# EFFECT OF EXPERIENTIAL LEARNING STRATEGY ON BIOLOGY STUDENTS' ACADEMIC ACHIEVEMENT IN DUTSIN-MA LOCAL GOVERNMENT AREA OF KATSINA STATE

**BY**
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**Abstract**
*This study investigated the effect of experiential learning strategy on biology students' academic achievement in Dutsin-Ma L.G.A. of Katsina State. The study employed a quasi-experimental research design. The population for the study comprised 718 Senior Secondary II biology students. Simple random sampling technique was used in selecting two schools in Dutsin-Ma LGA. Two intact classes were selected from the two schools. One intact class represented the experimental group (N=38) while the other intact class represented the control group (N=31.)The experimental group was taught using experiential Learning Strategy while the control group was exposed to traditional lecture method of teaching. The instrument for data collection was Biology Achievement Test (BAT) validated by experts with reliability coefficient of 0.63. The data was analyzed using mean, standard deviation and t-test. The result revealed that the Experiential Learning Strategy is superior to the traditional Lecture method in facilitating student's achievement in biology. The study also revealed that males showed higher achievement than females, and the difference in the mean achievement was statistically significant. The researcher recommended that experiential Learning strategy be adopted in senior secondary schools because it enhances academic achievement.*
**Key words:** ***Experiential learning strategy, Academic achievement, Diffusion, Osmosis concepts***

## Introduction

Modern science is the foundation upon which modern advances in technology depends. Most breakthroughs that man has experienced in his quest for a better life were achieved through scientific knowledge (Ihejiamaizu & Ochui, 2016). Ezeh (2013) stated that science is both a process and a product. Science as a process includes scientific methods, while as a product it includes knowledge, facts, and principles. Both the process and products of science are acquired through a specialized kind of education, such as science education. Science education according to Beyessa (2014) is concerned with the developing of technologically literate citizens who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday activities. Millar (2014) stated the aims of science education as: to help students to gain an understanding of as much of the established body of scientific knowledge as is appropriate to their needs, interests and capacities; to develop students' understanding of the methods by which this knowledge has been gained, and our grounds for confidence in the knowledge about science. However achieving these goals has been a problem.

Kaptan and Timurlenk (2012) stated some of the main problems that should be overcome for a sustainable and proper science education consisted of inadequate teacher motivation, lack of high-quality teachers, insufficient number of science and technology teachers' taking active role in the preparation of the programs, insufficient in-service training of the science teacher, lack of motivation in students, demographic changes, large class size, intensive curriculum with insufficient time , less laboratory opportunities for students, persistent achievement gaps in science and math among many student subgroups. Beyessa (2014) stated that many countries have given adequate attention, to the effective implementation and practice of science education at their secondary schools. This is because they realized

how important science education is in the economic growth of a nation. Federal Republic of Nigeria (2011) in its Science, Technology and Innovation Policy stated that the economy will be run based on science and technology because no nation can make progress economically without science and technology. At the senior secondary school level, science education has been divided into chemistry, physics and biology.

Biology is the study of living things, their evolution, structures, function, distribution and taxonomy which occupies a special position in the secondary school science curriculum. It serves as a pre-requisite to the study of different lucrative and challenging professions such as: medicine, pharmacology, nursing, biochemistry, agriculture among others. Federal Ministry of Education, (FME, 2014) stated the objectives of biology education which are: to prepare students to acquire adequate laboratory and field skills in biology, for meaningful and relevant knowledge in biology; to enhance student ability to apply scientific knowledge to everyday life in matter of personal and community health and agriculture; for reasonable and functional scientific attitudes.

Despite the importance of biology, the achievement of students in biology has not been encouraging as seen in Table 1.

