

## THE IMPACT OF PRACTICAL LABORATORY DISSECTION ON STUDENTS ACHIEVEMENT IN BIOLOGY AMONG UNITY COLLEGES IN NIGER STATE, NIGERIA

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### Abstract

This study investigated the "Impact of practical laboratory dissection on achievement in Biology amongst Unity Colleges in Niger State, Nigeria. The research design adopted for the study was a quasi-experimental: pretest, posttest and non-randomized experimental and control groups design. The population consisted of only 6 Unity Colleges with students' size of 576. A sample size of 92 students was selected and used as experimental and control groups. The sample consisted of 54 males and 38 female students. Practical Rabbit dissection lesson plan was used for the experimental group while the control group was taught using the conventional approach, i.e. without any practical specimen (alternative to practical approach). Practical Laboratory Achievement Test Items (PLATI) were used for as instrument for data collection. The instrument contained 25 items which were validated by experts in biology. A reliability coefficient of 0.66 was obtained from the instrument using split-half method. The data collected was first subjected to descriptive statistics, i.e. Means ( $\bar{X}$ ) and Standard Deviations (SD). Thereafter, Analysis of Covariance (ANCOVA) was computed using the same data. The result showed that, there was a significant difference between the experimental and control groups ( $F_{cal}(1,90) = 64.209, P < 0.05$ ). The ANOVA analysis on gender amongst the experimental group only indicated that there was no significant difference between male and female students ( $F(1,40) = 0.35, P < 0.05$ ). Based on the findings of the study, it was recommended that Biology teachers must always conduct practical to convey theoretical knowledge to practice while school administrators and government should also provide the enabling learning environment and resources for practical work/exercises in our schools. This is the only sure means of up scaling students' performances in external examinations. Their chances of securing admission and pursuing lifelong aspirations highly depend on the performance in external examinations in NECO and WAEC.

### Background to the Study

There has been numerous discoveries and inventions aided by laboratory experimentation in teaching and process. The laboratory has a central and distinct role in science education. Scientific theory has to be translated into concrete terms for it make meaning and also used to solve our daily experiences in order to make an impact on physical-social environment. Some educators have questioned the effectiveness of using the laboratory in promoting science education when virtual laboratory can provide adequate and cheaper accessibility to science content with ease. However, this is not feasible in our school environments for either lack of resources to use virtual laboratories or unwillingness on the part of teachers aggravated by the absence of skills to undertake such. This has made the use of our traditional laboratory settings very adequate for science education. Science is one of the core components of the school curriculum. That is reason why, it is an important component of secondary curriculum with a view to developing scientific literacy, attitude, critical thinking and inquiry and understanding of the physical environment surrounding us. Humans are always curious of their surrounding and would always seek to find meaningful relationship between elements and interpret same to build conceptual models. Man lives in a science driven world that is both challenging, making great demand on individual and the society at large. Science subjects constitute a major part of the subject being offered at post-primary institutions in Nigeria. So, simple observation of laboratory experiment is a pre-requisite for cognition which can bring about valid reasoning to ethical scientific considerations. At secondary level, science concepts are beyond the experiences of students, laboratory directly translate scientific phenomena through the influence of quantitative measurement, interpretation to discover theoretical principles. The laboratory is a place where scientific exercises are conducted by the science teacher for the benefit of the students (Learn Maduabum (1992) in.

Nations that have developed adopted instructional strategies that translate theory into practice effectively. Learning is achieved at the point where the individual is able to draw a link between theoretical constructs and real life application. It is therefore crucial that the nation's work force attains a point scientific readiness that will enable it translate its contents school curricular to drive the nation economy. Adeyeye, (2000) in emphasized the importance of science by stating that it is a fundamental basic tool for man's process and development. Science subjects enable students to have a substantial understanding of their subject matter offered and acquire technical know-how in solving problems in their ever-changing society. It is evident that the child learns because he perceives, and curious and this is a potent force in teaching-learning situation. The above implication means that, except the individual learner touches, hears, handles and sees, examines or manipulate objects, his base for learning is abstract. Obviously, perceptive activity leads to conceptual learning which, if denied (by teachers in the non-use of realia) might deprive the child some intellectual development. The place of biology as a course of study cannot be overemphasized, which makes it a prerequisite subject for many fields of learning that contributes immensely to the technological growth of the nation (Ahmed, 2011). It is a requirement for a student to study; medicine, pharmacy, Nursing, Agriculture, Forestry biotechnology According to Obeide and Al-Any (1996) in the school laboratory has become an essential component of the education process and science teaching throughout the school stage. And due to the nature of Biology, it cannot be taught effectively in the absence of practical, the quality of instruction by setting target for learning as well as finding out the appropriate instructional materials and strategies to be used in the classroom is paramount. In this plight, there is a need for the use of the laboratory approach where instructional materials are used as a means of facilitating better understanding to attain better achievement in Biology and in the field of science. observed that once a person has acquired accurate Biology is seen as one of the core subjects in the Nigeria Secondary School curriculum because of its importance, more students enrolled in Biology in the Senior Secondary School Certificate Examination (SSCE) than for Physics and Chemistry (WAEC 2014). *In spite of the importance of biology, the teaching and learning of biology have not been very successful over the last decade or more, there has been a gradual depreciation in the quality of teaching and learning, this is characterized by poor performance of students in schools and public examinations.*

