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Effect of Biology Practical Method of Teaching on Students' Academic Achievement of Senior Secondary Schools in Mubi Educational Zone, Adamawa State.

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Abstract

This study investigated the effect of practical teaching method on academic achievement of senior secondary biology students in Mubi Educational Zone, Adamawa State. Two research questions and two hypotheses were formulated to guide the study. The population of the study was 5,331senior secondary schools Biology students in Mubi Educational Zone. A sample for the study was 125 drawn from Senior Secondary two (SS II) students, which were randomly selected through purposive sampling technique. The design was quasi-experimental research which involve pre-test, post-test control groups. The instrument used for data collection was 40 item Biology Achievement Test (BAT) adopted from WAEC past question papers. The instruments were subjected to face and content validity by two experts. The reliability of the instrument was obtained using the Pearson Product Moment Correlation Coefficient of 0.61. Mean and standard deviation were used to answer research questions. Analysis of Covariance (ANCOVA) was used for hypotheses testing at 0.05 level of significance using Statistical Package for Social Science (SPSS). The findings show that there is significant difference in the effect of practical method and lecture method on students' academic achievement in biology. The result also shows that male students had higher mean score gain than their female counterpart when taught biology using practical method. It was recommended that government should organized training, seminars and workshops for both Biology teachers and Laboratory technicians in order to harmonize theoretical aspect of teaching Biology with practical activities.

Keywords: Practical method, Academic achievement and Gender.

Introduction

The future of every nation including Nigeria lies in the quality of education given to the citizenry. For every developing nation to attain and sustain national development, a well-planned and implemented science and technology education remains the only essential tool for her national development (Tafi, 2016). This is because individuals who acquire scientific and technological literacy, think innovatively and rationally, thus enabling them to conduct themselves within the global acceptable standard. Education is the bedrock of civilization and development of any nation. Without it no nation can move from where it is to the next level. Nigeria as one, has made various efforts towards the realization of science, technology, mathematics and biology. The knowledge of biology is not only paramount and useful to the learners, but to everyone who seeks to go with the changing trends of the society.

Biology as one of the science subject is defined as study of life and concern itself with the study of structure, behaviour, distribution, the origin of plants and animals and their relationships with their environment. Biology as the branch of science and the prerequisite subject for many fields of learning contributes immensely to the technological growth of the nation. This include medicine, forestry, agriculture, biotechnology and nursing. With global scientific and technological growth occurring rapidly, students' interest in biology is the major problems. Therefore, it is very important that man knows about the nature and the phenomenon surrounded him and consequences of the interactions between man and his environment.

Practical activities in biology provide opportunities for student to actually do science as opposed learning about science. In the past teachers are much more concern with loading students with theoretical facts and terminologies in Biology, but today it has become a matter of investigation, science process skill and inquiry. More emphasis is placed on the relevant of Biology to life. The objectives which guide the formulation of practical Biology

curriculum includes; -secondary school science laboratories serve as a conducive environment for practical work- a source of teaching and learning in science where students are able to carry out science process skills, practical work in school laboratory gives students appreciation of the spirit of method of problem solving analytical and generalization ability, practical work foster students positive attitudes toward science and maintains their interest in the learning of science subjects. The school laboratory simplifies complex and abstract subject matter of science; practical work is the "gem of science" which has made an influence in the World including Nigeria. The acquisition of these values and skills will help the learners to cope up with the challenges in their daily lives. Nwogbo, (2008:4) stated that: The use of practical biology activities (approach) to the teaching of biological concepts should therefore be a rule rather than an option to biology teachers, if we hope to produce students that would be able to acquire the necessary knowledge, skills and competence needed to meet the scientific and technological demands of the nation. In Nigeria secondary schools, biology instruction is divided into two; Theoretical and practical. This study centred on the practical aspect of biology, because students' achievement was poor. Also, reports from West African Examination Council (WAEC) have showed that students' performance has not been encouraging (WAEC, 2011).

