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Effects of an Activity-Based Learning Strategy on Secondary School Students' Academic Achievement in Biology in Asari-Toru Local Government Area, Rivers State

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Abstract
This study investigated the effect of activity-based learning strategies on the academic performance of secondary school students in Biology within Asari-Toru Local Government Area of Rivers State. The research was guided by two research questions and two corresponding hypotheses. A quasi-experimental design involving pretest and posttest control groups was adopted for the study. The population comprised 677 senior secondary one (SS1) Biology students enrolled in public secondary schools across the local government area. From this population, a sample of 132 students was drawn from four public schools, with each intact class serving as an experimental unit. The participants were selected through a purposive sampling technique. Data collection was carried out using the Biology Achievement Test (BAT) instrument, which yielded a reliability coefficient of 0.76 based on the Kuder-Richardson Formula 21 (KR-21). Descriptive statistics such as mean and standard deviation were used to address the research questions, while Analysis of Covariance (ANCOVA) was employed to test the hypotheses at a 0.05 level of significance. The findings indicated that students exposed to the activity-based learning strategy performed significantly better than their counterparts taught using the discussion method. Furthermore, a statistically significant difference was observed between the performance of male and female students taught through the activity-based approach. These outcomes suggest that Biology teachers can enhance students' academic achievement by integrating activity-based strategies into classroom instruction. The findings also emphasize the importance of providing equal learning opportunities for both male and female students, ensuring that all learners can effectively develop their scientific understanding and reach their full academic potential.

Keywords: Activity-Based Learning, Students' Academic Achievement, Retention, Hands-On, Minds-On Approach

Introduction

The global educational environment has evolved into newer and better ways of instruction that properly address issues in any area of life including science education. The instruments of Science and Technology (ST) has become crucial in teaching and offers value to learning. It fascinates and thrills the learning environment, boosts educational outcomes as well as gives tangible lifelong learning experiences of individuals. It allows ability to gain new abilities in more consistent approach and reduce educational shortcomings. Teaching and learning in the digital clime simply involves the use of technological resources and procedures to enhance the teaching and learning process which change pedagogies to create friendlier strategies to learning. Green (2024) believes that the employment of technological instruments in learning has introduced new learning strategies and has developed teaching and learning processes in a basic sense and has aided to the production of new learning theories. Several modern technologies have been integrated into teaching and learning, to make learning practical rather than abstract. The perspective of educational technology relies on the learners' ability to actively reproduce knowledge and understanding, letting learners and instructors transcend over the rising learning period. This basically implies that instructors can no longer be the repository of information required by the learners but rather becomes facilitator that drives learners' search for knowledge and information. The new orientation in education is student oriented learning; highly engaging and dynamic learning environment, interesting and promoting learners'

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interest. To achieve superior educational outcomes, instructors must understand and develop skills on how to apply learning resources and design activities that boost learners' performance