**Table 1: Percentage distribution of students' achievement in May/June Senior Secondary Certificate Examination (SSCE) in Biology in Nigeria, 2002 - 2016**

| Year | Total sat | Credit passes 1-6 | Percentage passes |
|---|---|---|---|
| | No of candidates | No of candidates | % of candidates |
| 2002 | 882,119 | 278,112 | 31.52 |
| 2003 | 909,101 | 392,249 | 44.15 |
| 2004 | 1,027,938 | 253,487 | 24.69 |
| 2005 | 1,072,607 | 379,850 | 35.04 |
| 2006 | 1,152,045 | 559,854 | 48.60 |
| 2008 | 1,259,964 | 427,644 | 33.94 |
| 2009 | 1,340,206 | 453,928 | 33.87 |
| 2010 | 1,300,418 | 427,544 | 33.90 |
| 2011 | 1,505,199 | 579,432 | 38.50 |
| 2012 | 1, 672,224 | 649,156 | 38.82 |
| 2013 | 1,757,726 | 709,471 | 40.28 |
| 2014 | 1,677,849 | 638,998 | 37.59 |
| 2015 | 1,181,535 | 627,770 | 53.13 |
| 2016 | 1,087,683 | 802,483 | 73.77 |

***Source: Statistics section, West African Examination Council (WAEC) Nation Office, Onipanu, Lagos, Nigeria.***

The table showed that, most of the result of performance of biology students is below 50 percent pass mark, apart from the 2015 and 2016 result. Experiencing difficulty in Biology could be attributed to many factors such as classroom learning environment, lack of interest in learning science, overloaded curriculum content, delineation of science from society, teaching strategy etc. (Etobro & Fabinu, 2017). Hasni, Roy and Dumais (2015) stated that studies have revealed that students have inadequate conceptions on biological concepts. Some of such biology concepts include osmosis and diffusion. Students' understanding of the phenomena of diffusion and osmosis is a requisite for their understanding of certain basic biological functions. For example, they allow students to understand exchanges that the cells maintain with their immediate environment; how some simple molecules are able to enter or leave cells (diffusion); how concentrations on both sides of a cell membrane determine the movement of water (osmosis) and

the resulting state of turgidity of cells (Hasni, et al., 2015). Emphasis in biology education, therefore, is now on students' involvement in their own learning through active participation in the learning process. In this way, students will be able to connect the biological facts, theories and principles they have learnt in biology classrooms to real purposes and practices in the world in which they live. To achieve this, appropriate opportunities should be provided during biology instructions for students to learn from direct experiences through manipulation of materials and engaging in science processes. This kind of learning is called experiential learning (Okafor, 2014). In order for biology learning to be meaningful, it is necessary that biology teachers create conducive environment and stimulate interest in learners through active method of teaching such as experiential strategy of teaching.

An experiential learning classroom is characterized by students active participation in the learning process such that learning becomes interactive, cooperative and collaborative (Wikipedia contributors, 2018). Experiential learning means learning from experience or learning by doing. Craig in Okafor (2014) defined experiential learning as 'knowledge, skills and abilities attained through observation and simulation. Experiential education first immerses learners in an experience and then encourages reflection about the experience to develop new skills, new attitudes, or new ways of thinking (Schwartz, 2012). Experiential learning is important in the sense that it reduces abstractness of concepts, thereby making them clearer in such a way that it creates opportunities for students to experience certain phenomenon by being involved in every necessary step. Through the use of experiential learning strategy, the objectives and goals of biology education mentioned earlier can be achieved, because as students experience certain phenomenon, it will expose them to certain knowledge, in a real life situation.

The Kolbs (2013) had identified 4- stage model of experiential learning which includes:

- The 1st stage model of experiential learning where the learner actively experiences an activity such as lab-session or field work.
- The 2nd stage reflective observation (RO) is when the learner consciously reflects back on that experience.
- The 3rd stage – abstract conceptualization (AC) is where the learner attempts to conceptualize a theory or model of what is observed.
- The 4th –stage; Active Experimentation (AE) is where the learner is trying to plan how to test a model or theory, that is, planning for a forthcoming experience.

Experiential learning is in contrast to rote didactic learning that is common with most biology teachers. Most biology teachers are pre-occupied with verbal instructions (through lecturing, exposition, discussions and questioning) and neglect concrete sensory experiences which give meaning to words. This will facilitate the acquisition of 21st Century skills not only for sustainable and responsible citizenship but for a career in an increasing science and technology driven world society. Although experiential learning is said to expose the learners to real life situations in the classroom, its usefulness for biology instruction has not yet been explored empirically in our conventional classrooms (Okafor 2014).
Studies in different subject areas by different researchers such as, Nwafor (2011); Okoli & Abonyi (2014); Adeyemi & Awolere (2016); Bada & Akinboboola (2017) confirmed that the use of experiential learning strategy in teaching of scientific concepts, improves students' achievement in different science subjects. To the knowledge of the researcher, no study found contrary view. Therefore this study is carried out in Dutsin-Ma local government to see if experiential learning strategy enhances academic achievement.

