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EFFECT OF EXPERIENTIAL LEARNING APPROACH ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN BIOLOGY IN ENUGU EDUCATION ZONE

[1]Ebele Chinelo Okigbo (PhD), [2]Onyekachi Promise Ogbodo, [3]Chioma Stephanie Mbaegbu (PhD)
[1]ec.okigbo@unizik.edu.ng, [2]ogbodopromiseonyekachi9@gmail.com, [3]cs.mbaegbu@unizik.edu.ng
[1, 2] Department of Science Education, Nnamdi Azikiwe University, Awka,

ABSTRACT

The search for innovative approaches for the effective teaching and learning of Biology in Secondary Schools necessitated the study on effect of Experiential Learning Approach (ELA) on secondary school students' academic achievement in Biology in Enugu Education Zone. Two research questions and three null hypotheses tested at 0.05 level of significance guided the study. A quasi-experimental research design, specifically the pretest posttest non-randomized control group design was used. A total of 3,935 Senior Secondary two (SS2) students constituted the population. Multi-stage sampling procedure was employed to draw a sample size of 136 SS2 students used in the study. The students from two intact classes were randomly assigned to experimental and control groups using a flip of a coin. A Biology Achievement Test (BAT) was used for data collection. The BAT and lesson plans were validated by three experts. The reliability index of the BAT established using Kuder-Richardson 20, yielded a reliability coefficient of 0.91. Mean and standard deviation were used in answering the research questions while analysis of covariance (ANCOVA) was used to test the null hypotheses. The findings of the study revealed among others that ELA is more effective in enhancing students' academic achievement in biology than CLM. There was no significant difference in the mean academic achievement in biology by male and female students. Also, there was no interaction effect of teaching methods and gender on students' academic achievement in biology. The study concluded that ELA is a gender friendly approach that enhances students' academic achievement in Biology. Based on the findings, it was recommended among others that ELA should be adopted by Biology teachers in schools to foster students' academic achievement in Biology.

Keyword: Academic Achievement, Biology, Experiential learning approach (ELA), SS2.

Introduction

Science has been acknowledged for a long time as the cornerstone of contemporary technological progress because of its enormous contributions to global development. In recognition of this importance, it is broken down and taught as school subjects like Mathematics, Physics, Chemistry, Geography, Biology etc. at the secondary school level. Biology is one of the science subjects studied in Nigerian secondary schools. Biology is the study of living organisms, their origins, anatomy, morphology, physiology, behaviour, and distribution. It is the study of living things and their vital processes. Similarly, Nwuba, Egwu, Awosika and Osuafor (2023) defined biology as the study of plants and animals as well as their attributes and relationship with their environment. Hence, Biology is simply a branch of science that studies living things, their characteristics and importance.

Considering the premise, one can assert that the importance of biology to man cannot be overemphasized as it deals with all the physiochemical aspects of life. Ghumdia and Adams (2017) in their study, asserted that biology is essential for many fields of learning as it contributes to other fields of study such as medicine, agriculture, biotechnology, and nursing that aid economic growth and development. Learning Biology equips learners with knowledge and skills that help them to face challenges in society especially those related to common diseases, pollution, and genetics. Similarly, Kareem (2018) posited that the knowledge of biology leads to self-understanding and how the body works. In light of the above advantages, one can categorically state that biology is a subject whose impact on man and his environment cannot be ignored as it fosters man's understanding of his body system and environment.

Despite the importance placed on biology, student's performance in the subject, in external examinations, has remained unsatisfactory. Many researchers have attributed this ugly trend of poor performance to many factors. For instance, Njoku (2016) identified the teaching methodology as a factor that can affect students' academic performance in Biology as many teachers have poor teaching skills and ability. Supporting Njoku, Ugwu (2017) reported that lack of qualified teachers is the reason many students perform badly in biology because many schools do not have the resources to employ qualified teachers. However, Nwagbo and Obiekwe (2020) identified school setting (location), students' ability and teachers' ineffectiveness as the many factors contributing to a level of difficulty in the teaching and learning of Biology in secondary schools. Yet, Nsanganwimana (2021) indicated that the root causes of the students' poor performance in Biology are namely: English language as medium of instruction, insufficient laboratory equipment, insufficient teaching and learning materials, inappropriate teaching methodology, amount of content and time allocated, inadequate involvement of parents in learners' education, poverty, students' absenteeism and school environment.

