use of demonstration in classroom allows students to have a picture and hands on experience of what evolution concepts are. They strengthen the capacity of students to develop and master their skills in identifying concepts in evolution given that retention of knowledge delivered through demonstration is higher than knowledge delivered through direct lecture. This level of effectiveness was accounted for by the fact that evolution as outlined in the biology syllabus had some practical oriented sub-concepts that were best taught using demonstrations. This finding is comparable to that of Passmore and Steward (2002) who noted that the use of modeling approach to teaching of evolutionary biology in high schools based on content-specific and embedded inquiry activities enhanced students' cognitive understanding of the theory.

Use of questions and answers was rated the third best teaching technique that students believed enabled them to master the sub-concepts of evolution. A majority of the students found question and answer techniques moderately effective in the teaching of evolution. This can be attributed to the fact that some of the evolution sub-concepts contained in the high school biology syllabus are straight forward in nature that students easily understand them on the basis of relevant questions and answers and also the fact that schools under study had an appropriate bank of questions and answers that provided an effective base for students' understanding of most sub-concepts of evolution within the syllabus. This is in line with findings of Skoog (2005), Skoog and Billica (2002) who noted that availability of adequate reference materials is the foundation to effective teaching and learning. Thus if students have access to a variety resources such as textbooks, they are able to progress smoothly and complete their homework their own (Ngesu, Gungu, Wachira and Kaluku, 2014).

The findings in Table 3.2 show that student practicals were the third least effective teaching technique in evolution. This happens to be the case since the nature of the sub-topics of evolution is such that a number of them are not easily taught by use of class practicals because most of the evolutionary processes are covered on

ex-post facto basis since they normally took a very long time to occur (Jensen and Finley, 1996). Some of the evidences of evolution are historical or geographical in nature and this makes it impossible for a biology teacher to design and carry out a practical that would facilitate demonstration or observation of the steps or process of evolution. Thus the experiments might have lacked the ability to exemplify what took place over the Geologic Ages and led to what many scientists believe that it is an evolutionary process. There are however aspects of evolution such comparative anatomy, comparative embryology and cell biology that can be taught practically but science teachers' inability to use inquiry approaches is due to lack of laboratories equipped with facilities, large class size of science students with very few teachers and, competency problems arising from the training of science teachers (Sifuna and Kaime, 2007). According to KNEC (2009) most teachers teach evolution as the last topics when examinations are approaching hence cover it through expository approach.

In contrast to these findings, studies have shown that generally practicals are effective in stimulating students' minds to be curious, explore more on a given subject area (Dagher and Boujaoude, 2005; Casado, 2000). This results in high achievement in examinations for those students who performed more practicals (Albert, Osman and Yungungu, 2014). Mayra and Parada, (2008) suggested that in order to ensure mastery of learning process among high school students continued use of visuals aids and practical sessions will help a lot in learning of evolution. Pazza, Pierre and Karine (2009) also assert that teachers should make use of practical sessions to enable students have an accurate knowledge about both evolutionary theory and its essential role in biology.

The use of project as a teaching technique was ranked the second least effective method. This can be accounted for by the fact that evolution process occurs so slowly taking millions of years. This meant that no observable difference could be seen or established through realistic evolution project because in Kenya students only spend a maximum of four years in high school yet this time period is too short for noticing or observing any evolutionary changes which would have facilitated this teaching technique. This makes the biology teachers to teach evolution sub-concepts like natural selection using artificial instead of real examples and computer simulations that attempt to show what could happen not withstanding what is happening. Griffiths and Barman (1995) established that such unrealistic projects are ineffective in the teaching and learning of evolution. This was further accounted for by the fact that the nature of the content of evolution covered in high school was such that only very limited projects could be designed for teaching purposes.

This was apart from the fact that the topic is normally covered at the very end of the four year study period when the minds of both the teachers and students were more set on revision for the national examinations than designing or participation in projects. However, Casado (2000) examined perceptions across six teaching methods and noted that applied projects were also favorably regarded by students as a method of teaching. In related studies Passmore and Stewart (2002), and Demastes *et al (*1995) showed that some students were able to understand and apply evolutionary concepts where teachers emphasized project approach based on content-specific activities.

The findings from this study indicate that field trip or excursion was the least effective technique. This can be attributed to the fact that most schools consider field trips as expensive and waste of time and thus prefer to have students in class throughout the year without field trip exposure. This was worsened by the fact that most excursions involved visitation to pre-historical sites which were located very far from the study area hence associated with heavy expenditure (KNEC 2009). Also evolution is a topic that is among the last to be covered when the minds of the school principals, teachers and more importantly students were focused on classroom based revision programmes and not involvement in field trips that could seem to waste a whole academic day instead of using the day to cover several examinable subjects. This occurred because of the closeness of national examinations at the time of teaching evolution.

From the foregoing discussion, student rating tend to be reliable and useful in gauging the effectiveness of the teaching technique used for instruction. Therefore on the basis of these findings, it can be concluded that effective techniques for teaching evolution are those that involve active student participation in the learning process. These are group discussion, demonstration, and question and answer techniques. These findings are consistent with those of Wabuke (2013) Kossack (2008), Cartley (2006), Passmore and Steward (2002), and Woods and Scharmann (2001). In these techniques, students didn't have to rely on rote learning since each gave their opinion hence developing creativity. Despite the fact that other techniques like class practicals, project work and field excursions involve more student participation and are therefore expected to be effective, they were least favored by students in the study location. The findings differ from those of Wabuke (2013), Pazza *et al* (2009), Mayra and Parada (2008), Dagher and Boujaoude (2005) and Casado 2000), who suggested that in order to ensure mastery of learning process among high school students continued use of visuals aids and practical sessions will help a lot. This discrepancy could be attributed to their lack of use or inadequate use in

the teaching as they require more time to implement yet most schools in the study location have a policy that the form four syllabus must have been covered by the end of the month of March.

