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**EFFECTS OF EXPERIENTIAL AND PROBLEM-SOLVING STRATEGIES ON  
ACADEMIC PERFORMANCE OF BIOLOGY STUDENTS IN SENIOR  
SECONDARY SCHOOLS IN NIGERIA**

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**ABSTRACT:** *The study investigated the effects of experiential learning and problem-solving strategies on academic performance of Biology students at senior level in some senior secondary schools located in south-west Nigeria. The study examined the difference in the academic performance of Biology students taught with experiential learning and problem solving strategies and their counterparts taught with conventional method. The research design for the study was a quasi-experimental research of the pre-test, post-test control group. The population consisted of Biology students in all public senior secondary schools in south-west Nigeria. The sample consisted 240 SS2 Biology students which was selected through multistage sampling procedure. Two groups were randomly selected to experimental groups and control group. The students in the experimental groups were exposed to experiential learning and problem solving strategies, while the control group were taught with conventional teaching method. Biology Performance Test was used to generate data for the study after the treatment. The instrument was validated by experts in Science Education and Tests, Measurement and Evaluation. Their suggestions were taken into consideration for necessary correction. The reliability was ensured by using test re-test method and coefficient of 0.82 was obtained. The hypotheses were analysed using mean, standard deviation, t-test, Analysis of Covariance (ANCOVA) and multiple classifications Analysis (MCA). The finding showed that there was low performance in experiential learning, problem solving and control groups before the treatment. After exposure of experimental group to experiential learning, problem solving strategies, their performance was high compare to their counterparts in control group. It was recommended that Biology teachers should upgrade their knowledge on experiential learning and problem solving strategies through seminar or workshop, students should be encouraged to use their experience to solve problems in any given concept to enhance their performance.*

**KEYWORD:** effect, experiential learning strategy, problem-solving strategy, academic performance, science students

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## INTRODUCTION

Education has been recognized as a process of imparting knowledge, skills and attitude to the learners. It is an act which involves the process of transmitting, reforming and preserving the collective values embedded in the culture of the society. Education according to mark (2015) can be defined as the wise, hopeful and respectful cultivation of learning undertaken in the belief that all should have the chance to share in life. Education improves the quality of life and the way to acquire wealth of knowledge is through education. Developing nations see

education as the key which will unlock their national resources, the study growth and existence and the best antidote to their problems and ignorance.

Science as Opined by Okorie (2002) is the study of nature and environment through which people can develop both enquiry and disciplined logical power of reasoning. Science is distinguished from other fields of knowledge by its use of experimentally confirmed theories and predictions. Science has been the key to technological take off and has played a vital role in improving the lots of mankind through transportation, agriculture, communication and education. Science is the system of knowing the universe through data collected by observation and controlled experimentation (RAO, 2008). Science is a dynamic human activity concerned with understanding of the working of our world. This understanding helps man to know more about the universe.

Science education occupied a reverend position in the cotemporary world of education practice. Science Education is the one acquainting students with certain basic knowledge, skill and scientific attitude (Jegede & Omotayo, 2010). Science education has contributed tremendously to the economic growth, health services and modern transportation systems and in the level of skilled man-power and their development. Science education in Nigeria concentrates on the teaching of science concepts, methods of teaching and addressing misconceptions held by learners regarding science concepts (Aina, 2013) .Science Education is very important to the development of any nation and that is why every nation must take it seriously in all instruction of learning. Without Science education development in science and technology as well as advances in information and communication technology would not have been possible.

Biology is the science which studies living things and concern itself with the study of the structure, behaviour, distribution, the origin of plants and animals and their relationship with their environments. Biology pervades literally every field of human endeavour. Science Education give special recognition to biology among science students because of its close relation to man as a living organism, its peculiar field of experimentation and interrelationship with the other science subjects. Biology involves a lot of practical work that can stimulate and arouse learners' intent and promote long term memory that theory can not do. Thus, there is need to justify the exposition of students to biology practical activities through experimental strategy.

