

Blended Learning Method and Students' Academic Achievement in Biology

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ABSTRACT

This study investigated the effect of blended learning method on students' academic achievement in Biology and the study was carried out in secondary schools in Obio/Akpor Local Government Area of Rivers State. The study adopted quasi-experimental design, the sample size was 100. The instrument for data collection was Biology Achievement Test (BAT). The validity and reliability of the instrument was established. A reliability coefficient 0.83 was obtained after analysing the data obtained from pilot test with Pearson Product Moment Coefficient (PPMC). Mean and standard deviation was used to answer research questions while t-test statistics at 0.05 level of significance was used to test the null hypotheses. The result revealed that there is a significant difference in the mean score of students taught Biology with Blended learning and those taught with discussion method in favour of blended learning. Result also showed that there is no significant difference between male and female students taught Biology with Blended learning. Therefore, properly designed blended learning approaches should be adopted by secondary school teachers in teaching Biology, as students benefit from the combination of face-to-face interaction and online resources.

Keywords: *Biology, Achievement, Blended learning, Academic, Discussion method*

Date of Submission: 05-01-2024

Date of acceptance: 17-01-2024

I. INTRODUCTION

Biology is a branch of natural science that examines the structures, functions, growth, regulation, and interactions of living organisms. The secondary school biology curricula in Nigeria were created by curriculum planners with the goal of advancing students' investigations into natural phenomena, enhancing their thoughts and concerns about biology, and igniting their excitement for using scientific reasoning in everyday situations. In addition to being an essential science topic, biology is also a prerequisite for courses in medicine, pharmacy, nursing, cytology, biochemistry, biotechnology, and genetic sciences. This means that in order for students to be actively interested in learning science, there is a need for appropriate biology instruction in schools (Akyol & Garrison, 2011 quoted in Olpak, Yagci, & Basarmak, 2016). Biology education is the transfer and acquisition of knowledge and skills pertaining to the study of living things and how they interact with their surroundings. Teaching biology usually entails a teacher or instructor giving pupils information about biological theories, concepts, and principles. This can be done using a variety of techniques, such as talks, lectures, interactive exercises, or demonstrations. Engaging students in the learning process, promoting critical thinking and questioning, and giving them opportunity to apply what they have learned in practical settings are all essential components of effective biology instruction. This can entail learning ideas, theories, and facts as well as honing one's critical thinking, problem-solving, and scientific reasoning abilities. Numerous techniques can be used to learn biology, such as reading, listening, watching, and engaging in practical exercises. For Biology instruction to be successful, students must possess a solid understanding of the subject's fundamental ideas and concepts in addition to the ability to apply them to practical settings. Effective teaching strategies, students' active participation, and a readiness to try new things, take chances, and learn from mistakes are all necessary for this (Wang et al, 2017).

In general, the traditional, conservative method of teaching still exists, with teachers serving as repositories of knowledge and students serving as passive recipients. Due to its tendency to favor passive knowledge reception, the traditional teacher-centered learning strategy frequently results in subpar performance or achievement on both internal and external exams. Conversely, interactive technology promotes active learning, which helps biology students retain more information and perform better (Njoku & Nwagbo, 2020). Biology instruction and learning diverge significantly, and pupils perform badly in scientific classes in secondary education, particularly biology. These also confirm that biology has not been taught well. Due to the use of ineffective teaching strategies in Biology, there has been a renewed focus on finding the most effective

ways to teach the topic, which will boost student performance and foster a favorable attitude toward all science courses, including Biology. However, educators avoid using activity-based teaching strategies that have been shown to be successful, like blended learning, and instead favor simple but frequently ineffective and unsuitable teaching techniques (Arbaugh et al., 2010 quoted in Olpak, Yagci, & Basarmak, 2016). Students' achievement level is impacted by this, either directly or indirectly.