In light of the above factors, one can obviously state that the major factor agreed by the many authors, that influence students' achievement in biology, is the teacher's method used for classroom instruction, which is mostly the use of the conventional methods of instruction. Conventional methods of teaching refer to approaches to teaching involving the teacher in front of the learner's disseminating information and the learners taking down the information. Ufommadu and Okoli (2019) described them as teacher-centred methods frequently utilized in the classroom that involves less participation on the part of students, including lecture, demonstration, discussion, role play method etc. These methods although widely recognized and utilized by teachers in the classroom because of their wide range of advantages which include faster coverage of a large content within a short time, development of students' listening, language and secretarial skills as well as their usefulness in teaching a large population according to Paris (2014) have been criticized by many because of their shortcomings in achieving a lesson stated objectives. In light of these shortcomings of conventional methods, efforts have been carried out by science researchers in search of innovative approaches that can be employed in the classroom to actively involve students in the teaching and learning process. Considering this, the researcher seeks to employ an innovative teaching strategy called experiential learning approach in the teaching and learning process and determine its effect on senior secondary school students' critical thinking ability and academic achievement in Biology in Enugu Education Zone of Enugu State.

Experiential learning approach emphasizes on learning by doing and reflecting on doing (Okuakaji & Sukolatambaya, 2020). Experiential learning approach (ELA) is a form of experience-based learning where learners make meaning of the actual experience. The process of experiential learning encompasses a variety of processes that give students a hands-on, group-based, and reflective learning experience that aids in their full acquisition of new knowledge and skills (Morris, 2020). According to Kolb and Kolb (2017), one develops knowledge in ELA by transforming their own experiences. A learning experience is not simply something that happens; it is a planned activity with a purpose and the learners confirm the purpose. According to Kolb and Kolb, experience-based learning is inductive, learner-centered, and activity-focused. Experiential learning involves the process of making sense of self-concrete experience, which lessens reliance on teachers. The teacher in experiential learning facilitates the process rather than directing it. According to Beard and Wilson (2018), to facilitate experiential learning, the teacher takes on the role of a facilitator, a less dominant position in the classroom, adopting a constructive and non-dominating mentality while approaching the learning process. Teachers that are experts in their fields aid students in organizing and connecting their reflections to the subject base of knowledge (Awolere, 2015).

Experiential learning contributes to student engagement, deeper learning, better academic performance, and improved career and life skills (Andresen, Boud, & Cohen 2020). Experiential learning also helps students relate to their learning specifically by giving them an opportunity to connect new ideas with pre-existing ones while building on their prior knowledge. In 1984, David Kolb introduced the experiential learning approach. Kolb highlighted that in order for students to gain more knowledge and experience with problem solving, learning must be effective and involve four processes: concrete experience, reflective observation, abstract conceptualization and active experimentation.

In the beginning stages of the process, concrete experience learning places a strong emphasis on each learner's capacity for adaptability and open-mindedness when it comes to approaching problems methodically. During the reflective observation process, students watch brief demonstrations using virtual visualizations and attempt to explain why and how they might happen. Because it enables one to critically evaluate the reliability and value of experiences, reflection is crucial for converting experience into knowledge. Students' comprehension of concepts in general is emphasized by the abstract conceptualization process, which makes reference to the procedures of firsthand knowledge and thoughtful observation. Through the process of abstract conceptualization, students must apply critical thinking to comprehend issues. Following that, the process of active experimentation is finished. Students can now forecast using the theory they developed during the abstract conceptualization process. In order to improve students' academic achievement, Zan, Toni, Fornasier, and Battistella (2015) emphasized that learning needs to move away from the conventional model of the teacher standing in front of the class imparting knowledge, to allowing students to apply what they learn in context. Experimental learning approach involves students in both analyzing and synthesizing information as well as applying it to new situations, which improves their problem-solving skills over time.