In order to operate educational resources effectively, teachers must be proficient in Biology tools and applications as working tools to create, develop and manage the learning environment, run laboratories and other scientific equipment and gadgets. The teacher should be able to effectively handle resources within the scientific community, and incorporate it into teaching and learning to strengthen science process abilities. In order to navigate the scientific world effectively, the learning environment must excite and motivate the learner and advertently elicit critical thinking. The inspired learners activate creativity and science thinking, actively organize and generate knowledge. Therefore, the development of scientific process skills is built on various features that makes learning incredibly productive and communicates to the actual world to instructors (Januszewski & Molenda,2014). Learning tactics have been altered worldwide from what was known as traditional to more efficient strategies. This paradigm shift has substantially boosted learning at various levels with the emergence of recent instructional approaches available due to developments in education. Innovative teaching strategies are crucial in improving learning deficiencies resulting from the former. The traditional teaching methodologies have fallen below relevant educational standards and no longer compatible with 21st century learning rather the aftermath leads to disappointment and poor performance (Wagbara & Amakiri, 2017). Many of the teaching strategies adopted in the past emphasized "drill and rote"; modeling, presentations, shard learning and practical examples. These basic methods hinder critical thinking, problem solving, meta-cognition and collaborative capacities. The prior educational techniques targeted teacher-centered approaches that did not suit learners' needs (Green, 2022). The developments in science education has supported learners to acquire science process abilities and boost scientific methodology across science domains. Qualitative teaching strategy that delivers motivation, self-directed learning and competence is considerably required for scientific learning. Although, the traditional approach of teaching is still extensively employed today, Wagbara and Alu (2022) claims that educational reform has transformed learning experiences and opened learners' ability to receive, analyze and integrate critical knowledge. The previous approach of teaching that de-emphasizes collaborative learning has been rejected and teachers are motivated to adopt best suited strategies to increase learning. Newer learning approaches appropriate for the 21st-century learner has been devised and used in the new educational clime. Innovative learning approaches employs active ways to learning, problem solving and absorbing new information. Learning strategies are realistically developing to more organized and renewed ways that are better suited for the 21st century learners' who are digitally driven (Odutuyi, 2024).

The learning strategy is crucial in every teaching and learning situation as learners' are meant to receive content knowledge in a manner that facilitates understanding; remembering, applying, analyzing, evaluating and problem-solving. This helps students' to efficiently organize and structure information by simply producing blocks of new knowledge by receiving, assimilating, and constructing essential information. This sequence profoundly invigorates creativity and imaginative problem solving skills (Halpern, 2020).

Education is the process of teaching the mind and transferring knowledge to increase and grow talents in learners. Education is an avenue of teaching and learning mostly in schools or colleges, to develop knowledge and build skills (Osuala, 2019). The ultimate purpose of education is to enable a person to accomplish in a selected field so as to make favorable influence on the environment (Mustapha, 2020). The latter definition makes it evident that education helps a person to be responsible and develops a building block for the development of an equitable society and to attain national and international goals. Education helps in establishment of Constitutional Provisions, accomplish Millennium Development Goals, promotes Education for all and supports Universal Declaration of Human Rights, and the fulfilment of the United Nation's convention on the rights of the child which has generated tremendous expectations for education at all levels. This indicates that education is the foundation for national growth. It gives form and shape and organize our growth in a formidable manner so that national development is attainable. Nevertheless, the quality of education which is as crucial as the quantity still requires a lot in developing countries like Nigeria in order to satisfy these standards and expectations for education (Osuala, 2019).

The National Policy on Education (NPE, 2013), section 11 of the policy on educational services which was enacted to guarantee the implementation of the policy on education and make learning experience concrete and meaningful for learners. The policy provides special ways in accomplishing educational objectives via the creation of teacher resource centers, science and mathematics centers and workshops. The scientific curriculum also focuses on the

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student and fosters learner centered activities and technique that is learner driven rather than teacher centric. According to Hong Kong SAR (2015), the objective of science education is to offer students with enough scientific material that meet their needs, interests and abilities, build scientific skills efficient for solving everyday situations. To this end, schools and institutions should promote instructional strategies that are not only student oriented but also emphasizes creating important science process abilities that enable learners manipulate the scientific process and engage in critical thinking. The transition in education necessitates that instructors migrate from the old classroom approaches to digital classroom which include technology in teaching to control the effect of negative attitude of students toward study of Biology. The modern class enables self- motivation, involvement, and collaboration, interested and actively engaged learners to interact with learning materials throughout the learning.

Learning Biology should include a wide variety of scenarios that encourages problem solving. Due to the limitations in teaching science, learners are not able to develop inferences and draw conclusions about certain events. The mental and physical processes involved in resolving difficulties are underutilized in the day-to-day study of science. This makes the study of Biology uninteresting and tedious. This circumstance resulting in poor educational outcomes and does not stimulate scientific thinking. Thus, learners' lack basic science process skills and are not proficient in the scientific process (Hong Kong SAR, 2015).