Experiential learning is a philosophy and methodology in which educators purposefully engage with student in direct experience and focused reflection in order to increase knowledge, develop skills, and clarify values (Association for experiential education, 2011). Experiential learning is also referred to as learning through action, learning by doing, learning through discovery and exploration all which are clearly defined by their well-known maxims such as; I hear and I forgot, I see and I remember, I do and I understand – Confucius, 450 BC; Tell me and I forget, Teach me and I remember, Involve me and I will learn- Benjamin Franklin, 1750. Lewis & Williams (1994) divided experiential learning into two major categories: field-based experience and classroom-based learning. Field-based learning includes intership, practicum, cooperative education and science learning .Classroom-based experiential learning includes role-playing, games, case studies, simulations, presentations and various types of group work. Association for experiential education, (2011) enlist some principles of experiential learning to include;

- Experiential learning occurs when carefully chosen experience are supported by reflection, critical analysis and synthesis.
- Experience is structured to require the student to take initiative, make decisions and be accountable for results
- Throughout the experiential learning process, the student is actively engaged in posing question, investigating, experimenting, being curious and solving problems assuming responsibly, being creative and constructing meaning
- Students are engaged intellectually, emotionally, socially and/or physically. Their involvement produces a perception that the learning task is authentic
- The results of the learning are personal and form the basis for future experience and learning etc

The experiential learning process involves a number of steps that offer students hard- on collaborative and reflective learning experience which helps them to fully learn skills and knowledge (Haynes, 2007). Auston and Rust (2015) believed that the benefits of experiential learning as it relates to student learning outcomes, global awareness, reduction of cultural, and stereotypes, increased social responsibilities and citizenship skills, positive effect on service, commitment and development of problem analysis and critical thinking. According to Goldberg (2007), he asserted that experiential integrates academic content and peer partnership. This could foster social relationship among the learners.

Okoli and Aboli (2014) revealed that efficacy of experiential learning in senior school biology, evidence of its efficacy at the primary school science level is still lacking. According to Ebonyi (2013) he asserted that experiential learning allows student to be active in learning process through interaction, cooperation and collaboration.

Adeoye (2014) submitted that students benefited immensely through experiential learning in the science classes by motivating students to share his/her own idea with others through cooperation skill and through enhanced self-esteem, more than using any other method that will not involve the learners in the teaching-learning process.

Also, Ross (2015) reported that experiential learning is suitable for all learners. An experimental research conducted by Josephine and Okechukwu (2013) in Biology, showed that experiential learning strategy positively influences students' attitude. Positive attitude can invariably influence the academic performance of students.

Problem solving is an investigative task whereby the solver explores the solution path to reach a goal from given information. The problem solving strategy is put in place to assist students to solve problem by moving in a logical step sequence from a problem state to a solution state. No wonder Alabi and Lasisi (2015) believed that Problem Solving could be any action involving channelling the cavity between the anticipated solution and the problem itself. Nbiti and Neji (2018) revealed in their research on effect of problem solving method on students' academic performance that, the experimental groups taught with guided Problem Solving method had a higher mean score than the control group taught with conventional groups. Also, Mandina and Ochonogor (2018) submitted that there was statistically significant difference in the performance of students taught using two Problem Solving strategies and those taught with conventional method. One of the millennium development goals (MDGs) is gender

equality. Fatokun and Odagboyi (2011) noted, most societies, the role of women is knocked to the floor, preventing women from participating in, any benefitting from development efforts. They added that some subjects such as science in which Biology is not exceptional branded masculine. Abubakar & Oguguo (2011) in their comparison, found no significant difference between the performance of boys and girls.

