

Kolb's Experiential Learning Cycle: A Pedagogical Framework for Enhancing Students' Academic Achievement in Biology

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ABSTRACT

This study investigated Kolb's Experiential Learning Cycle: A Pedagogical Framework for Enhancing Students' Academic Achievement in Biology. The study focused on determining the effect of Kolb's experiential learning cycle (KELC) on secondary school students' academic achievement biology in Awka Education zone of Anambra state. A quasi-experimental design was employed with 115 SS2 students from three intact classes as participants for the study. A validated Biology achievement test (BAT) was used for data collection, and the data obtained were analyzed using mean, standard deviation, and ANCOVA. The major findings of the study showed that students exposed to KELC achieved highly in Biology than those taught with expository method. Based on the findings, it was concluded that learning through Kolb's experiential learning cycle promotes students-based learning in which the students discover solution for themselves, consolidate theoretical understanding of biology concepts, develop cognitive abilities, creative thinking, scientific attitude and obtain a scholastic academic achievement. This research study made several contributions to the existing body of knowledge by demonstrating that the use of Kolb's experiential learning cycle in teaching Biology is crucial for engaging learners, promoting effective learning in the classroom and invariably, improving the achievements of students in Biology in secondary schools in Anambra State, Nigeria.

Keywords: Kolb's Experiential Learning Cycle, Academic Achievement, Biology

INTRODUCTION

Biology is the study of life, living organisms, and how they interact with their environment and it is seen as one of the core science subjects offered by the majority of students at secondary school Nigerian education system. This subject also plays a fundamental role in educational advancement as it is a prerequisite subject for many fields of learning which contributes immensely to the technological growth and development of the nation. Despite some of objectives of teaching biology in senior secondary schools in Nigeria, reports revealed that the records of students' achievements in both internal and external examinations have been consistently poor over the years and does not seem to be improving despite research efforts that sought ways of addressing the issue. Nwuba and Osuafor, (2021), attributed this issue to many factors which includes include inadequate laboratory facilities and instructional materials and most importantly, teachers predominant use of conventional methods like expository method of teaching which makes students to be passive listeners in the classroom. Although no single method may address the learning needs of all students in the classroom, teachers are, however, encouraged to be flexible in their choice of teaching strategies, so that all students will participate in the teaching and learning process despite their level of understanding. In this regard, Odukwe, (2021) recommended the use of diverse innovative instructional strategies such as Kolb's experiential learning cycle, which may help to improve students' achievement in biology and enhance learning.

Kolb's experiential learning cycle is a holistic perspective on learning that encompasses experience, perception, cognition, and behaviour (Kolb, 2017). This learning model was developed by educational theorist David Allen Kolb in 1984. Essentially, Kolb believed that individuals could demonstrate their knowledge,

understanding, or the learning that occurred, when they were able to apply abstract concepts to new situations. In this cycle, learning is a process that involves our experiences, reflections, and ability to utilize what we have learned in new situations (Cherry, 2025). Kolb's experiential learning cycle (KELC), a four-stage process, posits that effective learning occurs through concrete experience, reflective observation, abstract conceptualization, and active experimentation, leading to improved knowledge retention and academic achievement. Educational research widely applies KELC in Biology instruction to transition students from hands-on lab work to theoretical understanding which frequently improves academic achievement.

Academic achievement is a key educational variable that demonstrates accomplishment of some outcome for which learning experiences were designed (Nnorom & Odukwe, 2021); reflecting the success or failure of teaching and learning by measuring a student's attainment of educational goals, often through assessments like exams or continuous evaluations. Academic achievement is a direct manifestation of learning effectiveness and a valid indicator to evaluate the effectiveness of teaching and education in higher education as well as the overall development of students (Zheng & Mustapha, 2022). By promoting active engagement and reflection, KELC is a powerful tool for improving the way learners absorb and apply new knowledge irrespective of gender. In Nigeria, and perhaps the whole of Africa, gender bias is still very prevalent and in recent times, gender related issues have generated serious concerns for science educators judging by the number of studies done to that effect, still, there is no consensus as to whether it influences students' achievement in biology or not. Hence, the researcher considered it necessary to explore the effect of gender on students' achievement in biology using Kolb's experiential learning cycle.