The researcher had an interaction with students during the course of this study, students in secondary schools in Mubi Educational Zone made complain of poor method of instruction used by biology teachers while teaching. They said, this method was not okay for them to understand the real concept being taught in Biology subject. Students during delivering a lesson also observed some terminologies in Biology such as virus, bacteria and fungi among others that are too abstract for them. They arouse their interest for practical activities in biology for them to be able to see the real features or structures of those micro-organisms with the aid of microscope that appear to be too abstract during lecture method of instruction.

National Academy of Sciences (2010) recommended that practical work was found to achieve higher than the non-practical in biology. The use of practical activities (approach) to the teaching of biology should be harmonized with the theoretical aspect by the biology teachers so as to produce students who can acquire the necessary knowledge, skills and scientific competence needed to meet the scientific and technological demands of the society. These findings agree with that of Khan and Iqbal (2011) found similar result in Pakistan and it was observed that, the students taught through practical inquiry lab teaching method show more performance in science process skill than the students of the control group taught through traditional teaching method. Nzewi (2008) and Aina (2012) observed that the laboratory is an indispensable organ of the school if effective teaching and learning of science subjects are to be achieved and laboratory is a room or building or a special period of time equipped and set apart for practical or experimental studies to take place". Ude and Onah (2017) said, "It is an instructional facility used by the teacher to help students learn about science and how scientists investigate the world around them. In the same vein, Orokpo (2009) laments that the use of traditional lecture method of "chalk and talk" has gained prominence in the teaching of biology than practical method. Oyedeji (2000), discovered that students taught with science Laboratory Instructional Strategy performed significantly better than use of traditional lecture method.

The conventional/traditional teaching methods involve unidirectional flow of information/knowledge from teacher to the students and do not encourage process skill acquisition needed for proper understanding of biological principles, concepts and facts. Guisti (2008) referred to these traditional teaching methods as teacher-centered approaches to learning in the sense that the teacher and those up in the educational hierarchy are considered as the possessor of knowledge to be transferred to the students, and as such decides how the knowledge transfer takes place. The unidirectional flow of information in the traditional teaching method makes students passive and unable to construct meaningful knowledge in the teaching and learning of Biology. The shortcomings of these traditional teaching methods resulted to the persistent search for an effective method of teaching and learning Biology which culminated to the discovery and suggestions by some researchers (Mandor, 2002; Ibe & Nwosu, 2003; Nwagbo, 2006; Akpan, 2010), for the use of innovative teaching methods such as inquiry method, concept mappings, simulations and games, constructivism, problem based learning etc. The innovative methods are

considered as effective teaching methods that can improve on students' achievement and interest in Biology. The innovative teaching methods are activity-based and characterized by students sharing some degree of responsibility for making decision in the learning process. In the innovative teaching methods, the teacher is often described as a partner and a facilitator in the teaching and learning process and not the possessor of knowledge hence the innovative teaching methods are referred to as student-centered approach to learning (Campbell, 2006).

Apart from teaching methods, gender is also implicated in students' academic achievement in biology. Gender refers to the roles and responsibilities of men and women that are created in family, societies and culture. The concept of gender is the expectations held about characteristics, attitudes, and likely behaviour of both men and women (masculinity and feminity) in the society (Ezeh, 2013). There is a general belief among Nigerians that boys are superior to girls in terms of physical build up, intelligence and reasoning. According to Okeke (2007) gender and gender stereotyping have brought discrimination in academic achievement which is a matter of great concern to educationist. Agomuoh (2010) and Ukozor (2011) found that gender influences male students' conceptual in favour of the female. This finding is in agreement with Archer and Macrae in Iwuji (2012) who stated that males' students appear to be higher in achievement than the females and also reported that boys are better at activities requiring manipulation (psychomotor skills) than girls, and that boys are more aggressive towards laboratory and project work. The finding is also in line with the view of Iwuji (2012) who stated that boys also perform better than girls in process of measuring and experimenting. The finding of the study is also supported by Oakley in Iwuji (2012) who opined that right from the childhood, a boy traditionally receives more training and encouragement for achievement than girls.