The degree of success or accomplishment attained by a person in a specific field or endeavor is referred to as achievement. A number of factors can be used to measure it, including scholastic achievement, professional success, personal objectives, and any other acknowledged successes. Success is frequently the consequence of developing one's abilities, knowledge, and competence along with working hard, being committed, and persevering. It may also be impacted by elements like opportunity, support from others, and resource accessibility. Success can be both subjective and objective, depending on the standards by which it is evaluated. Academic success, for instance, might be determined by grades, test results, or finishing a degree program; personal achievement, on the other hand, can be determined by achieving a personal objective, such as acquiring a new skill or finishing a marathon. In addition to offering chances for both professional and personal development, achievement can instill feelings of contentment, pride, and confidence in people. But it's crucial to remember that success or value shouldn't be determined only by one's accomplishments. It is only one facet of a person's life; other elements like connections with others, health, and general well-being are equally crucial for leading a happy and meaningful life (Vygotsky & Cole, 2018).

The degree of success a student has reached in their study of biology is referred to as student achievement in biology. This can be assessed using a variety of methods, including lab reports, research projects, exam scores, grades, and any other acknowledged academic achievements in the discipline of biology. Biology requires students to have a solid understanding of the subject matter and a solid foundation in scientific principles. They should also be able to demonstrate their understanding of biological concepts, including genetics, evolution, ecology, physiology, and the structure and function of cells. They should also be able to use these principles to analyze data, solve issues, and effectively convey scientific concepts. Numerous factors, such as the caliber of instruction, the resources available, the degree of student participation, and the level of support from parents, peers, and other stakeholders, can affect how well students perform in biology classes. It is crucial that students actively participate in their own education by looking for more resources, going out of their way to study, and working in groups. All things considered, success in biology demands perseverance, commitment, and a love of the subject. In addition to providing numerous chances for both professional and personal development, this fulfilling area also allows for significant gender-related contributions to society (Vaughan et al., 2023).

The low levels of academic achievement in Biology classes can be ascribed to various factors such as the students' attitude, the quality of the laboratories and teachers, poor lighting, noise, high levels of carbon dioxide in classrooms, inconsistent temperature, poor maintenance and ineffective ventilation systems, student health, higher absentee rates, school management, inadequate learning facilities, gender and age differences, peers, and inadequate teaching and learning strategies. Blended learning is an easy way to get around these obstacles (Baldwin-Evans, 2016).

Blended learning is a teaching strategy that combines many teaching modalities to achieve a learning objective. According to Stoyanov and Kirschner (2014), blended learning is the process of imparting precise skills to the real person during the factual period by coordinating the appropriate learning technology in the appropriate learning manner in order to meet the learning objectives. With an engaging learning environment and good learning results, blended learning seeks to provide greater advantages than employing a single acquisition delivery medium. Teachers that employ a blended learning approach permit their students to use their devices during in-person instruction (Garrison & Vaughan, 2018). Blended learning is utilizing any technique, platform, skill, or media in the classroom. Teaching now involves more than just writing down information and facts. The swift adoption of blended learning and technology-assisted teaching techniques shows that educators are using technology to enhance learning in the modern classroom. It's a teaching approach that combines traditional instructor-led classroom activities with digital media and technology. Students benefit from having more flexibility in customizing their learning experiences. Openness and ease of use in the classroom, a wealth of learning opportunities, multiple learning persistence, heightened interest in learning, high-quality interaction, and low cost are all characteristics of blended learning. Owing to time constraints, activities conducted during regular class hours are insufficient. Students can complete their multimedia system applications through blended learning, which fills in the gaps left by teachers who solely use the traditional mode of instruction during class. Additionally, having the ability to study the material before class allows students to recognize the research subjects and organize their arrival in the classroom. Students' attention and literary achievement levels may increase when the blended learning technique is used in biology classes (Beams, 2017). This is due to the fact that learning through projects in classrooms equipped with technical instruments encourages students to be analytical thinkers while giving them practical experiences and abilities.

Blended learning approaches include the rotation model, flex model, a la carte model, enhanced virtual model, and face-to-face driver model, according to Bates (2015). A corpus of research supports the combination of in-person education with technology delivery modes, despite disagreements over the viability and relevance of hybrid teaching in secondary schools. Better learning results are produced by this kind of partnership. Blended learning creates a forum for lucid, interactive discourse in addition to a community of inquiry.

