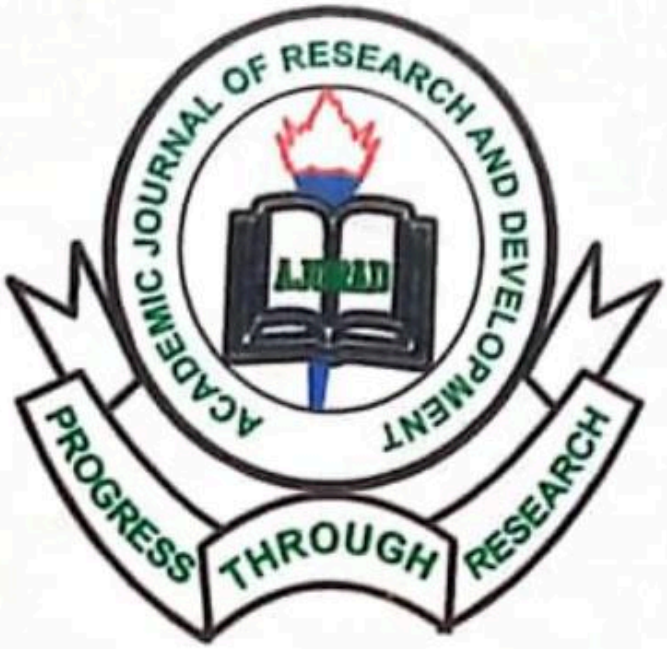

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EFFECTS OF HANDS-ON ACTIVITIES ON ACHIEVEMENT AND INTEREST OF PRE-SERVICE BIOLOGY TEACHERS IN COLLEGES OF EDUCATIONS IN NIGER STATE

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Abstract

The research work discussed the effects of Hands-on Activities on Achievement and interest of Pre-service Biology Teachers in colleges of Education in Niger State. The study adopted quasi-experimental which entail the Pre-test, Post-test, non-equivalent experimental and Control groups design. Purposive sampling was used to select the two schools based on the availability of functional Biology Laboratory. An intact class of (90) Pre-service Biology Teachers from both Colleges were selected. The research instrument; Hands-on Activities Achievement (HoAAT) was adopted and consist of twenty-five (25) items multiple choice objectives test item and Practical Biology Interest Questionnaire (PBIQ) was developed by the researcher. The research instruments were tested and the reliability coefficients obtained are 0.83 using Cronbach's alpha for HoAAT and 0.81 for PBIQ. The research questions were analyzed using descriptive statistics while ANCOVA was used to test the hypotheses at a significant level of 0.05. The result revealed that Hands-on Activities has help Pre-service Biology Teachers develop good identification, communication and observational skills and these skills gave birth to pre-service teachers' high performance in Hands-on Activities unlike the alternative to practical method. The researcher recommended that Pre-service Biology Teachers should be involved in practical Biology early from when they are in SS1 until they finished their secondary school, with the background they can effectively perform well in tertiary institution.

Key words: *Hands-on, Interest, Achievement, Pre-service Biology Teachers*

Introduction

Science and technology play a key role in the development of the world; science entails actively doing or Hands-on in broad sense. Pre-service teachers in biology are supposed to perform this Hands-on Activities in order to develop their skills and enable them to have conceptual knowledge of the benefits of the skills in time to come. Science and Technology is one of the most important factors of sustainable development in the universe, the reason being that, they play significant roles in determining the quality of life of a people in many aspects: nutrition, agriculture, health, energy, transportation, material production and industrial development Gyuse and Adejoh (2010).

In essence, it is understood that science actively involve "doing" or "Hand –on" into general knowledge. It implies that, science covers both practical and theoretical aspects. Furthermore, Whitley, Kite and Adams (2013) states that, science doesn't have a specific definition so, he sees science as systematic process of achieving verifiable and testable knowledge concerning the nature in general and natural occurrence, making use of observation and experiment. The knowledge of science, Biology in particular, is important for national building. Science comprises the basic disciplines such as Physics, Chemistry, Mathematics and Biology. One of the most crucial aspects of science for national building is the acquisition of science through observation, evaluation of evidence and drawing of inferences based on the evidence provided , Kuhn (2012). Bell *et al.* (2010) emphasized that, processes of science grant an individual the ability to make wise and useful decision and to make rational arguments based on the evidence provided. Hands-on or activities are emphasized in all areas of science to produce knowledge. Biology as one of the branch of science talks more on hands-on activities in conducting the practical aspect.