Academic achievement is the outcome of an educational programme. Academic achievement refers to an academic position a student occupies in the class relative to the position of others, in the same class, usually assessed by the teacher's use of rating scales, tests and examinations. Nwuba

(2021) defined it as the gain in knowledge of a student which occurs as a result of taking part in a learning activity or programme. Hence, academic achievement maybe defined as a statistic report of a student's performance in an engaged educational (academic) programme. In this study therefore, its relationship with students critical thinking ability, a personal variable, was studied irrespective of gender.

Gender is a social construct given to male and female. Filgona and Sababa (2017) defined it as a range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine (female and male) population. Issues on gender influence on students' achievement in biology for over the years have remained inconsistent and inconclusive. For instance, while many researchers (Nwuba & Osuafor, 2021; Uzoma & Okoli, 2019) have reported in their various studies in biology that gender has no significant influence on students' achievement, some (Egwu & Okigbo, 2021; Pat-Anyaeji and Okeke, 2019) reported that male students achieve higher than female students in biology. The inconsistent results on gender calls for further investigation to find out if gender has any influence on students' academic achievement in biology or not. Therefore, in this study, gender differences in academic achievement among secondary school students' taught biology using experiential learning approach was also investigated. Since it is said that a problem identified is a problem half solved, it is then against this scenery that the researcher deemed it necessary to find out the effect of experiential learning approach on secondary school students' academic achievement in biology in Enugu Education Zone of Enugu State, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the difference between the mean achievement scores of secondary school students taught biology using experiential learning approach (ELA) and those taught using conventional lecture method (CLM)?
2. What is the difference between the mean achievement scores of male and female students who were taught biology using ELA and that of those taught using CLM?

Hypotheses

The following null hypotheses were tested at 0.05 alpha levels:

1. No significant difference exists between the mean achievement scores of students taught biology using experiential learning approach (ELA) and those taught using conventional lecture method (CLM).
2. No significant difference exists between the mean achievement scores of male and female students taught biology using ELA and that of those taught using CLM
3. There is no interaction effect of gender and teaching approaches (ELA & CLM) on students' academic achievement in biology.

Methodology

The study adopted a quasi-experimental design, specifically the pretest-posttest non-randomized control group with a 2x2 factorial research design. Nworgu (2015) defined quasi-

experimental research design as one that aims to establish cause-and-effect relationship between variables, without random assignment of people to experimental and control groups. Hence, intact groups were used for the study. 3935 SS2 students constituted the population of the study. Multi-stage sampling procedure was employed to compose the sample size of 136 senior secondary year two (SS2) students sampled from two government owned coeducational schools in Enugu education zone of Enugu State. The sampled students who were in two intact classes were randomly assigned to experimental and control groups using flip of a coin. The instrument used for data collection was a 50-item multiple choice Biology Achievement Test (BAT) developed by the researcher using complied SSCE biology past questions. The instrument was validated by three experts. The reliability of the instrument was that of internal consistency established using Kuder Richardson 20. The reliability coefficient of the BAT was found to be 0.91.

The experiment was conducted in two phases. Phase 0ne and Phase two. Phase one was the briefing of the research assistants who were the regular biology teachers of the sampled schools. In the experimental group, the research assistant was briefed on the use of ELA using the lesson plans developed by the researcher while the research assistant of the control group was given the lesson plans on CLM and then asked to teach as usual. In Phase two, the treatment process commenced with the administering of the pretest (BAT) to both the experimental and control groups. The teaching process in both groups lasted for four weeks in which for each new week a selected concept in biology was taught to the two groups. In the last week of the teaching, a posttest (reshuffled BAT) was administered again to the research participants of the two groups. The two administered tests (pretest and posttest) were collected, scored, and recorded by the researcher. Data from the tests were analyzed using Mean and Standard deviation in answering the research questions and Analysis of Covariance (ANCOVA) in testing the null hypotheses at 0.05 alpha levels. In taking decisions, a null hypothesis was rejected if the Probability (P) value is less than or equal to the level of significance (0.05), if otherwise, the null hypothesis was not rejected.