Ekere (2020) opines that the purpose of education is to assist individuals grow in knowledge and empowered to succeed in any chosen career, generate beneficial change in behavior and affect others alike. To this goal, education should not focus simply on academic distinction but ability to make positive change in the community. On the contrary, the output of the process of education have gradually degraded in expectations of academic distinction and change in behavior in the learners. Several factors may be answerable for the decline which may range from educational policies, curriculum content as well as learning strategies which are vehicles that drive the learning process and responsible for actualizing anticipated learning outcomes.

Furthermore, suitable teaching strategies must be deployed to enhance instruction and offer possibilities to correct low academic performance in schools. The teachers are expected to assume responsibility in the quest for excellence in all subject areas to solve the present problem of poor performance (Agabi et al., 2015). However, studies have shown that there is a fall out in the teaching of Biology. The attitude of students towards the study of Biology has been adverse contributing to poor outcomes. This has surely influenced students' choosing of higher educational courses. The negative attitudes and the questionable performances in Biology can be attributed to inadequate teacher education and improper teaching strategies or approaches. Unlike most ancient methodologies, contemporary scientific education contains demonstrative techniques which may be applied within a style of teaching or used independently. The Demonstration technique which is often referred to as problem solving method and boosts students' learning capacities in specific ways. This method allows the learner to think far apart, search beyond facts to comprehend broad perspective of the topic and make choices between two or more alternatives (Ekere, 2020). Demonstration technique helps the brain to explore new concepts and engage in tackling hard issues. Scientific demonstration is used as an exhibition lesson to highlight elements of an object or model correct use of scientific equipment. It could be done by the instructor, teacher-student, student group, simply students or by a guest (Halpern, 2020). This technique focuses on accomplishing psychomotor and cognitive objectives. The teacher displays activity and learners duplicate activity on their own. This strategy helps learners' build competence by applying the principle of learning by doing. This helps to blend several senses to make learning practical and focuses on students' intellectual progress. The teacher offers intellectual challenges to allow learners gain key abilities like critical thinking, problem solving etc. Learners are free to develop their own learning style and study at their own pace. Learners' insight and innovative ideas are appreciated and valued. Although, this technique is never one hundred percent self-directed by students, instructors provide support via shared and guided learning, scaffolding, chunking etc (Green, 2020).

The world has become globalized. Hence, uniqueness and innovation in both teaching and learning is crucial to the growth of science. The trends in teaching science has significantly developed that the traditional technique is no longer suitable for current learning strategy. On the other side, discovery method in science is more interesting and student led. It comprises an unrestrained exploration in problem solving scenarios in which the learner learns value evaluation from diverse physical and mental processes (Nwanekezie & Arokoyu, 2016). However, the projected technological advancements cannot be accomplished without providing focus to the study of basic science in scientific education. This is because of its continual usage in the delivery of vital necessities and the general well-being of the scientific community.

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In contemporary science education, the curriculum increasingly prioritizes learners' active participation in scientific inquiry rather than teacher-centered instruction. Empirical evidence indicates that students achieve higher levels of cognitive and psychomotor performance when instructional processes incorporate scientific tools and resources (Ifeakor, 2020). Without access to adequate facilities for hands-on engagement, students are unable to meaningfully "do" science. Consequently, unless this imbalance is corrected, the goals of Biology teaching and learning will remain unattained. The persistent low performance of students in Biology and other science subjects in national examinations reflects this challenge. Such outcomes suggest deficiencies in developing essential scientific skills, often stemming from limited exposure to practical activities. This situation points to a broader weakness in the instructional system that warrants further examination and improvement.