According to the findings up to 57% of the high school students felt that the terms applied in the teaching/learning of evolution were difficult. This could be because the teaching /learning processes were carried out in English which is a second language to the students. Besides, the study of evolution mainly started among the Greek people; therefore most of the terminologies used are of Greek origin. This makes the learners in other countries like Kenya where Greek language is not taught in schools to find these terms to be very complicated and by extension difficult to understand. Clerk and Rutherford (2000) established that language-linked factors made terms applied difficulty for most students to comprehend certain concepts. They asserted that the terminology problem might be more pronounced in students being tested in a language that was not their first.

The findings indicated that an overwhelming majority (87%) of the learners felt that evolution was a theory in Biology. This could be because most students had been theoretically exposed to relevant knowledge or most teachers had successfully convinced the students through appropriate teaching of the relevant aspects of evolution. This approach of teaching/learning could have been convincing to the learners but since experimentation about most of the content was not possible, it resulted into the strong perception of evolution being a theory in biology. This approach to teaching could have decreased students' erroneous nonscientific conceptions through newly acquired knowledge as established by Lawson and Worsnop (1992). It could also be because the theory of evolution is appropriately organized into generalization as noted by Sober (2010) according to whom biologists usually organize their theories or generalizations into clear framework of concepts and that progress in biology was a function of the development of these theories and generalizations. Further, Driver, Leach and Scott (1996) noted that majority of students expressed the idea that evolution was considered as theory because it lacked "hard facts" as employed in some of the branches of physical science.

According to the findings, majority (91%) of the students accepted that there was evidence to support that evolution occurred. This aspect of the study sought to establish students' perception of the idea that evolution can be experimented and proved. The high perception indicated that most of the learners had probably been exposed earlier to substantial information about the existence of evidence for evolution. Access or learning of related concepts prior to learning these concepts in school was likely to have provided a strong background for learning of the evolution as required by the syllabus. This was in line with the assertions of Dagher and Boujaoude (2005), Sinatra, Southland, McConaughy, Demastes (2003), and Passmore and Stewart (2002) that students possess incoherent or alternative conceptions about almost any science topic that they bring into the classroom.

One of the biggest questions across human generations is the origin of life and more specifically human life. Among the theories that attempt to explain the origin of life is chemical evolution theory which asserts that life could have gradually evolved from reactions of simple molecules while the alternative theory asserts the concept of special creation through the command of God. According to the findings of the study as expressed in Table 3.2, majority (74%) of the students strongly disagreed and disagreed that evolution and creation were same. This was because all the respondents in this study were either Christians or Muslims both who believed in special creation as written in the Bible and holy Quran. This is in line with the findings of Demastes *et al* (1995) who asserted that religious orientations influence the students' perception on the origin of life at an early age.

In terms of evolution continuing, 63% of the students disagreed that evolution stopped taking place millions of years ago. Evolution as a biological process is said to occur so slowly that it takes millions of years for any significant observable step to occur. This means no human generation has lived to witness a specific step of macroevolution. What is observed is actually microevolution or evolution on a small scale through evidence from natural selection. These findings are comparable to those of Dagher and Boujaoude (2005) and Passmore and Stewart (2002) who noted that what was hard about proving the process of evolution was the fact that evolution requires long periods of time, thousands or even hundreds of millions of years to take place.

On the basis of these findings, it is advanced that students' perception was indeed predictive of their learning outcomes in evolution. These findings therefore provide empirical evidence and basis for concluding that student perceptions of various sub-concepts of evolution influence their understanding. This could be seen from the student perception level and performance in the achievement test on items related to the statements. This is in line with findings of earlier studies that asserted that students have individual characteristics that influence how they learn. Duffy and Jonassen (1992) and Marra and Jonassen (1993) recognizes that students bring their existing knowledge and abilities to their study. Students also bring with them a range of ways of

thinking (Gardner, 1993) and have varying levels of emotional maturity (Goleman, 1998). All these influence their perception and the way they learn concepts.

VI. CONCLUSIONS

The teaching techniques used in the classroom have an effect on how students will understand and appreciate the importance of evolution in biology as a subject. Detrimental outcomes can occur when the wrong pedagogical approach in teaching evolution is adopted. Effective teaching techniques that may help shape students perceptions on evolution are those that promote greater student participation such as group discussions. On the other hand inadequate use of teaching techniques such as practicals and field trips which have been proven to promote learning may limit the students from appreciating the importance of evolution as a central concept in biological science. Deliberate efforts should be made to mitigate against factors the hinder use of learner-centered teaching techniques.

Students have different perceptions concerning the topic of evolution which do have a significant influence on their understanding of evolution. There was consensus that evolution is a theory in biology. This provides a good foundation that can be used by teachers in teaching other sub-concepts of evolution.

The implication on instruction is that biology teachers' priority when choosing techniques of teaching evolution should stretch from group discussion, demonstration as well as use of question and answer. Equally, biology teachers should need to explore the importance of using project approach, use of class practicals and excursions/field trips as techniques of teaching evolution. The entry behavior of students' in so far as evolution is concerned need to be understood by the teacher. The teacher should then use this knowledge to change students' perceptions that interferes with learning of evolution and reinforce those that promote learning.

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