Biology is that branch of science that deals with the study of living things. Biology is a rapidly advancing science with huge amounts of information about living Organisms. Starr *et al.* (2015) defined biology as the science of life. It is one of the science subjects that are made compulsory in all the senior secondary schools in Nigeria; most times Art oriented students are also forced to offer biology in senior secondary schools. Mberekpe, (2013) stated that, biology teaching is very essential because, it prepares the students to have a clear view of the world that revolve around them and also prepares them with the basic skills to construct a progressive society. Mberekpe, (2013) observed that biology plays an essential role in the field of biochemistry, medicine, physiology, ecology, genetics, molecular biology and other related biology oriented courses.In respect to this, biology has been made a central focus in most human activities including being a solution to the problem of food scarcity, health, hygiene family life, poverty eradication, management and conservation of natural resources, biotechnology, ethics, various social vices and as well lack of appropriate infrastructural materials. Most importantly, biology is a popular subject among students and its popular nature among other science subjects has made it a distinct choice for all students (Lawal, 2011).

Borich, (2016) has linked poor achievement trend in biology particularly to the lack of instructional resources in schools due to poor funding of schools. The poor funding of schools has hindered the principals from providing the teachers with adequate instructional resources. The National Policy on Education, (2010) emphasizes the need for teaching and learning of science processes and principles The policy recommends practical, exploratory and experimental methods of teaching. In this regards Osu and Ekpem (2010) stated that the basic tools that scientist use in the learning of science processe are the instructional materials. Studies have shown that the use of instructional materials hav

improved achievement Oladejo *et al.* (2011). Instructional materials are wide varieties of equipment and materials use for teaching and learning by teachers to stimulate self-activity on the part of the pre-service teachers.

In the same view, Mberekpe, (2013) viewed that; Biology provides an avenue for teaching students the capacity to involve learning of science concepts and principles in solving their everyday problems. Biology remains one of the basic sciences whose teaching and learning is universally known to be efficient and successful, if only undertaken simultaneously with the help of adequate instructional resources and facilities. The study of life has assisted in moulding the world and making people know about them. In the same view, it has also helped in giving a valid answers to questions concerning why things occur in a more scientific way. Biology is very essential in senior secondary schools; it is a subject that is well known to all students either in science oriented or art oriented. It is a very comprehensive science subject and have paved way to study some professional courses like medicine, optometry, medical laboratory, biochemistry microbiology, pharmacy and botany.

Teaching and learning standards are not only centred on acquisition of knowledge but should involve the development of skills and affective characteristics of science and the development of life-long learning skills, inquiry skills, problem solving skills, creative and critical learning skills and also ethical value Mustapha and Abimbola (2011). Biology Hand-on Activities are practical skills acquired in the process of practical explorations in the laboratory. In the course laboratory practical activities (Hands-on) students' acquire Science Process skill. These skills form the basis for Scientific inquiry as well as the development of intellectual abilities and attitudes that are needed to learn science concepts. Hands-on Activities (HA) is a process which involve science teaching and learning action which includes Pre-service teachers working on their own or in small groups, manipulating and/or observing real objects and materials as different to the virtual world (Science Community Representing Education Brinson, (2015). Hands-on Activities enable students to be conversant with the specimen they are working with, makes them to find out and master what they are working with instead of the use of alternative to practical which only exposes them to pictorial view of the specimen and theoretical analysis concerning the specimen to be studied. Students which take part in alternative to practical tend not be satisfy with what they see in the picture and how the specimen is verbally explain to them.