Arukoyu (2018) emphasized that science education is fundamentally experimental and should therefore be taught through activity-oriented approaches within well-equipped laboratory settings. Similarly, Azizoglu and Uzuntiryaki (2016) argued that laboratory experiences are indispensable for fostering students' curiosity, creativity, positive attitudes toward science, and problem-solving skills, as well as for deepening their understanding of scientific concepts and methods. The laboratory, therefore, serves as a vital medium for effective science instruction.

According to Green (2024), Activity-Based Learning (ABL) represents an instructional model that immerses students in direct, practical engagement with subject matter. Rather than functioning merely as passive recipients of knowledge, learners construct understanding by performing tasks, participating in real-world problem-solving, and engaging in experiential learning processes. The approach is grounded in the idea that students learn best through active involvement. ABL provides diverse, purposeful activities and scenarios that encourage learners to observe, explore, analyze, and apply newly acquired knowledge and skills. This hands-on and minds-on approach connects learning experiences to real-life situations, thereby promoting inquiry, creativity, and critical thinking. Geneva Global (2022) notes that ABL encourages students to pose questions, seek solutions, and adapt to different learning contexts. The teacher's role is to design engaging, relevant, and purposeful learning experiences, communicate clear objectives, offer constructive feedback, and guide students in collaborative reflection and assessment of learning outcomes.

Activity-based learning (ABL) techniques can be broadly grouped into three major categories of instructional approaches. The first category involves relatively traditional strategies such as reading, note dictation, lectures, and question-and-answer sessions; however, these methods are modified to promote student engagement and inquiry, allowing learners to explore topics more independently. The second category includes learner-centered practices that actively engage students in discovering and applying information drawn from the curriculum. The third category emphasizes experiential learning beyond the classroom, where students relate academic content to real-life situations, thereby applying acquired knowledge to broader societal contexts (Geneva Global, 2022).

Within science education, ABL encompasses a range of practical and investigative activities that encourage scientific reasoning and problem-solving. These activities often rely on laboratory experiments, digital simulations, and other inquiry-based procedures that help actualize the objectives of experiential learning. According to Omoki and Ufonfu (2019), laboratory-based instruction offers multiple benefits, including helping students to better understand the nature of science and technology, appreciate the human aspect of scientific exploration, and develop a deeper intellectual and aesthetic interest in scientific inquiry. One of the fundamental goals of science education is to equip learners with transferable skills that can be applied across various real-world contexts. Through such experiences, students cultivate scientific curiosity, critical thinking, and positive attitudes toward science. Omoki and Ufonfu (2019) further identified eight essential scientific attitudes that can be nurtured through laboratory experiences—curiosity, open-mindedness, objectivity, intellectual honesty, rationality, suspension of judgment, humility, and respect for life.

Queensu (2018) affirmed that since the late nineteenth century, educators have recognized the laboratory as a central component of science teaching. Laboratory education, according to the author, promotes observational skills, enhances understanding, sustains curiosity, and reinforces conceptual learning. Effective laboratory teaching, however, demands careful planning, creativity, and instructional expertise comparable to designing and executing rigorous scientific research. A well-structured laboratory program can help learners internalize scientific concepts, apply classroom theories in new contexts, observe fundamental phenomena, refine experimental and analytical skills, and develop proficiency in both written and oral scientific reporting. Similarly,

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Omoki and Ufonfu (2019) emphasized that laboratory instruction complements theoretical lectures by improving students' technical competence and capacity to apply abstract concepts in tangible ways. As Omoki and Ufonfu (2019) observed, hands-on experimentation fosters a spirit of inquiry, enabling learners to acquire scientific skills, appropriate attitudes, and proficiency in the use of laboratory tools and materials.

Thus, the science laboratory provides one of the most comprehensive platforms for authentic learning experiences. It allows students to engage directly in scientific inquiry, mirroring the practices of real scientists, and helps them develop competencies relevant to future educational and professional endeavors. For laboratory instruction to be truly effective, learners must not only carry out experiments but also grasp the underlying principles, relevance, and logical connections that enhance their conceptual understanding. Consequently, schools that lack functional laboratories for Biology, Chemistry, and Physics risk producing graduates with insufficient practical knowledge—an essential requirement for examinations administered by bodies such as the West African Examinations Council (WAEC) and the National Examinations Council (NECO).