Results

Table 1: Mean Achievement and Standard Deviation scores of students taught Biology using ELA and CLM

		Pretest		Posttest		
Groups	N	Mean	SD	Mean	SD	Gain in Mean
Experimental (ELA)	53	33.17	0.82	39.94	0.63	6.77
Control (CLM)	83	30.63	0.76	32.90	0.70	2.27
Mean Difference		2.54		7.04		4.50

Table 1 shows that the experimental group taught with ELA had mean achievement scores of 33.17 and 39.94 in their pretest and posttest respectively while their counterparts taught with CLM had achievement mean scores of 30.63 in their pretest and 32.90 in their posttest. The mean difference of the gains in mean for ELA and CLM, revealed that the experimental group achieved higher than the control group, with a mean difference of 4.50. The result indicates that teaching biology using ELA increased students' academic achievement more than CLM. Also, students taught

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Biology using ELA had a less spread of scores in the post-test (0.63) than those taught with CLM (0.70) indicating that students taught with ELA had a more homogeneous score in their post-test.

Table 2: ANCOVA Test of Significant Difference between the Mean Achievement Scores of Students Taught Biology Using ELA and those Taught Using CLM.

Dependent Variable: PreTest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	3255.035[a]	4	813.759	40.000	.000	
Intercept	6.327	1	6.327	.311	.578	
Posttest	2994.901	1	2994.901	147.212	.000	
Method	270.385	1	270.385	13.291	.000	Sig.
Gender	11.757	1	11.757	.578	.448	Not Sig
Method * Gender	6.425	1	6.425	.316	.575	Not. Sig
Error	2665.082	131	20.344			
Total	141876.000	136				
Corrected Total	5920.118	135				

a. R Squared = .550 (Adjusted R Squared = .536)

ANCOVA test from table 2 shows that at an F-value of 13.291, the P-value is 0.000. Since the P-value is less than 0.05 alpha level at df 1 and 131, the null hypothesis is rejected. This shows that there is a significant difference between the mean achievement scores of students taught biology using ELA (experimental group) and that of those taught using CLM (control group) in favor of those in the experimental group. This indicates that the use of ELA in teaching biology enhanced academic achievement of students in the experimental group.

Table 3: Mean Achievement and Standard Deviation Scores of Male and Female Students taught Biology using ELA and CLM

Groups	Gender	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gain in Mean
ELA	Male	22	32.82	1.26	40.27	1.16	6.45
	Female	31	33.42	1.09	39.71	0.71	6.29
	Mean Difference		0.60		0.56		0.16
CLM	Male	33	31.55	1.08	34.12	0.93	2.57
	Female	50	30.02	1.03	32.10	0.97	2.08
	Mean Difference		1.53		2.02		0.49

Table 3 data shows that for the experimental group, the male students had a mean score of 32.82 in their pretest and 4.27 in their posttest while their female counterparts had 33.42 and 39.71 in their pretest and posttest respectively. The mean difference, in the gains in mean, for male and female students taught biology using ELA is 0.16. From the gain in means, it can be deduced that male students achieved better than their female counterparts when both are taught biology using ELA. On CLM, the study showed 0.49 difference in mean gains, revealing also that male students achieved better that their female counterparts. Also, the SD scores obtained in the posttest, for both

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methods, revealed that the scores are more spread out for the females than the males in both ELA and CLM.