Objectives of Laboratory work in science includes amongst others; familiarizing the students with the operation with the operation of laboratory equipment, training the students on laboratory steps, fostering the students social attitudes, providing the students with skills of obtaining, classifying, tabulating data and coming up with results, training the students on the scientific method, discovery and investigation, integrating the theoretical with practical knowledge, enhancing the students understanding of the scientific concepts, developing the mental skills like observation, interpretation, prediction, and developing the students' creativity and innovations. Science students have need for practical skill and experiences. This will simplify abstract and complicate concepts. Participation of students ensues cooperative work attitude for problem solving. Howei (2005) in noted that, students can undertake laboratory experiments using simple tools. Thus, the laboratory plays a very important role in the realization of the objectives of teaching process by supporting the intellectual capacity (achievement), the emotional stability (affective) and the psychomotor (skill) objectives of science teaching.

Achievement is learning outcomes of students, which include the knowledge, skills, and ideas acquired and retained through what they have learnt within and outside the classroom environment. Aql (1983) in purposes that the school laboratory has a significant role in accomplishing the cognitional, emotional and psychomotor objectives. To carry out laboratory experiments, the teacher must have the readiness and positive attitude towards laboratory work and should be able to guide the students and advise them so that they carry the work successfully. Again, Kok and Brian (1993) in their study compared knowledge cognition and the learning outcomes of the preparatory stage students who were taught by the traditional teaching method in the capital city of Singapore. The study showed that, there were significant differences in the Mean (X) scores of the students who studied Science through experiments and those who studied through the traditional method. The students taught by using the laboratory experimental method scored higher than the students taught by the traditional method. Zaytoun (1996) in emphasized the necessity of introducing laboratory experiments in Science Curriculum to help achievement of the objectives of teaching science. Furthermore, Hussein (2001) in also investigated the effect of laboratory experiments on the Send grade secondary students' achievement in chemistry in Abyan Governorate in Yemen. The sample of the study consisted of 126 students divided into experimental and control groups. The result showed that the experimental group students scored higher than the control group students, due

to the positive effect of laboratory experiments on the students' achievement. El-shemaly (2006) in studied the laboratory effect on the tenth grade students' achievement of physics concepts. The sample of the study consisted of 96 students divided equally into an experimental and control groups. The study showed that they were statistically significant differences in the Mean (X) scores of both groups. The students in the experimental group scored significantly higher than those of the control groups, but there were no significant differences at  $\alpha$  0.05 that could be attributed to the student gender in both the control and experimental groups. El-Rabadi (2013) investigated the effect of laboratory experiments on grade ten students' achievement in Physics. A sample size of 130 Jordanian students was used for the study. A 30 multiple choice item achievement test was designed to measure the students' achievement. The result showed that the experimental group student achievement was higher than that of the control group.

### **Aim and Objectives of the Study.**

The aim of the Study was to investigate the impact of practical Laboratory dissection on students' achievement in Biology among Unity Colleges in Niger State. Specifically, the study investigated the following objectives:

1. To determine the impact of practical laboratory dissection on Students' achievement in Biology among Unity Colleges in Niger State.
2. To find out whether practical laboratory dissection differentiate between male and female on achievement among Unity Colleges students in Niger State.

### **Research Questions**

The following research questions were raised to guide the study:

1. Is there any difference in the mean achievement scores of students taught practical dissection of rabbit and those taught using an alternative to practical method?
2. Is there any difference in the mean achievement scores of male and female students' taught practical dissection of rabbit and those taught using an alternative to practical method?

### **Null Hypotheses**

The following null hypotheses were tested at the 0.05 alpha level:

- HO<sub>1</sub>**: There is no significant difference in the achievement of students taught dissection of Rabbit using practical methods and those taught using an alternative to practical method.
- HO<sub>2</sub>**: There is no significant difference in the achievement scores of male and female students' taught practical dissection of Rabbit and those taught using an alternative to practical method.