According to Nwosu et al. (2022), addressing the persistent low performance in Biology necessitates examining the learning conditions that contribute to it. Recent studies have increasingly demonstrated that activity-based learning environments foster students' academic development by encouraging active participation and responsibility for learning outcomes. Traditional teaching methods, often characterized by rote learning and teacher dominance, have been identified as a major contributor to declining instructional quality and poor academic performance among secondary school students in Nigeria. This persistent problem underscores the need for empirical investigations into the effectiveness of activity-based learning strategies in enhancing students' achievement in Biology. The present study therefore seeks to evaluate the impact of activity-based learning on the academic performance of secondary school students in Biology.

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Statement of the Problem

Over the years, the drastic drop in students' academic performance in Biology calls for worry and have been ascribed to numerous variables which may be accountable for the low results in Biology. These issues which involve improper instructional pedagogies that de-emphasize scientific thinking, lack of science equipment and learning resources as well as lack of flexibility to new learning methodologies. The lack of sufficient scientific materials necessary for teaching Science at different levels of education is a barrier in the Biology classroom. Teachers select simpler approaches to escape the difficulty of lack of instructional media and give instruction in one- way process instead of actively engaging students via the use of technology and link learners to the learning. They tend to override the use of digital tools and resource that is inherent to the 21st century learner and continues to preserve the dull practice of 'talk and chalk'. This traditional and somewhat quirky educational method has adversely affected learners' attitude towards the study of Biology. The incapacity of Biology instructors to migrate to adaptive learning has created a danger to the future of students' academic success in Biology. Many instructors use discussion approaches not ideal for teaching science, which is poor in terms of application, analysis, synthesis and assessment and does not encourage divergent thinking. Learning should be discovery oriented and that discovery only happens when the learner utilizes his mental processes to find particular features of a defined occurrence. In spite of the acknowledged value of Biology as the cornerstone of the sciences and allied fields, literatures have shown that students' low performance in Biology is mostly attributable to teaching style. Hence, the necessity to use Activity-based learning technique to enable learners' access and engage with learning materials that encourages the learner and makes learning meaningful. Most instructors are not versed with the philosophy of science and does not use adequate instructional strategy for teaching science. Given the scenario, Activity-based learning technique may be the best option for successful learning of Biology.

Aims and Objectives of the Study

The purpose of this study is to examine the effect of activity-based learning on Biology students' academic performance in secondary schools in Asari-Toru Local Government Area, Rivers state. And the objectives were to;

i. Find out the difference between the mean achievement scores of students' taught Biology using face-to-face Activity-based learning strategy and Discussion method.
ii. Determine the academic achievement mean scores of the male and female students taught Biology with the face -to-face Activity based learning strategy?

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Research Questions

The following research questions guided the study

1. What is the difference between academic achievement mean scores of students taught Biology by the use of face-to-face Activity-based learning strategy and those exposed to Discussion method?
2. What is the difference between the academic achievement mean scores of the male and female students taught Biology with the face -to-face Activity based learning strategy?

Hypotheses

The following formulated null hypotheses were tested at .05 level of significance.

$H0_1$: There is no significant difference between the academic achievements mean scores of students taught Biology by the use of face-to-face Activity-based learning strategy and those taught by the use of Discussion method**.**

$H0_2$: There is no significant difference between the academic mean scores of male and female students taught Biology by the use of face-to-face Activity-based learning strategy.