Table 4: ANCOVA Test of Significant Difference between the Mean Achievement Scores of Male and Female Students Taught Biology using ELA

Dependent Variable: PreTest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	875.753[a]	2	437.876	22.908	.000	
Intercept	4.727	1	4.727	.247	.621	
Posttest	871.102	1	871.102	45.573	.000	
Gender	15.648	1	15.648	.819	.370	Not Sig.
Error	955.719	50	19.114			
Total	60144.000	53				
Corrected Total	1831.472	52				

a. R Squared = .478 (Adjusted R Squared = .457)

The result from the ANCOVA test in Table 4 reveals that at an F-value of 0.819, the P-value is 0.370. Since the P-value is greater than 0.05 level of significance at df 1 and 50, the null hypothesis is not rejected. Showing that, there is no significant difference between the mean achievement scores of male and female students taught biology using ELA. This indicates that the use of ELA in teaching students' biology is not gender biased as it promoted their academic achievement irrespective of gender.

ANCOVA test from Table 2 shows that at an F-value of 0.316, the P-value is 0.575. Since the P-value is greater than 0.05 alpha levels at df 1 and 131, the null hypothesis is not rejected, revealing that there is no interaction effect of gender and teaching methods on students' academic achievement in biology. This implies that achievement of students in biology in relation to the teaching methods employed, is not influenced by students' gender.

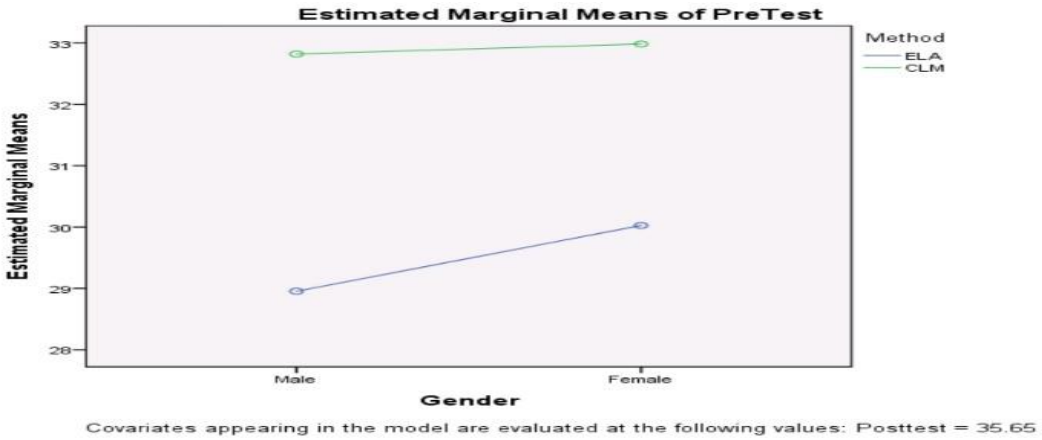

Figure 1: Profile Plot of Interaction Effect of Gender and Teaching Methods on Students academic achievement in biology.

Discussion of Findings

The finding of the study showed that the students taught biology with Experiential Learning Approach (ELA) gained in achievement more than the students taught using Conventional Lecture Method (CLM). This difference in achievement is confirmed by the test of hypothesis 1 examined in table 2 of the study, revealing that there is a significant difference in the mean achievement scores of students taught biology using ELA and those taught using (CLM) in favor of those in the experimental group (ELA). This superiority in achievement can be attributed to nature of Experiential Learning Approach which is "learning by doing" that involves learners experiencing things for themselves and learning from these experiences, as this learning approach exposed the students to opportunities where they experienced things for themselves, worked together and applied the knowledge gained in solving problems. The finding of this study is in line with that of Nwoke (2017) who reported that students taught the concept of geometry in mathematics with ELA outperformed those taught with lecture method. Findings of Agsalog (2019), Bada and Akinbola (2017), Nwuba and Osuafor (2021), and Okolocha (2021) also confirmed the findings of the present study, as they all in their respective studies found out that ELA is more effective in enhancing students' academic achievement in subjects than the conventional method of instruction, prompting them to recommend the adoption of ELA in teaching school subjects. Also, the findings of Onyeka and Okonkwo (2023) lends credence to the current study as their study established that students who were taught with the experiential teaching method retained higher than those taught with the deductive teaching method.