### **Statement of the Problem**

The various methods for teaching biology in secondary schools has been a major concern to many educators. In spite of all the curricular innovation and other efforts aimed at promoting science teaching in schools, it seems little success has been achieved. Teachers need to be conversant with numerous teaching strategies which they use in teaching a concept. Unfortunately, most teachers do not attend workshops and seminars where new innovations and methods could be discussed. Teachers seem not to believe that education is dynamic, things are changing on daily basis. They still believe in using conventional strategy of teaching which may not cater for all round learning, as well as the advancement in science and technology. Some of the teachers believe that they are victims of conventional methods of teaching and they can still raise their heads in society. They forget that a lot of facts such as maturity, dedication and perseverance contributed to their success which students of nowadays perceive as time wastage. The students seem to believe that the conventional method of teaching is becoming old "old school", as it makes the teachers the only source of knowledge with little or no contribution from the students which could have negative effects on student performance. Thus, there is need to try experiential learning strategy and problem solving strategy and find out whether it could influence better academic performance in biology.

One of the millenium development goals (MDGs) is gender equality. Fatokun and Odagboyi (2011) noted that most societies, the role of women is knocked to the floor, preventing women from participating in, any benefitting from development efforts. They added that some subjects such as science in which Biology is not exceptional branded masculine. Abubakar and Oququo (2011) in their comparison found no significant difference between the performance of boys and girls.

### **Research Hypothesis**

The following hypotheses were formulated and tested at 0.05 level of significance

H<sub>01</sub>: There is no significant difference in the pre-test performance mean scores of students in biology in experimental and control groups.

H<sub>02</sub>: There is no significant difference in the post-test performance mean scores of students in biology in experimental and control groups.

H<sub>03</sub>: There is no significant difference in the performance mean scores of male and female students in experimental and control groups.

### **METHODOLOGY**

The research design adopted in this study was a quasi experimental pre-test, post-test control group. The target population consisted of all the biology students in all public senior secondary schools in South-West Nigeria. The sample for the study comprised 240 biology students selected from three states in South-West Nigeria using multi-stage sampling procedure. One instrument was used to collect data for this study and the instrument was Biology Achievement

Test (BAT). This was developed by the researcher to cover those topics on which the pre-test and post-test examination was based. For face and content validity, the instrument was given to experienced biology examiners from both West African Examination Council (WAEC) and National Examination Council (NECO). Also, it was given to experts in the field of science education for critical appraisal before administration. The reliability of the instrument was ascertained using test- retest methods. The reliability coefficient of 0.82 was obtained. The researcher first observes the two groups pre-test after which the experimental group was exposed to experiential learning and problem solving strategies (treatment). The students in the control groups were exposed to conventional teaching strategy. The researcher observed all the groups again for post-test, their scores were subjected to statistical analysis.

## RESULTS

Relevant statistical techniques were used for the testing of all the hypotheses and decision was taken at 0.05 level of significance.

**H0<sub>1</sub>:** There is no significant difference in the pre-test performance mean scores of students taught using experiential learning strategy, problem solving strategy and conventional method

Table 1: Analysis of Variance of pre-test performance mean score of students in the experimental and control groups.

Source of Variance	Sum of Squares	df	Mean Square	F <sub>cal</sub>	F <sub>tab</sub>
Between Groups	3.063	2	1.320	.088	3.62
Within Groups	2256.240	237	25.138		
Total	2259.360	239			

Table 1 showed the Analysis of Variance (ANCOVA) of the pre-test performance mean score of students in experimental and control groups. It revealed that F<sub>cal</sub>(0.088) is less than F<sub>tab</sub> (3.62) at 0.05 level of significance. The null hypothesis is not rejected which implies that, there was no significant difference in the performance of the students in the various groups before the treatment. This indicates the homogeneity of the groups before the treatment was given.

**H0<sub>2</sub>:** There is no significant difference in the post-test performance mean scores of students taught using experimental and control groups.

**Table 2:** ANCOVA showing post-test performance mean scores of students in experimental and control group.

Source of Variation	Sum of Squares	Df	Ms	Fcal	Fcal	Ftab
Corrected Model	4117.239	3	1207.064	258.622	2.40	
Covariate	2274.352	1	2371.352	347.316	3.62	
Group	2127.727	2	1037.753	158.427	3.01	
Error	1149.547	237	3.711			
Total	105333.000	240				
Corrected Total	5120.361	239				

Table 2 showed that Fcal (158.427) was greater than Ftab (2.40) at 0.05 level of significance. The null hypothesis was rejected which implies that there was significant difference between the performance of students exposed to experimental and control group. In order to determine the source of the significant difference, multiple clarification analysis (MCA) was carried out. The result is presented in Table 3.