Methods and Materials

The study employed a pre-test post-test quasi experimental research approach; One hundred and thirty-two (132) Senior Secondary One (SS1) Biology students in four complete classes provided the sample size for the study. They were sixty-eight (68) males and sixty-four (64) women. Purposive sampling technique was utilized to identify four public schools in the Local Government Area. Two from the four selected Secondary schools with their intact classes were randomly divided into experimental group composed of 66 pupils and the control group containing 66 youngsters. The public schools were selected based on the availability of skilled and experienced Biology instructors and availability of operational scientific facilities. Using the varied teaching materials that followed activity-based learning approach, the experimental group acquired instruction in Biology on the topic of interest. The same lecture on the issue were presented to the control with discussion style applied as it is typically accessible in the secondary school settings. Before the experiment, a pre-test was administered to the control group and experimental group to confirm their baseline knowledge. The two groups received schooling for five weeks. On the conclusion of the instructional period, a post-test was administered to assess the level of performance. The mean and standard deviation was applied to answer research questions while ANCOVA was done to analyze hypotheses at 0.05 level of significance.

Results

Research Question 1: What is the difference between academic achievement mean scores of students taught Biology by the use of face-to-face Activity-based learning strategy and those exposed to Discussion method?

Table 1: Academic achievement mean scores and standard deviation scores of students taught Biology using activity-based learning strategy and those taught using Discussion method.

Teaching Method	N	Pre-test		Post test		Mean Gain
		Mean	SD	Mean	SD	
Activity	66	26.29	6.55	78.17	9.72	51.88
Discussion	66	25.14	7.34	47.26	9.20	22.12
Mean Difference						29.76

It can be seen that the students who were taught biology through an activity-based learning method during the pre-test had a mean score of 26.29 (SD=6.55), and in the post-test students mean score was 78.17 (SD=9.72), which represents a mean of 51.88. Students instructed through a discussion method registered a baseline mean of 25.14 (SD = 7.34) during pre-test, but their mean score was 47.26 (SD = 22.12) during post-test. The difference of 29.76, in favor of the activity-based instructional approach, was statistically significant.

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Research Question 2: What is the difference between the academic achievement mean scores of the male and female students taught Biology with the face -to-face Activity based learning strategy?

Table 2: Academic achievement mean scores and standard deviation scores of male and female students taught Biology by the use of Activity-based learning strategy.

Gender	N	Pretest		Post test		Mean Gain
		Mean	SD	Mean	SD	
Male	34	35.95	6.53	74.41	9.88	38.47
Female	32	21.16	7.40	81.41	9.85	60.25
Mean Difference						21.78

Table 2 indicates that the average score of the male students taught Biology using the Activity-based learning in the pre-test stage was 35.94 (SD= 9.84) and that a mean increase of 38.47 was attained. Conversely, female students who learned Biology through the means of Activity-based learning had the mean of 21.16 (SD 7.40) on pre-test and 81.41 (SD 9.85) and 60.25 (mean gain) on post-test. The general mean disparity in favor of the female pupils was 21.78.

Testing of Hypotheses

$H0_1$: There is no significant difference between the academic achievement mean scores of students taught Biology with the use of face-to-face Activity-based learning strategy and those taught by the use of Discussion method.

Table 3: Analysis of covariance (ANCOVA) of students' academic achievement mean scores in Biology when taught with face-to-face Activity-based learning strategy and those exposed to Discussion method.

Source	Type III Sum of squares	Df	Mean Square	F	Sig.
Corrected model	31964.834[a]	2	15982.417	183.817	.000
Intercept	28204.834	1	28204.834	324.834	.000
Pretest	437.562	1	437.562	5.032	.027
Method	30704.921	1	30704.921	353.143	.000
Error	11216.226	129	86.947		
Total	56.2312000	132			
Corrected Total	43181.1061	131			

a R squared=.740 (Adjusted R squared=.7365)

Table 3 data were used to assess the existence of a statistically significant overall difference in mean academic success among students taught Biology using an activity-based methodology of teaching that is based on face-to-face approach and that taught by a discussion-based approach. According to table 3, the F-ratio is 352.1 and the p-value is =.00. The p -value was also contrasted with the significance level 95 0 = -.05, giving P = -.05. In turn, this has resulted in the null hypothesis ($HO_{1)}$ being rejected, which implied that there is indeed a significant difference between the mean academic success scores of the group of students taught Biology by the activity-based method based on face-to-face activities and the group taught with the use of the discussion technique.