On gender influence on academic achievement of students' taught biology using Experiential Learning Approach (ELA), the finding of the study from table 3 showed that male students taught biology using ELA achieved higher than their female counterparts. This finding agrees with that of Nwuba and Osuafor (2021) who reported that male students outperformed their female counterparts, when both are taught using ELA. However, on testing the null hypothesis in table 4, the study revealed that this difference in mean achievement scores of male and female students taught biology using ELA is not statistically significant. The finding of this study agrees with the findings of Adeyemi and Awolere (2016), Nwuba and Osuafor (2021), and Okoli and Abonyi (2014) who in their various studies found no significant gender difference in academic achievement of students taught with ELA. The findings of Selvarani and Saroja (2022) contradict the finding of this study as it revealed that there is significant difference between male and female secondary school students in their academic achievement in science.

Conclusion

The study established that Experiential learning approach (ELA) significantly improved students' academic achievement in biology irrespective of their gender, as the experimental group taught with ELA had higher mean achievement scores in biology than their counterparts taught with the conventional Lecture Method (CLM). The study also revealed a non-significant influence of teaching methods and gender on students' academic achievement in biology. In light of this, it is therefore pertinent to say that ELA is a gender friendly approach of learning that promotes students' academic achievement in biology.

Recommendations

In accordance with the findings of the study, the following recommendations were made:

1. Biology teachers in secondary schools should adopt the use of ELA to improve students' academic achievement in biology.
2. Seminars, workshops, and conferences should be organized for biology teachers by the government, educating stakeholders and professional bodies like Science Teachers' Association of Nigeria (STAN) to familiarize teachers with innovative instructional approaches such as ELA.
3. Teachers should place greater emphasis on student-student interaction during the teaching and learning process as this will enable students learn from each other those things they cannot learn from the teacher or textbooks, hence enhancing their academic achievement.

REFERENCES

Adeyemi, S.O. & Awolere, M. A. (2016). Effects of experiential and generative learning strategies on students' academic achievement in environmental concepts. *Journal of human ecology, 56(3),* 251-262.

Andresen, L. Boud, D., & Cohen, R. (2020). Experience-based Learning. *In Understanding Adult Education and Training,* 225-239.

Awolere, M. A. (2016). Effects of experiential and generative learning strategies on students' academic achievement in environmental concepts. *Journal of human ecology, 56(3),* 251-262.

Beard, C. & Wilson, J. (2018). Experiential Learning: A Practical Guide for Training, Coaching and Education. *Kogan Page Publishers*.

Egwu, S. O. & Okigbo, E. C. (2021). Effect of field trip on secondary school students' academic achievement in ecology in Anambra State. *South Eastern Journal of Research and Sustainable Development*, *4(1),* 140–156.

Filgona, J. & Sababa, L.K. (2017). Mastery learning strategy and learning retention: Effects on senior secondary school students' achievement in physical geography in ganye educational zone, Nigeria. Preprints.

Ghumdia J. C. & Adams, A. (2017). Effects of inquiry-based teaching strategies on students' science process skills acquisition in some selected biology concepts. This paper likely appeared in the International Journal of Scientific Research (IJSR).

Kareem, D. (2018). Design of inquiry-oriented science labs: impacts on students' attitudes. *Research in Science & Technological Education, 43(12),* 241-255.

Kolb, A. & Kolb, D. (2017). Experiential Learning Theory as a Guide for Experiential Educators in Higher Education. *Experiential Learning & Teaching in Higher Education, 1(1),* 7-44.

Morris, T. (2020). Experiential Learning–a systematic Review and Revision of Kolb's Model. *Interactive Learning Environments, 28(8),* 1064-1077.