Purpose of the Study

The study focused on determining the effect of Kolb's experiential learning cycle on secondary school students' achievement in selected biology topics irrespective of gender. Specifically, the study is set to determine the:

- Mean achievement scores of students taught biology using Kolb's experiential learning cycle and those taught using the expository method.
- Mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle.
- The interaction effect of teaching method and gender on students' mean achievement scores in biology

Research Questions

The following research questions guided this study:

- What is the mean achievement scores of students taught biology using Kolb's experiential learning cycle and that of those taught using the expository method?
- What is the mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle?
- What is the interaction effect of methods and gender on students' mean achievement scores in biology?

Hypotheses

The following null Hypotheses guided this study and were tested at 0.05 level of significance.

H₀₁: There is no significant difference between the mean achievement scores of students taught biology using the Kolb's experiential learning cycle and those taught using expository method

H₀₂: There is no significant difference between the mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle.

H₀₃: There is no significant interaction effect of methods and gender on mean achievement scores of students in biology.

METHOD

Quasi-experimental design was adopted as a design for this study. Specifically, the study applied the non-equivalent control group design of pretest and protest. This design was considered appropriate for the study because random assignment of subjects to experimental and control groups is not possible. The sample size for the study comprised of 115 SS2 students from three intact classes in two Government owned co-educational secondary schools in Awka Education Zone of Anambra State. A purposive sampling technique was used to draw one double-stream and one single stream co-education schools offering Biology. Simple random sampling was used to assign one school to the experimental group and one school to the control group. The experimental group was made up of two intact class with total number of 70 participants while the control group was made up of one intact class with total number of 45 participants

Data Collection

A validated Biology Achievement Test (BAT) was used for pre-test and post-test treatments respectively to collect data for the study. Three days intensive training programme was organized for both the control group and the experimental group teachers in the sampled schools to assist in the study. The biology teachers in the experimental group were trained on the necessary techniques required for teaching students through Kolb's experiential learning cycle while the biology teachers in the control group were notified on the general requirements of the research since, they use expository method lesson plans to teach. The pre-test was administered to both the experimental and control groups before the treatment to establish baseline data.

Two sets of lesson plans were used in this study. The lesson note on Kolb's experiential learning cycle was used by regular classroom biology teacher in teaching experimental group and that of the expository method was used by regular classroom biology teacher in teaching the control group. They were used based on the contents of the topic (excretory system and respiratory system) that was taught to the students during the period covered by this study. These lesson plans highlighted the specific objectives to be achieved, the instructional materials, strategies, entry behaviour, the teachers' activities, learners' activities and the evaluation techniques. In the experimental group, regular biology classroom teachers served as facilitators and provided some clues similar to the experiential learning whereas the students solved the problems from their experience and got the answers themselves.

The learner begins by having an experience (experience) and then reflects on the experience from several perspectives (observation). From those reflections, the learner draws concepts or conclusions and formulates them into theories or models (conceptualization) that lead them to experiment (experimentation). In the control group, regular biology classroom teachers taught using expository method. After the experimental teaching periods, the pretest was re-numbered, and administered to the students in each group as a post test at the end of 4 weeks teaching.

Method of Data Analysis

The scores obtained from the pre and post-test were analyzed using mean and standard deviation and ANCOVA. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance.

RESULTS

Research Question 1: What is the mean achievement scores of students taught biology using Kolb's experiential learning cycle and those taught using expository method?

Table 1: Mean achievement scores of students taught biology using Kolb's experiential learning cycle (KELC) and those taught using expository method.

Variable	N	Pretest		Posttest		Mean Gain
		$\bar{X}$	SD	$\bar{x}$	SD	
KELC	70	50.47	4.11	82.28	5.61	31.81
Expository method	45	48.95	5.06	71.71	7.67	22.76

The result in Table 1 showed that the posttest mean achievement scores of students taught biology with Kolb's experiential learning cycle were 82.28 while that of students taught with expository method were 71.71. Therefore, students who were taught biology with Kolb's experiential learning cycle had higher mean achievement scores than students who were taught biology using the expository method after the posttest treatment.

Research Question 2: What is the mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle?

Table 2: Mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle.

Gender	N	Pretest		Posttest		Mean Gain
		$\bar{X}$	SD	$\bar{x}$	SD	
Male	26	50.00	6.03	80.74	6.27	30.74
Female	44	51.00	4.62	84.00	4.17	33.00

The result in Table 2 showed that the posttest achievement mean score of male students taught biology using Kolb's experiential learning cycle were 80.74 while that of female students taught biology with Kolb's experiential learning cycle was 84.00. Therefore, female students who were taught biology using Kolb's experiential learning cycle had higher mean achievement scores than their male counterparts.