While, much has been done on the effect of biology practical method of teaching on students' academic achievement of senior secondary schools in different subjects and in various localities. In view of the above mentioned problems, this study was carried out to determine the Effect of Biology Practical Method of Teaching on Students' Academic Achievement of Senior Secondary Schools in Mubi Educational Zone, Adamawa State.

Research Questions

The following research questions guided the study:

1. What is the difference in the mean and standard deviation scores of students when taught biology using practical and lecture methods (non-practical activities)?
2. What is the difference in the mean and standard deviation scores of male and female students when taught biology using practical method?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

H_{01}: There is no significant difference between the mean achievement scores of students taught biology with practical and those taught using lecture methods.

H_{02}: There is no significant difference between the mean academic achievement scores of male and female taught biology using practical method.

Materials and Methods

A quasi-experimental design was used for this study. The study used pre-test and post-test with one experimental and one control groups. The population of the study consists of 5,231 senior secondary school students (SS II) in Mubi Educational Zone. Random sample technique was used to select two intact classes with 135 biology students as research sample. A 40 item Biology Achievement Test (BAT) was adopted from WAEC past question papers 2007-2010 was used as instrument for data collection. The instrument has four options with one correct answer and three distractors. The instruments were subjected to face and content validity by two experts. The reliability coefficient was determined by testing 17 students from GDSS Gombi outside the area of study. The reliability of the instrument 0.61 was obtained using the Pearson Product Moment Correlation Coefficient. The study was conducted in two different schools, one school for experimental group and one for control group. The experimental group was taught, food tests in food nutrients using practical method while the control group was taught the same topics using lecture method of teaching. The study was conducted for a period of five weeks during which the topics selected were covered. Pre-test was administered in the first week of the research exercise before the students were subjected to treatment. The significance of the pre-test is to

ascertain students' entry behaviors' on the topics to be taught and control selection bias, to make sure that the groups are equivalent at the beginning of the administration. The post- test was administered at the end of five weeks. The pre-test and post-test contain the same items arranged in different order and form the data for the study. The research questions were answered using descriptive statistics of mean and standard deviation while the two hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA).

Results

In order to determine the students' entry bahaviour at the beginning of the study; students' pre-test scores in the experimental and control groups were subjected to analysis using mean and standard deviation. The result is presented in Table 1.

The analysis in Table 1 below reveals that there is no significant differences in the mean and standard deviation in the achievement of students in Practical Biology in the experimental and control groups before the treatment (mean=25.20 with S.D =6.65 and mean=25.50 with S.D =7.50). This indicates that the students had homogenous entry behaviour before the treatment.

Research Questions:

Two research questions were formulated and analyzed using descriptive statistics (mean and standard deviation) while the hypotheses were tested using ANCOVA. The results are presented according to research questions in Tables 1 and 2 respectively while the hypotheses are presented in Table 3 and 4 respectively.

The research questions were raised and answered using mean and standard deviation

Research Question I: What is the difference in the mean and standard deviation scores of students when taught biology using practical and lecture methods (non-practical activities)?

Table I: Summary of Mean and Standard Deviation of Students' Academic Achievement by Teaching Method.

		Pre-test		Post-test		
Teaching Method	N	Mean	S.D	Mean	S.D	Mean Gain
Practical method	65	25.20	6.65	38.70	12.60	13.50
Lecture method	60	25.50	7.50	30.35	7.37	4.85
Total	125					

The descriptive statistics in Table 1 shows that 125 subjects participated in the study. Experimental group (practical) has 65 students with pre-test mean score of 25.20 and standard deviation 6.65. The post-test mean score of the group is 38.70 with a standard deviation of 12.60. The pre-test and pot-test mean score difference of the group is 13.50. The control group (lecture) has 60 students with the pre-test mean score 25.50 and standard deviation of 7.50. The post-test mean score of the group is 30.35 with a standard deviation of 7.37. The pre-test and post-test mean score difference of the group is 4.85. This implies that there is difference of (8.65) in the mean scores of student when taught biology using practical and lecture methods. The results show that the mean score gains of senior secondary school students when taught biology using practical (experimental group) is higher than the mean scores gain of those taught biology using lecture group (control) in Adamawa State.