Hands-on Activities will make teaching and learning of Biology easier and understandable because what your eyes sees is what your mind will build upon. The word hands-on is used in science education to mean, allowing students to have knowledge of biology as a science course by actually using their hands. In hands-on practical activities, Pre-service Biology teachers interact with the

available tools and equipments with the use of their hands. With Hands-on activities, students are able to manipulate equipment and in the process acquire skills and abilities necessary for Science Process. The student only concentrates on what they do with their hands. The brain assists in thinking by applying the necessary steps to achieve a goal. Hands-on activities are considered to be effective in teaching and learning of biology. Indeed, hands-on activities play a major role in the life of the students learning process which has been shown to improve students' science learning and achievement as well as improve their attitudes towards science (Kanter and Konstantopoulos, 2010).

Statement of the Problem

Practical laboratory examination is a compulsory aspect of Biology curriculum used to determine the overall grades of students in either internal or external examinations. Because it is an integral part of the whole process, pre-service teachers in colleges of education must acquire appropriate skills and competencies, that is, Hands-on Practical Laboratory Activities for effective presentation of biology curriculum content to students at post-basic education level. The Biology Chief Examiners reports on National Examination Council (NECO) conducted public examinations at Senior Secondary Schools Certificate (SSC) level in Nigeria with particular reference to in practical biology have always indicated underperformance. Despite the central and essential role of biology among the science and applied science courses, students' performance in biology has consistently been poor and not impressing at all. The average students' performance for these years was 30.33%. Implying that about 69.67% of the students could not make a credit in biology.

Therefore, this research is designed to determine the effects of hands-on activities on achievement and interest of pre-service Biology teachers in Colleges of Education in Niger State.

Objectives of the Study

The objectives of the study are to:

1. Determine whether Hands-on Activities (HoA) could influence the achievement of Pre-service Biology Teachers (PsBT) of NCE II
2. Determine whether Hands-on Activities (HoA) could influence the achievement of Pre-service male and female Biology Teachers (PsBT) of NCE II
3. Find out whether Hands-on Activities (HoA) influences the interest of Pre-service Biology Teachers (PsBT) of NCE II in dissecting the gill chamber of a bony fish.

Research Questions

The following research questions were raised to guide the study:

1. What is the difference in the mean achievement score of pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals?

2. What is the difference in the mean achievement of Pre-service male and female Biology Teachers of NCE II exposed to HoA and those exposed to Alternative to Practicals?
3. What is the difference in the interest of Pre-service Biology Teachers of NCE II exposed to HoA and those exposed Alternative to Practicals in dissecting the gill chamber of a bony fish?

Research Hypotheses

1. There is no significant difference in the mean achievement score of pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals (AT).
2. There is no significant difference in the mean achievement of Pre-service male and female Biology Teachers of NCE II exposed to HoA and those exposed to AT.
3. There is no significant difference in the interest of Pre-service Biology Teachers of NCE II exposed to HoA and those exposed AT in dissecting the gill chamber of a bony fish.

Scope of the Study

The geographical scope of the study was limited to Colleges of Education in Niger State. The study consists of two colleges of education in Niger State.

i. Niger State College of Education, located in Minna Metropolis of Niger State.
ii. Federal College of Education, located in Kontogora town of Niger State .

Significance of the Study

1. The result of the research study will be useful to Pre-service Teachers, In-service Biology Teachers, management of Colleges of Education, educational policy makers and researchers.
2. Pre-service teachers will appreciate the more how Hands-Practical Laboratory activities will help develop their Science Process Skills and also encourage team-work among Pre-service Biology Teachers of different socio-economic background.
3. In-service Biology Teachers will benefit from this work because they will gain more insight into Science Process Skills through the conduction of Hands-on Practical Laboratory Activities. It will help them to improve on other teaching- learning activities by using Science Process Skills in teaching some of the topic that have been problematic. These will help to reduce the time used in explaining a particular topic that seem difficult to the Pre-service Teachers. It will enable the in-service biology teacher to talk less, ease teaching, make more resourceful and enable them to discover more talents through application of Science Process Skills.