Research Question 3: What is the interaction effect of method and gender on students' mean achievement scores in biology?

Table 3: Interaction effect of method and gender on students' mean achievement scores in biology.

Teaching Method	Gender	N	Pretest		Posttest		Mean Gain
			$\bar{x}$	SD	$\bar{X}$	SD	
KELC	Male	26	50.00	6.03	80.74	6.27	30.74
	Female	44	51.00	4.62	84.00	4.17	33.00
Expository method	Male	25	49.51	4.26	67.59	6.71	18.08
	Female	20	48.36	3.93	75.94	6.17	27.58

The result in Table 3 showed that both male and female students taught biology with Kolb's experiential learning cycle had a mean achievement score of 164.74, while that of male and female students taught biology with expository method was 143.53. This indicated that KELC is superior to expository method at the two levels of gender (male and female). Therefore, there was no interaction effect on method and gender on students' mean achievement scores in biology. This was because at all the levels of gender, the mean achievement scores were higher for students in the experimental group than those in the control group.

Hypotheses Testing

Hypothesis 1

There is no significant difference between the mean achievement scores of students taught biology using the Kolb's experiential learning cycle and those taught using expository method.

Table 4: ANCOVA on the difference between the mean achievement scores of students taught biology using the Kolb's experiential learning cycle and those taught using expository method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7161.860 ^a	4	1790.465	54.831	0.000
Intercept	9777.255	1	9777.255	299.416	0.000
Pretestach	162.808	1	162.808	4.986	0.027
Method	4998.588	1	4998.588	153.075	0.000
Error	6792.122	109	32.654		
Total	1331778.000	115			
Corrected Total	13953.981	114			

Data presented on Table 4 indicated the level of significance of the effect of Kolb's experiential learning cycle on students' achievement in biology. The calculated F-value of the test was $(1, 213) = 153.075$ with p-value of 0.000. Since the p-value (0.000) is less than 0.05 level of significance, the study rejected the first null hypothesis which stated that there is no significant difference between the mean achievement scores of students taught biology using Kolb's experiential learning cycle and those taught using the expository method. This indicates that the significant difference in the mean achievement scores is in favour of students taught biology using Kolb's experiential learning cycle.

Hypothesis 2

There is no significant difference between the mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle.

Table 5: ANCOVA on the difference between the mean achievement scores of male and female students taught biology using the Kolb's experiential learning cycle.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7161.860 ^a	4	1790.465	54.831	0.000

Intercept	9777.255	1	9777.255	299.416	0.000
Pretestach	162.808	1	162.808	4.986	0.027
Gender	1621.311	1	1621.311	49.651	0.000
Method	4998.588	1	4998.588	153.075	0.000
Error	6792.122	109	32.654		
Total	1331778.000	115			
Corrected Total	13953.981	114			

Data presented on Table 5 is the ANCOVA on the difference between the mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle. The calculated F-value of the test is 49.651 with is p-value of 0.000. Since the p-value (0.000) is lesser than the 0.05 level of significance, the study rejected the second null hypothesis that "there is no significant difference between the mean achievement scores of male and female students taught biology using Kolb's experiential learning cycle". Since the mean achievement scores of female students is higher than their male counterpart, this implies that the significant difference is in favour of female students.

Hypothesis 3

There is no significant interaction effect of methods and gender on mean achievement scores of students in biology.

Table 6: ANCOVA on the interaction effect of methods and gender on mean achievement scores of students in biology.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7161.860 ^a	4	1790.465	54.831	0.000
Intercept	9777.255	1	9777.255	299.416	0.000
Pretestach	162.808	1	162.808	4.986	0.027
Gender	1621.311	1	1621.311	49.651	0.000
Method	4998.588	1	4998.588	153.075	0.000
gender * method	355.039	1	355.039	10.873	0.001
Error	6792.122	109	32.654		
Total	1331778.000	115			
Corrected Total	13953.981	114			

Data presented on Table 6 is the ANCOVA on the interaction effect of methods and gender on mean achievement scores of students in biology. The calculated F-value of the test is 10.873 with is p-value of 0.001. Since the p-value (0.001) is lesser than the 0.05 level of significance, the study rejected the third null

hypothesis that “there is no significant interaction effect of methods and gender on mean achievement scores of students in biology”. This indicates that there is a significant difference in interaction effect of method and gender on students’ mean achievement scores in biology

DISCUSSION

Mean achievement scores of students taught biology using Kolb’s experiential learning cycle (KELC) and those taught using expository method.