Njoku, M. H. (2016). Characterizing the level of inquiry in the Undergraduate Laboratory. *Journal of College Science Teaching, 9(10),* 52-58.

Nsanganwimana F. Karegeya C., & Sentongo J., 2021. Factors affecting the achievement of twelve-year basic students in mathematics and science in Rwanda. *International Journal of Learning, Teaching and Educational Research. 20,* 61-84.

Nwagbo, C. & Obiekwe, I. C, (2020). Surveying students' attitudes and perceptions toward guided-enquiry and open-enquiry laboratories. *Journal of chemical education, 76(21),* 27-32.

Nworgu, B.G. (2015). *Educational Research: Basic issues and methodology (3rd ed).* Enugu: University Trust Publishers.

Nwuba, I.S. (2021). *Effect of Experiential Learning Approach on Secondary School Students' Critical Thinking Ability and Academic Achievement in Biology in Awka Education Zone*. An unpublished thesis submitted to the Department of Science Education, Nnamdi Azikiwe University, Awka.

Nwuba, I. S., & Osuafor, A. M. (2021). Effect of experiential learning approach on secondary school students' academic achievement in biology in Awka Education Zone. *South Eastern Journal of Research and Sustainable Development, 4(2),* 1–15.

Nwuba, I. S. Egwu, O. S., Awosika, O. F., & Osuafor, A. M. (2023). Examining of crossover instructional strategy toward biology students' academic performance in secondary schools. *Inornatus: Biology Education Journal, 3 (2),* 50-59.

Okoli, J.N. and Abonyi, S.O. (2014). Effects of experiential learning strategy on secondary school students‟ achievement in biology. *US-China Education Review, 4(2),* 96-101.

Okuakaji, M. & Sukolatambaya, (2020) Effect of Experiential Learning Strategy on Biology Students' Academic Achievement in Dutsin-MA Local Government Area of Katsina State in Nigeria. *AL-hikmah Journal of Education, 7(10),* 20-25.

Okudo, C.O. (2024). Influence of Attachment Styles on The Development of Adolescents from Anambra State Nigeria. Sapientia Global Journal of Arts, Humanities and Development Studies; 7(4) 235-243.

Okudo, C.O. (2024). Influence of Parental Career on the Psychosocial Development of Secondary School Students in Awka South Local Government Area of Anambra State. *Sapientia Foundation Journal of Education, Sciences and Gender Studies;* 6(4) 161-166.

Pat-Anyaeji, V.N. & Okeke, S.O.C. (2019). Effect of scaffolding instructional strategy on secondary school students' achievement in biology in Onitsha Education zone in Anambra State, *Unizik Journal of STM Education, 3(1),* 32-40.

Paris, P.N. (2014). Advantages and Disadvantages of lecture method of teaching. Retrieve from https//nairaproject.com/m/project/870.html

Selvarani, S. C. and Saroja, M. M. (2022). Critical thinking and academic achievement of secondary school students. *Journal of Positive School Psychology, 6 (4),* 8168 – 8173.

Ufommadu, O. and Okoli, J.N. (2019). Effect of instructional scaffolding on achievement in biology by secondary school students with different cognitive styles in Awka educational zone. *UNIZIK Journal of STM Education, 3(1)*, 72-81.

Ugwu, C. L. (2017). Web-based Collaborative Inquiry Learning. *Journal of Computer Assisted Learning, 19*, 56-69.

Uzoma, J.I. & Okoli, J.N. (2019). Effect of think-pair share instructional strategy on secondary school students‟ academic achievement in Biology in Anambra East Local Government area, Anambra State. *Unizik Journal of STM Education, 3(1),* 52-60.

Zan, G.D. Toni, A.F., Fornasier, A., & Battistella, C. (2015). A methodology for the assessment of experiential learning lean. *European Journal of Training and Development, 39(4),* 332-354. https://doi.org/10.1108/EJTD-05-2014-0040.