Research Methodology

The research design adopted for the study is quasi-experimental which entail the Pre-test, Posttest, non-equivalent experimental and control groups design. White, & Sabarwal, (2014) stated that the quasi experimental design involve selecting groups upon which a variable is tested without any random pre-selection. Two groups of gender (male and female) were investigated in this study as moderating variables. The experimental and control group were administered pre-test. Later experimental group was exposed to treatment by dissecting gill chamber of bony fishes using hands-on activities and the control group was treated using conventional laboratory method. After which both groups received posttest. The population for the study comprised all the Pre-service Biology Teachers of NCE II in Niger State College of Education Minna and Federal College of Education, Kontogora both in Niger State. A Purposive sampling technique was used to select the two sampled Colleges of Education because of Biology Laboratory facilities and man power, school type and gender composition. Secondly, a simple random sampling technique was used to assign the two colleges selected to experimental group and control group respectively.

The instrument used for the study is Hands-on Activities Achievement Test (HoAAT) and Practical Biology Interest Questionnaire (PBIQ). The Hands-on Activities Achievement test (HoAAT) was used to evaluate the Pre-service teachers acquisition of dissection of the gills of a tilapia fish, and the instrument contain 25 objectives items with options A-D drawn from the Pre-service Biology Teachers past examination questions. Practical Biology Interest Questionnaire (PBIQ) was used to evaluate the Pre-service Biology Teachers interest in the use of Hands-on Activities. The instrument has two sections (A&B). Section A contains Bio- data information while section B has Interest statements towards Hand-on Activities. A total of 20 items was designed. The Hands-on Activities Achievement Test (HoAAT) Instrument and Practical Biology Interest Questionnaire were validated by three experts, one senior lecturer from Biology department, FUT Minna, one senior lecturer from School of Science Education FUT Minna, and one Chief Lecturer from Biology department, College of Education (COE) Minna. The Hands-on Activities Achievement test items were validated for content and face validity. The Practical Biology Interest Questionnaire was validated by the same experts as above.

A Pilot test was conducted using Pre-service Biology Teachers NCE II of Federal College of Education Zuba, Abuja. FCE Zuba is not part of the population but has the same features that the sampled colleges' has. The rationale behind the pilot testing was to enable the researcher to diagnose problems encounter and foretell such problems during the course of the field work for the final administration of the instrument in the colleges to be survey. The test instrument was administered on (20) Pre-service Biology Teachers. The researcher scored the items. Cronbach's alpha reliability

coefficient was calculated for PBIQ and a value of 0.830 was obtained which shows a high reliability for the instrument while Kuder Richardson Formula 20 test was calculated for HoAT and a value of 0.816 was obtained which shows a high reliability for the instrument.

The researcher first visited the two sampled schools for the study to seek permission to use their schools for the study. When the permission was granted, the head of department introduced the researcher to pre-service biology teacher of NCE II. The contact period for the group lasted for six weeks. Training was given to the Biology teachers as a research assistant in the use of Hands-on Practical Laboratory Activities. The study took four (4) weeks. After the four weeks of conducting the hands-on activities and one week of revision, the two groups received a post-test on PBIQ and HAAT items where each was scored four (4) marks. While the items in PBIQ were rated between 1 and 4, with 1 as the lowest score and 4 the highest score. Descriptive statistics were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

Results and Discussion

Research Question 1: What is the difference in the mean achievement score of pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals?

Table 1: Mean and Standard deviation of the difference in the mean achievement score of pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals

DESCRIPTION	$\bar{x}$	SD
Pretest	26.96	9.012
Postest	62.60	18.383

Table 1 presented above shows that the mean achievement score of pre-service Biology teachers exposed to Hands-on Activities is 62.60 with a standard deviation of 18.383 while that of those exposed to Alternative to Practicals is 26.96 with a standard deviation of 9.012. This indicates that Hands-on Activities have positive effects on the achievement of pre-service Biology teachers.

Research Question 2: What is the difference in the mean achievement of Pre-service male and female Biology Teachers of NCE II exposed to HoA and those exposed to Alternative to Practicals?

Table 2: Mean and Standard deviation of the difference in the mean achievement of Pre-service male and female Biology Teachers of NCE II exposed to HoA and those exposed to Alternative to Practicals.