The findings revealed that students taught biology with a Kolb’s experiential learning cycle had higher mean achievement scores than students taught biology using the EM after the posttest treatment. Further analysis of research findings shows that result of the first null hypothesis was rejected indicating that there was a significant difference in favour of students taught biology using Kolb’s experiential learning cycle. This was in agreement with the findings of Maduegbunam (2025) who revealed that adopting Kolb’s experiential learning cycle in teaching and learning, help students to have expected achievement at the end of the learning outcome and also enhance their permanence of knowledge in Biology. Teaching with Kolb’s experiential learning cycle, creates an enabling environment where students can discover learning information themselves, thereby acquiring higher achievement towards the subject.

Mean achievement scores of male and female students taught biology using Kolb’s experiential learning cycle.

The findings showed that female students taught biology with Kolb’s experiential learning cycle had greater mean achievement scores than their male counterparts taught biology with Kolb’s experiential learning cycle. Further analysis of research findings shows that the result of the second hypothesis was rejected, indicating that there was a significant difference in favour of the female students taught biology using Kolb’s experiential learning cycle. The research finding was in line with observation result of Eya et.al. (2024) who revealed that female students showed higher achievement than the male students in the teaching and learning process, but disagrees with the findings of Anugwo et.al (2024), Nwuba and Osuafor, (2021) which states that male students taught with experiential approach showed higher achievement than the female students. Therefore, while Kolb’s experiential learning cycle is a superior alternative to expository methods for improving achievement in Biology, it does not eliminate the disparity in achievement between male and female students, with girls typically maintaining a higher achievement level.

Interaction effect of method and gender on students’ mean achievement scores in biology.

The analysis of the result showed that there was no interaction effect of method and gender on students’ mean achievement scores in biology after the posttest treatment. Furthermore, the result of the third hypothesis was rejected, indicating that there was a significant difference in interaction effect of method and gender on students’ mean achievement scores in biology. This was in agreement with the research findings of Ogundana (2025) who revealed that the interaction effect of treatment and gender significantly influenced the attitude of students towards Biology, with male students achieving higher mean scores. The findings suggest that active learning strategies, such as case-based and experiential methods, may shift student attitudes and improve their achievement when compared to conventional, teacher-centered methods; this is because, learning through Kolb’s experiential learning cycle promotes students-based learning in which the teacher takes on the role of a facilitator, letting the students to discover solution for themselves.

CONCLUSIONS

Learning through Kolb’s experiential learning cycle promotes students-based learning in which the students discover solution for themselves, consolidate theoretical understanding of biology concepts, develop cognitive abilities and obtain a scholastic academic achievement. Kolb’s experiential learning cycle is a highly effective

framework for student-centered biology education that bridges the gap between abstract theory and real-world observation.

Educational Implications of Findings

The education implications of findings for this study reflects the impact of Kolb's Experiential Learning Cycle (KELC) in teaching Biology to senior secondary school students. From the findings of the study, it was revealed that teaching biology using KELC was more efficient and effective than with expository method, by taking students through concrete experiences, reflective observation, abstract conceptualization, and active experimentation, KELC significantly boosts students' achievement.

RECOMMENDATIONS

Based on the findings and conclusion of the study, it was recommended that; School administrators should include innovative learning approach such as Kolb's experiential learning cycle in the school curriculum for teachers to employ in the classroom as this will encourage students' active participation. This is because from the findings, students exposed to Kolb's Experiential Learning Cycle (KELC) achieved higher in Biology than those taught with expository method. Also, STEM educator professional associations should monitor the implementation of the innovative methods in the classroom because monitoring ensures effective evidence-based instructional feedback, which is essential for enhancing students' academic achievement.

Contributions to Knowledge

This research study contributes to the evolving stream of research on the effectiveness of Kolb's experiential learning cycle (KELC) on students' achievement toward the learning of Biology. Additionally, the findings of this study confirm that KELC has huge significant contributions to the teaching and learning of Biology than expository method emphasizing on enhanced academic achievement among students which places an emphasis on practical exploration and real-world applications, better learning, comprehension, fostering a deeper knowledge of Biology principles and concepts.

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