Research Question 2: What is the difference in the mean and standard deviation scores of male and female students when taught biology using practical method?

Table 2: Summary of Mean and Standard Deviation of Male and Female Academic Achievement of Students Taught Biology Using Practical Method.

			Pre-test		Post-test		
Teaching Method	N	Gender	Mean	S.D	Mean	S.D	Mean Gain
Practical	35	M	25.15	6.58	40.05	15.15	14.15
	30	F	26.56	7.70	32.30	10.05	5.74

Table 2 shows that practical group has 35 males with the pre-test mean score of 25.15 and standard deviation of 6.58. The post-test mean score of the group is 40.05 with standard deviation of 15.15. The pre-test and post-test mean score gain is 14.15. They are also 30 females with the pre-test mean score of 26.56 and standard deviation of 7.70. The post-test mean score of females is 32.30 and standard deviation of 10.05. The pre-test and pot-test mean score gain difference of the group is 5.74. This implies that there is difference of (8.41) in the mean score gain of male students taught biology using practical method compared with the females. The results show that male students had higher mean score gain than their female counterpart.

Hypotheses Testing

The hypotheses were tested using ANCOVA.

H_{01}: There is no significant difference in students' academic achievement when taught Biology using practical method and lecture method.

Table 3: Summary of 2-way Analysis of Covariance of Students' Academic Achievement by Gender and Interactive Effect of Teaching Methods.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3816.526[a]	4	954.132	5.760	.000
Intercept	16802.373	1	16802.373	101.400	.000
Pre-test	195.420	1	195.420	1.180	.280
Methods	1288.684	1	1288.684	7.780	.010
Gender	654.122	1	654.122	3.950	.050
methods * Gender	275.722	1	275.722	1.660	.200
Error	21541.074	130	165.701		
Total	229291.000	135			
Corrected Total	25357.600	124			

R Squared = .151 (Adjusted R Squared = .124) *significant, P≤0.05

The results of the analysis in Table 3 show that, there is significant difference in the mean achievement scores of students in senior secondary schools when taught biology using practical and lecture methods, F (1,124) =7.78, P≤0.05. Since the computed P-value (0.01) is less than the F-value at 0.05 level of significance, the null hypothesis of no significant difference is rejected, which means there is significant difference in the effect of practical method and lecture method on students' academic achievement in biology.

H_{02}: There is no significant mean difference between male and female students' academic achievement when taught Biology using practical method.

Table 4: Summary of 1-way Analysis of Covariance of Students' Academic Achievement by Gender.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3816.526[a]	4	954.132	5.760	.000
Gender	654.122	1	654.122	3.950	.050
Error	21541.074	130	165.701		
Total	229291.000	135			
Corrected Total	25357.600	124			

R Squared = .151 (Adjusted R Squared = .124) *significant, P≤0.05

Analysis in Table 4 show that, there is significant mean difference between male and female students' academic achievement when taught Biology using practical method, F (1,64) =3.95, P≤0.05. Since the computed P-value (0.05) is equal to 0.05 level of significance. Therefore, the null hypothesis of no significant difference is rejected, which means there is significant difference between male and female academic achievement when taught biology using practical method.

Discussion

In this study, the homogeneity of students' achievement in the experimental and control groups prior to treatment was evaluated by subjecting their pre-test scores in practical biology to mean and standard deviation. The analysis revealed that there is no significant differences in the achievement of students in practical biology in experimental and control groups prior to treatment (mean=25.25 with S.D =6.65 and mean=25.50 with S.D =7.50 respectively. These suggest that the two groups were quite homogeneous, which implies that students used for the study have relatively equal background knowledge of practical biology.