**Table 3:** Multiple Classification Analysis showing the effect of treatment on students' performance.

Grand Mean = 25.76							
Variable Category	+	N	Mean	Unadjusted Devn	Eta <sup>2</sup>	Adjusted for independent +Covariate	Beta
Control		78		-3.16	.82	-3.16	.82
Problem Solving Strategy		82	28.91	0.57		0.69	
Experiential learning Strategy		80	22.11	4.45		4.50	
R						0.866	
R <sup>2</sup>						0.5678	

Table 3 showed that students exposed to experiential teaching strategy had the highest adjusted mean score of 30.26 (25.76 +4.50) while the problem solving strategy group had an adjusted mean score of 26.45 (25.76 + 0.69). The control group had the least adjusted mean score of 22.60 (25.76+(-3.16)). The implication is that, the experiential learning treatment with higher adjusted mean score was more effective followed by Problem solving strategy group than those in control group. The treatment accounted for 82% of the observed variance in student's performance in biology and the remaining 18% could be due to other variables.

H<sub>03</sub>: There is no significant difference in the performance mean scores of students taught using experiential learning strategy and Problem solving strategy based on gender .

Table 4: ANCOVA showing students' performance in Biology by Gender and Treatment

Source	SS	Df	Ms	Fcal	Ftab
Corrected Model	4170.016	4	517.003	125.016	
Covariate	2064.640	1	2064.640	350.531	3.62
Group	2136.767	1	1057.272	171.562	3.01
Gender	2.135	1	.2.135	.417	3.62
Group * Gender	67.411	2	33.705	.6.146	3.01
Error	1031.345	236	5.317		
Total	105333.000	240			
Corrected Total	5121.361	239			

Table 4 showed that Fcal (6.146) is greater than Ftab (3.01) at 0.05 level of significance. Thus, the null hypothesis is rejected. The implication is that, there was significant difference in the performance scores of male and female students exposed to experimental and control groups. However, the main effect of gender on the post-test performance of students was not significant ( $F=0.417, P<0.05$ ).

## DISCUSSION

The findings of this study revealed that there was no significant difference in the mean performance of students exposed to experimental and control groups, at initial, when the instrument administered on the groups which indicate the homogeneity of the students in the groups before the treatment. The significant difference in their post-test was as a result of effect of treatment on the experimental groups. The experiential group had the highest adjusted mean score followed by problem solving group. This was in line with Goldberg (2007) and Goldberg & Coufal (2009) who asserted that the experiential learning approach integrates academic content and peer partnership which is designed to increase students understanding of the concepts and ideas in a particular subject. The result was also supported by the finding of Ebonyi (2013) who believed that experiential learning allows students to be active in the learning process through interaction, cooperation and collaboration. The problem solving strategy followed the experiential group due to the treatment, the result was in line with the finding of Alabi et al (2015), Nbiti et al (2018) they asserted that the experimental group taught with problem solving strategy had a higher mean score than the control group taught with conventional group. The findings showed significant difference in the performance scores of male and female students after exposing to treatment. This is in agreement with the finding of Ghazvini and Khajepour (2011) that gender difference exists at all level of cognitive functioning in the academic environment.

## CONCLUSION AND RECOMMENDATION

On the premise of the outcome of this study, it could be concluded that the use of experiential and problem solving learning strategy enhances better performance of biology students in southwest Nigeria.

Based on the findings of this study, the following recommendations were made.

1. Adequate orientation should be given to biology teachers through workshop and seminars to update their knowledge on the use of experiential learning and problem solving strategies.
2. Students should be sensitizing in order to embrace this method of teaching in order to improve their performance in biology.

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