Studies carried out on the effect of experiential learning and academic achievement of gender by Nwafor (2011), Adeyemi and Awolere (2016), showed that male and female performed equally the same, but studies by Okoli &Abonyi (2014) showed that males performed better than the females when taught using

experiential learning. This study is carried out to find out if male and female students perform significantly different when exposed to experiential learning strategy in Dutsin-Ma Local Government.

**Statement of the Problem**

In Nigeria, the academic achievement of secondary school students in science subjects, especially biology, has not been encouraging. Different researchers attributed different reasons for students' poor achievement in biology especially practical biology. Some factors which can be attributed to students' poor achievement in biology include: abstractness of some concepts, lack of qualified teachers, and absence of appropriate teaching method among others. Most teachers prefer the traditional lecture method in teaching maybe because it's easier to carry out compared to other teaching strategies that encourage active learning in students. Traditional method of teaching, promote rote learning and lack of opportunity for students to manipulate materials and reflect on what they do during teaching and learning processes.

For students to achieve high results, it is necessary that the teacher use teaching methods that will enable the students to participate actively during learning and also link the lesson to true life phenomenon. It is assumed that experiential learning strategy will ensure active participation of students and better academic achievement during teaching and learning of biology. Therefore, this study is set to investigate the effect of experiential learning strategy on students' academic achievement in osmosis and diffusion concepts in Dutsin-Ma Local Government of Katsina state.

**Objectives of the Study**

The objectives of the study are to:

1. Investigate the effect of experiential learning strategy on biology students' academic achievement in osmosis and diffusion concepts.
2. To determine the difference in achievement between male and female biology students taught osmosis and diffusion concepts using experiential learning strategy.

**Research Questions**

The following research questions will guide the study:

i. What is the effect of experiential learning strategy on biology students' academic achievement in osmosis and diffusion concepts?
ii. What is the difference between male and female biology students' academic achievement when taught osmosis and diffusion using experiential learning strategy?

**Hypotheses**

The following null hypotheses are formulated and tested at 0.05 level of significance:

$Ho_1$: There is no significant difference in the achievement of biology students taught osmosis and diffusion using experiential learning strategy and those taught using traditional method of teaching.

$Ho_2$: There is no significant difference in the academic achievement of male and female biology students taught osmosis and diffusion using experiential learning strategy.

**Methodology**

Quasi-experimental Design involving pretest, posttest was used for the study. The population was 718 Biology students made up of 426 males and 292 females. Simple random sampling technique by balloting method was used to select two secondary schools out of the six coeducational schools that served as population of the study. Intact class of each of the two sampled schools was used. A total of seventy eight (69) students were used. Government Day Senior Secondary School Darawa comprised of 38 students served as experimental group while Government Day Senior Secondary School Karofi comprising of 31 served as the control group. Pretest was administered on the subjects, before they were exposed to the treatment to determine if they are different significantly in their ability level. The experimental group was taught diffusion and osmosis concept using experiential learning strategy while the control group was taught the same biology concept using lecture method for six weeks. The posttest was administered six

weeks after treatment. Biology Achievement Test (BAT) validated by two Senior Lecturers from Department of Science Education, Federal University Dutsin-Ma and a biology teacher from one of the sample schools. Test re-test method was used to get the reliability coefficient of 0.79 of the instrument used for data collection. Two research questions and two hypotheses guided the study. The research questions were answered using Mean scores while the hypotheses were tested using t-test statistics at P≤ 0.05 level of significance.

**Results**

The result is presented according to the research questions and research hypothesis.

**Research Question 1**: **What is the effect of experiential learning strategy on biology students' academic achievement in diffusion and osmosis concepts?**

Data obtained in both the pre- and post- tests for the treatment and control groups were used to answer this research question. Mean score and standard deviations were used. The mean gain and standard deviation of students' academic achievement score of experimental and control groups are presented in Table 2

**Table 2: Pretest and Posttest Mean and Standard Deviation of Students' Achievement in Experimental and Control Groups**

| Groups | N | Pre-test mean | Standard deviation | Post-test mean | Standard deviation | mean difference |
|---|---|---|---|---|---|---|
| Experimental | 38 | 8.97 | 2.843 | 13.66 | 4.806 | 1.47 |
| Control | 31 | 8.81 | 2.574 | 12.19 | 3.772 | |

Table 2 shows that the post-test mean score of the experimental group is 13.66 which is greater than that of the control group which is 12.19. The mean difference of the Posttest between the experimental and control groups is 1.47 which shows that there is a difference between the achievement of the experimental and the control group.