Corrected Total	29613.789	89

a. R Squared = .198 (Adjusted R Squared = .180)

The results of the ANCOVA are presented in Table 4 to determine a statistically significant difference between hands-on activities and achievement of pre-service Biology teachers controlling for alternative to practicals. There was a significant effect of hands-on activities on achievement of pre-service Biology teachers after controlling for the effect of alternative to practicals, $F(1, 87) = 20.861$, $p < 0.0001$. This shows that there is enough evidence to reject the null hypotheses. Hence, there is significant difference in the mean achievement score of pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals (AT).

H_{02}: There is no significant difference in the mean achievement of Pre-service male and female Biology Teachers of NCE II exposed to HoA and those exposed to AT.

Table 5: ANCOVA Results for the Effect of Hands-on Activities on the Achievement of Male and Female Pre-service Biology Teachers

Dependent Variable:Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6256.384[a]	4	1564.096	5.692	.000	.211
Intercept	27345.455	1	27345.455	99.513	.000	.539
Pretest	39.345	1	39.345	.143	.706	.002
Group	5706.697	1	5706.697	20.767	.000	.196
Gender	126.260	1	126.260	.459	.500	.005
Group * Gender	211.034	1	211.034	.768	.383	.009
Error	23357.405	85	274.793			
Total	305949.000	90				
Corrected Total	29613.789	89				

a. R Squared = .211 (Adjusted R Squared = .174)

The results of the ANCOVA are presented in Table 5 to determine a statistically significant difference between hands-on activities and achievement of male and female pre-service Biology teachers controlling for alternative to practicals. There was an insignificant effect of hands-on activities on achievement of male and female pre-service Biology teachers after controlling for the effect of alternative to practicals, $F(1, 85) = 0.768$, $p = 0.383$. This shows that there is no enough evidence to reject the null hypotheses. Hence, there is no significant difference in the mean achievement score of male and female pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals (AT).

H_{o1}: There is no significant difference in the interest of Pre-service Biology Teachers of NCE II exposed to HoA and those exposed AT in dissecting the gill chamber of a bony fish.

Table 6: ANCOVA Results for the Effect of Hands-on Activities on the Interest of Pre-service Biology Teachers

Dependent Variable:Interest					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	25.016[a]	1	25.016	108.505	.000	.552
Intercept	804.540	1	804.540	3489.639	.000	.975
Group	25.016	1	25.016	108.505	.000	.552
Error	20.288	88	.231			
Total	892.134	90				
Corrected Total	45.305	89				

a. R Squared = .552 (Adjusted R Squared = .547)

The results of the ANCOVA are presented in Table 6 to determine a statistically significant difference between hands-on activities and interest of pre-service Biology teachers controlling for alternative to practicals. There was a significant effect of hands-on activities on interest of pre-service Biology teachers after controlling for the effect of alternative to practicals, $F(1, 88) = 108.505$, $p < 0.0001$. This shows that there is enough evidence to reject the null hypotheses. Hence, there is significant difference in the interest of pre-service Biology teachers exposed to Hands-on Activities and those exposed to Alternative to Practicals (AT).

Conclusion

Biology lessons may benefit from inclusion of hands-on activities with living organisms, but these benefits are not limitless (Holstermann, Grube, and Bögeholz, 2010). Hands-on activities with fish, as an example of an unpopular, but common and easily observed animal, provide benefits in terms of improved conservation efforts, but these efforts seem to be generalized to other animals. The knowledge gain showed by the pre-service Biology teachers of NCE II shows that hands-on activities has great positive effects on the achievement and interest of pre-service Biology teachers. As a conclusion, hands-on learning was a good idea to engage students actively in their learning. Furthermore, hands-on activities are inexpensive by using easily obtainable and simple life materials, straight forward and practical to perform in class, adaptable for most of the lessons and science subjects. On the other hand, this study was limited to 90 pre-service Biology teachers of NCE II in two intact classrooms. For further study, similar researches can be constructed for different science topics, and different levels with larger sample size.

Recommendations

Based on the findings of the study, it is recommended that:

1. Biology teachers should be encouraged by the school management to teach their lessons using hands-on activities because of its advantages oer the alternative to practicals.
2. The curriculum planners should design a suitable curriculum that will ensure that Biology teachers use hands-on activities in their lessons.

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