### **Research Methodology**

The research design adopted is quasi-experimental research design; pre-test, post-test non-equivalent experimental and control groups design. The population of the study was 539 students (male & female) SS2 biology students between the age brackets of 16 and 20 years in five (5) Unity Colleges in Niger State. Sample size of 92 students (54 male & 36 female) was selected from two colleges using purposive sampling technique. The experimental group was exposed to Practical Laboratory class of rabbit dissection while the control group was exposed to alternative to practical, i.e. they were taught internal anatomy of the rabbit without practical exposition. Experimental sample (Federal Government College, Minna) of 44 students (26 male & 18 females) and a control sample (Federal Science and Technical College, Kuta, Shiroro) of 48 (29 male & 19 females) were involved in the study. Practical Laboratory Achievement Test Items (PLATI) multiple choice items on rabbit dissection was used as instrument for data collection. The PLATI was validated by experts (content validity) by experts in science education in Federal University of Technology, Minna and reliability coefficient of 0.66 was obtained using Pearson Product Moment Correlation Coefficient (PPMC). The data were collected with the assistance of biology teachers (research assistants) in the schools' involved in the study. Descriptive statistics were used to analyze the research questions, i.e. Mean (x) and Standard Deviation (SD) while inferential statistics, i.e. Analysis of variance (ANOVA) was used to analyze the two null hypotheses. Statistical Package for Social Science (SPSS), version 20.0 was used in carrying the analysis of data collected.

### **Data Analysis and Presentation of Results**

Analyses of research question are presented as follows:

RQ1: Is there any difference in the mean achievement scores of students taught practical dissection of rabbit and those taught using an alternative to practical method?

Table 1: Mean (X) and Standard Deviation of Achievement Scores of experimental and control groups

Group	N	Pre-test		Post-test		Mean Diff
		$\bar{X}$	SD	$\bar{X}$	SD	
Practical Dissection	44	38.23	6.69	74.36	10.25	36.13
Alternative to Practical	48	37.83	7.61	51.52	16.15	13.69 $\omega$

Table 1 reveals the Mean (X) and SD of pre-test and post-test scores of students taught dissection of the rabbit of the experimental group (practical method) and control group (alternative to practical). It is observed that, the X scores of the two groups at post-test differ significantly ( $X = 74.36$ ;  $SD = 10.25$  &  $X = 51.52$ ;  $SD = 8.25^*$ ). The result showed a Mean Difference of 12.44 between the two groups in favour of the experimental group that were taught practical dissection with a live rabbit.

RQ 2: Is there any difference in the mean achievement scores of male and female students' taught practical dissection of rabbit and those taught using an alternative to practical method?

Table 2: Mean (X) and Standard Deviation (SD) of Male and Female Students Achievement Scores at Pre-test and Post-test of Experimental Group.

Group	Gender	N	Pre-test		Post-test		Mean Gain
			$\bar{X}$	SD	$\bar{X}$	SD	
Experimental Practical Dissection	Male	26	39.62	5.76	74.46	11.32	34.82 $\omega$
	Female	18	36.22	7.57	74.22	8.80	38.00

Table 2 reveals the mean and standard deviation of the pre-test and post-test scores of male and female students in the experimental group. From the table, the mean scores of the two groups at post-test differs, where male students had mean scores of 76.00 with a standard deviation of 10.07 while their female counterparts had mean scores of 74.22 with a standard deviation of 8.80. The table further shows that male students recorded mean gain score of 36.42 as against 38.00 recorded by their female counterparts. This implies that there is a difference of -1.58 between the mean achievement scores of male and female students taught dissection of rabbit through practical method.

**Null Hypotheses**

Result of analysis of variance (ANOVA) of the null hypotheses.

Table 3: Pre-test analysis of experimental and control groups results

Source of Variation	Sum of Square	df	Mean Square	F <sub>cal</sub>	P value
Between Groups	3.563	1	3.563	0.069 <sup>NS</sup>	0.793
Within Groups	4648.394	90	51.649		
Total	4651.957	91			

NS: Not Significant at 0.05 level

Table 3 shows the ANOVA comparison of pre-test scores of experimental and control groups. The table reveals that no significant difference exists in the post-test scores of the two groups ( $F_{(1,90)} = 0.069$ ,  $p > 0.05$ ). Hence, Analysis of Variance (ANOVA) was used in testing all the null hypotheses in this study.

**HO<sub>1</sub>**: There is no significant difference in the achievement of students taught dissection of Rabbit using practical methods and those taught using an alternative to practical method.