When comparing students' academic achievement taught practical biology with lecture methods using descriptive statistics of mean and standard deviation. It was revealed that, the findings obtained from the results of the pre-test and post-test at the beginning and at the end of the instruction revealed that there is significant differences between practical biology and lecture methods post-test scores corrected according to the pre-test scores of the experimental and control groups. It indicated that students in the experimental group (those taught biology concept using practical method) performed better than the control group (those taught biology concept using lecture method). It was found out that active involvement of students in practical activities may have helped in enhancing and facilitating students' academic in biology. Moreover, the presentation of topics by means of sequential practical activities and objectives increase the achievement of students. The results also revealed that there is great difference between the experimental and control groups. The higher F-value obtained from the study 7.78 indicated that the group and the pre-test variables can provide the explanation for the variances in the scores of the post-test. The level of the students' achievement improved drastically and significantly in the experimental group after the treatment. This is in line with the findings of National Academic of Science (2010) which recommended that practical work was found to achieve higher than the lecture method (non-practical) in biology. This in line with the finding of Oyedeji (2000) who found that, students taught with science Laboratory Instructional Strategy performed significantly better than use of traditional lecture method. This finding agree with Kibirige & Tsamago (2013) who recommended the use of practical method in fostering students' acquisition of science process skills. The result is conflicting with Orokpo (2009) who laments that the use of traditional lecture method of "chalk and talk" has gained prominence in the teaching of biology than practical method.

The study also found out that, gender does not significantly differ. This means the students' achievement in the post-test score did not differ between males and females. This implies that there is difference in the mean score gain of male students taught biology using practical method than female students. These findings agreed with Joseph, John, Yusuf and Olubunmi (2015) who found out that, even though male students had slightly better performance compared to the female students in the biology, but it was not significant. The finding is also in line with the view of Iwuji (2012) who stated that boys also perform better than girls in process of measuring and experimenting. The finding of the study is also supported by Oakley in Iwuji (2012) who opined that right from the childhood, a boy traditionally receives more training and encouragement for achievement than girls. These findings are in conformity with Fabunmi (2004) who found out that male and female composition has a significant relationship with students' academic performance and also has a significant influence on secondary school students' academic performance. The result is conflicting with Atovigba, (2012) who found out that there are no significant differences in male and female students' achievement in mathematics performance at any level.

The study similarly found out that, students taught biology concept using practical activities performed better than those taught with lecture method. The use of practical activities has positive effect on the students' academic achievement in biology. The findings is in line with that of Kibirige & Tsamago (2013) who recommended the use of practical method in fostering students' acquisition of science process skills. These findings agree with that of Khan and Iqbal (2011) found similar result in Pakistan and it was observed that, the students

taught through practical inquiry lab teaching method show more performance in science process skill than the students of the control group taught through traditional teaching method. Results showed that practical activities in biology lessons is more effective in developing scientific process skills among secondary school biology students. The increase students' academic achievement in this study is not unconnected with the fact that practical activities teaching considers students as the key element of constructing his knowledge while the teacher only serves as a guide to the students.

The study also found out that, the interactive effect of teaching method (practical activities and lecture methods) and gender did not significantly differ. This means that the significant difference found among the teaching methods did not depend on students' gender. The results of the findings agree with the findings of Sakiyo and Waziri (2015) and Ugwuadu (2011) who found out that the interactive effect of teaching method and gender is not significant.

Conclusion

From the results of this study, the researcher concluded that practical method was more effective method of teaching biology in senior secondary schools in Mubi-North local government area of Adamawa State compared to lecture method. Also, practical method is a teaching method that benefits male compared to female students in Mubi-North local government area of Adamawa State.

Recommendations

The following are recommendations for the study:
This study provide evidence on the effectiveness of biology practical method of teaching which enhances students' academic achievement. This implies that the use of practical activities in the teaching of biology at senior secondary school level can address the poor achievement in internal and external examinations.

The Federal and State Ministry of Education and other educational bodies like Nigeria Educational Research and Development Council (NERDC) and the Science Teachers Association of Nigeria (STAN) should organized training, seminars and workshops for Biology teachers and Laboratory technicians. This is done in order to update their knowledge on the use of theoretical aspects with practical activities instruction to improve teaching and learning in Nigerian schools.

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