**Research Question 2: What is the difference between male and female students' academic achievement taught osmosis and diffusion using experiential learning strategy?**

Mean scores and standard deviation were used to answer this research question. The mean gain and standard deviation of students' academic achievement scores of male and female students in experimental group are presented in Table 3

**Table 3: Pretest and Posttest Mean Achievement Difference between Male and Female Students in Osmosis and Diffusion Using ELS**

| **Variables** | **N** | **Pretest mean** | **SD** | **Posttest mean** | **SD** | **Mean Difference** |
|---|---|---|---|---|---|---|
| Male | 26 | 9.81 | 2.713 | 14.92 | 5.86 | 1.13 |
| Female | 12 | 7.17 | 2.289 | 13.79 | 2.763 | |

Table 3 shows that the post-test mean score of male biology student is 14.92 which is greater than that of the females which is 13.79. The mean difference between the posttest of male and female biology students is 1.13 which shows that there is a difference in achievement between the males and the females taught diffusion and osmosis using experiential learning strategy.

**$Ho_{1:}$ There is no significant difference in the academic achievement of students taught diffusion and osmosis using experiential learning strategy and those taught using traditional method of teaching.**

**Table 4: t-test Analysis of Students' Academic Achievement in the Experimental and the Control Group**

| Variable | N | Mean | SD | Df | p-value |
|---|---|---|---|---|---|
| Experimental: posttest | 38 | 13.66 | 4.806 | 67 | 0.000 |
| Control : Posttest | 31 | 12.19 | 3.772 | | |

Table 4 shows that the calculated p-value of the experimental and control posttest is 0.000 which is less than 0.05 level of significance. This shows that there is a significant difference in achievement between students taught diffusion and osmosis using ELS and those taught using traditional lecture method of teaching. The null hypothesis is therefore rejected.

**$Ho_2$: There is no significant difference in the academic achievement of male and female Biology students taught osmosis and diffusion using experiential learning strategy**

t-test statistic was used in testing this hypothesis as presented in Table 5

**Table 5: Analysis of Gender Difference in Achievement of students Diffusion and Osmosis**

| Variable | N | Mean | SD | Df | T | P-value |
|---|---|---|---|---|---|---|
| Male(experimental) | 26 | 14.88 | 5.086 | 36 | 14.92 | 0.000 |
| Female(experimental) | 12 | 11.00 | 2.763 | | 13.79 | |

Table 5 shows that the calculated p-value between male and female biology students taught osmosis and diffusion using ELS is 0.00 which is less than 0.05 level of significance: This shows significant difference in the achievement of the male and female students

**Discussion**

Table 2 and 4 showed that students taught with experiential learning strategy performed significantly higher than those taught with lecture method. This finding corroborates with the findings of Nwafor (2011) ; Okoli and Abonyi (2014); Bada and Akinbobola (2017), that experiential learning strategy had significant positive effect on students academic achievement.

Table 3 and 5 showed the posttest mean scores of the males and females taught diffusion and osmosis using experiential learning strategy. It revealed that the males achieved higher mean score. This means that gender factor has effect on students' academic achievement in diffusion and osmosis concepts. This disagrred with the findigs of Nwafor (2011); Okoli and Abonyi (2014), which stated that there is no significant difference in acdemic achievement of male and female students when taught using ELS.

**Conclusion**

The result of this study showed that ELS improved students' academic achievement in diffusion and osmosis concepts. It also improved both male and female students' academic achievement.

**Recommendations**

Based on the findings of the study, the following recommendations were made:

i. Biology teachers should embrace the use of experiential learning strategy as it enhanced academic achievement of biology students.

ii. Curriculum planners, ministry of education and other educational bodies such as Science Teachers Association of Nigeria (STAN) should organize workshops, seminars, and conferences on how to use experiential learning strategy.

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