**Table 4: Summary of ANOVA result of post-test achievement scores of experimental and control groups**

Source of Variation	Sum of Square	df	Mean Square	F <sub>cal</sub>	P value
Between Groups	11978.567	1	11978.567	64.21*	.000
Within Groups	16790.161	90	186.557		
Total	28768.728	91			

Significant at 0.05 level

Table 4 shows the ANOVA comparison of post-test scores of experimental control groups. The table reveals a significant difference in the post-test scores of the two groups ( $F_{(1,90)} = 64.209, p < 0.05$ ). Hence, hypothesis one was rejected. This implies that a significant difference exists between the achievement of students taught dissection of rabbit using practical laboratory dissection and those with alternative to practical method.

**HO<sub>2</sub>** There is no significant difference in the achievement scores of male and female Students' taught practical dissection of rabbit and those taught using alternative to Practical method.

**Table 5: Analysis of Variance (ANOVA) result of post-test achievement scores of male and female students in the experimental group**

Source of Variation	Sum of Square	df	Mean Square	F <sub>cal</sub>	P value
Between Groups	32.508	1	32.508	0.356 <sup>NS</sup>	0.554
Within Groups	3655.111	40	91.378		
Total	3687.619	41			

NS: Not Significant at 0.05 level

Table 5 shows the ANOVA comparison of post-test scores of male and female students in the experimental group. The table reveals that no significant difference exists in the post-test scores of the two groups ( $F_{(1,40)} = 0.356, p > 0.05$ ). Hence, hypothesis two was not rejected. This implies that significant difference does not exist between the achievement of male and female.

This implies that significant difference does not exist between the achievement of male and female students taught dissection of rabbit through practical method.

### Discussion of Result

The result of the ANOVA analysis on the achievement of students who received instruction using practical laboratory dissection and those taught without laboratory dissection (alternative to practical). The finding shows that, there is a significant difference between the two groups in favour of the experimental group that were taught rabbit dissection in the laboratory ( $F_{(1,90)} = 64.209, p < 0.05$ ). This finding corroborates that of Aql (1983) in that school laboratory has a significant role in accomplishing the cognitional, emotional and psychomotor objectives. The finding is also in line with the finding of Hussein (2001) which investigated the effects of laboratory experiments on the sixth grade secondary students' achievement in chemistry in Yemen. Furthermore, the finding of this research study supports another earlier study by El-Shemaly (2006) in on the effect of laboratory work on tenth grade students' achievement in physics. Still, in Chukwu, (2009) in his findings that, practical laboratory work enhances inquiry and performance, especially when students are taught through practical work. This agrees with the finding of in Chinwe and Uzoamaka, (2011) who found out that students exposed to practical laboratory work strategy performed significantly better than their counterparts who were taught using traditional method. Therefore, laboratory experiments have a very significant effect on the overall performance of students in Biology and other science fields.

The analysis on whether there is a gender difference among students' exposed to laboratory practical dissection shows that, there is no significant difference ( $F_{(1,40)} = 0.356, p > 0.05$ ) between them. This is shown that, male and female students can perform equally when subjected to practical laboratory approach to learning biology concepts at secondary school level. Because then the result of ANOVA

analysis showed that there was no significant difference in the achievement of male and female students. This finding is in agreement with the finding of who found out that male and female students performed equally well when exposed to adequately equip laboratory. This finding disagrees with Galadima (2003) and Ekeh (2004) in that reported male superiority in achievement in science. While Shuaibu and Mari (1997) reported female superiority in achievement in science. The researcher could not find any literature on practical laboratory works that indicated differences in achievement between male and female students in biology and other science related subjects at secondary school level of education in Nigeria.

### Conclusion

From the findings of the study, the following conclusion was raised:

- I. That secondary school students' achievement in biology can be enhanced when practical laboratory works/dissection is used as a technique for teaching rabbits' internal physiology. Because, practical activities have helped students to make an observation, identification, analysis and inferences which both cognate and skills required for optimum performance in science. Male and female students were affected positively by practical laboratory work, showing that this approach is gender friendly.
- II. That practical laboratory work/exercises do not differentiate between male and female students. And so, it can be adjudged as a good approach to learning biology and science.

### Recommendations

The following recommendations were made:

- I. Secondary school science laboratories should be established and equipped for teachers to conduct practical works.
- II. Science teachers in training must be equipped with the skill to be able to prepare and undertake laboratory practical exercises for students.
- III. School administrators should be interested in providing necessary support and equipment for practical laboratory exercises, since practical works are capital intensive.
- IV. Funding for education must be raised to cater for ever increasing population of students at the secondary level of education at both federal and states controlled schools for laboratory exercise bearing the importance of science to national development.

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