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$H0_2$: There is no significant difference between the academic achievement mean scores of the male and female students taught using face-to-face Activity-based learning strategy.

Table 4: Analysis of covariance (ANCOVA) of significant difference between the academic achievement mean scores of the male and female students taught Biology using face-to-face activity-based learning strategy.

Source	Type III Sum of squares	Df	Mean Square	F	Sig.
Corrected model	828.284[a]	2	414.412	4.197	.019
Intercept	26525.054	1	12244.323	288.288	.000
Pretest	21.798	1	21.798	.221	.640
Gender	823.676	1	823.676	8.3480	.005
Error	6216.156	63	98.669		
Total	406553.000	66			
Corrected Total	7044.439	65			

a R squared=.118 (Adjusted R squared=.090)

Table 4 was used to assess whether a significant difference existed in the average score of academic success of male and female students studying biology with the help of the activity-based learning. The analysis shows that the F -ratio is 8.34 and the p-value is 0.00. The outcome is statistically significant since it is less than the standard alpha of.05 (P100.05). It therefore follows that H 2 was rejected and it was found that there is significant difference in the academic performance of male and female students learning Biology using activity-based learning.

Discussion

The findings of the study conducted on the influence of activity-based learning strategies on the academic achievement of secondary school students in Biology within Asari-Toru Local Government Area of Rivers State revealed that learners exposed to activity-based instruction achieved higher mean scores than their counterparts taught through the discussion method. Further analysis using Analysis of Covariance (ANCOVA) confirmed that the observed difference between the two groups was statistically significant. Moreover, a significant difference was also recorded between male and female students who participated in the activity-based learning sessions, suggesting that gender may play a role in learning outcomes when this instructional approach is employed.

These findings align with the results reported by Green (2024), who observed that students taught Biology using an activity-based approach demonstrated superior performance compared to those taught through conventional discussion-oriented techniques. Similarly, the results are consistent with Agbenyeku (2017) study, which identified activity-based learning as a more effective pedagogical strategy for enhancing students' academic performance than the traditional lecture method. The current study therefore reinforces the recommendation that science educators adopt activity-based teaching approaches to improve students' learning outcomes and overall academic achievement.

In addition, the present findings corroborate those of Mokiwa and Agbenyeku (2019), who emphasized the value of activity-based instructional methods in fostering both theoretical understanding and practical competence in science education. Likewise, Sarpong et al. (2020) found that students taught through activity-based strategies in Social Studies exhibited higher recall ability and academic performance compared to peers taught via conventional methods. Their research also indicated that gender significantly influenced learners' academic attainment when exposed to activity-based learning environments. Collectively, these studies affirm that engaging students in hands-on, experiential learning enhances comprehension, retention, and overall achievement in science subjects such as Biology.

Conclusion

The research reveals that students taught Biology using Activity-based learning technique did better than those taught with Discussion method. Activity based learning technique boosts both male and female students' academic performance while female students substantially performed better than their male counterpart.

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Recommendations

1. Based on the outcomes of the research, students taught Biology using Activity-based learning approach fared better than those taught with Discussion technique. Hence, Biology instructors should embrace the usage of Activity-based learning technique to boost students' academic performance and retention in Secondary schools.
2. The research revealed that gender has a substantial influence on students' academic performance and retention in Biology. It is thus vital for instructors to advise and provide students of various gender equal learning chances in Biology so that students of different gender might have optimal academic performance.
3. Secondary schools should be appropriately provided with basic instructional materials resources to let instructors utilize learning techniques suited for problem solving such as Activity-based learning approach

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