II. REVIEW OF LITERATURE

In a high school located in the heart of Baghdad, Weiner (2022) investigated the impact of blended learning on students' progress in biology when compared to alternative teaching approaches. The experimental group (those receiving blended learning instruction) outperformed the control group in both information retention and accomplishment tests, according to the data. Adams et al. (2017) conducted an investigation into the impact of blended learning, which integrates face-to-face instruction and distance learning, on computer skills instruction for pre-med students at Arabian Gulf University in Bahrain. The findings indicated that the method of blending face-to-face instruction with distance learning proved effective in developing the educational skills that students would need for their future studies. Arbaugh et al. (2010), referenced in Olpak, Yagci, and Basarmak (2016), described blended learning technology and its impact on second-grade students' academic performance in biology at private secondary schools. The relevant statistical techniques were applied for processing the data. The study found that there are statistically significant positive trends among sample members who answered the questionnaire's items measuring the trend toward blended learning, as well as statistically significant differences favoring the students who studied through blended e-learning (the experimental group).

Areji and Onuba (2022) conducted a study at Enugu State University of Science and Technology on the impact of a blended learning environment on genetics students' academic performance. The ANCOVA statistical method and the mean and standard deviation were used to analyze the acquired data. The findings demonstrated a noteworthy distinction in the average academic performance between students educated in a blended learning environment and those in a standard classroom setting when it comes to genetics. The mean genetic achievement of male and female students educated in a blended learning setting did not differ significantly.

Data were gathered and analyzed for a study by Obe and Oladepo (2023) titled Blended learning: A viable teaching strategy for increasing Biology students' academic results in the post-Covid-19 age. The results demonstrate how using blended learning in the classroom improved biology students' academic performance.

Shea et al.'s (2022) study compared the academic achievement of male and female students studying biology through blended learning. The findings indicated that gender did not significantly differ, indicating that the students' academic performance was determined by their own study habits, the environment in which they studied, the qualities of their teachers, and the teaching approach employed. However, Panetta (2017) studied the academic performance of male and female students taught using the blended learning method. The findings showed that male students outperformed female students, which the author attributed to the male students' greater access to technology. Technology as it exists now has a significant impact on the process of teaching and learning, leading to a paradigm shift in the way that this is done.

It is anticipated that today's teaching and learning practices would change from the conventional or traditional approach to a learner-centered, more dynamic and adaptable one. This learner-centered approach puts the student at the center of the learning process and fosters independent learning by allowing them to have a say in the curriculum, activities, resources, and speed of the course. The education ministry has invested a significant amount of money in ICT-driven projects, but despite the obvious value of computers and the internet in education, biology teachers continue to be hesitant, inefficient, and unproductive when implementing blended learning in their classes. In secondary schools in the Obio/Akpor local government area of Rivers State, a study on blended learning and the academic accomplishment of biology students was conducted against this backdrop. Two research questions and two hypotheses guided the study; *Research Questions*

- What is the mean difference in the achievement of secondary school students taught Biology with blended learning method and those taught with discussion method?
- What is the mean difference between male and female secondary school students taught Biology with Blended learning?

Hypotheses

H₀₁: There is no significance difference in the mean achievement scores of secondary school students taught Biology with blended learning method and those taught with discussion method.

H₀₂: There is no significance difference between male and female secondary school students taught Biology with Blended learning.

III. RESEARCH METHOD

The Obio/Akpor local government area was the study area, and a pre- and post-test experimental group as well as a control group were used in this quasi-experimental design. For the study, two coeducational schools in the Obio/Akpor local government region were chosen. 100 students from two complete courses made up the study's sample (42 and 58 for blended learning and discussion, respectively). The Biology Achievement Test (BAT), which was created by the researcher, served as the data collection tool. The BAT was divided into two sections: part 1 asked questions on students' personal information, including name, class, school, and sex, while part 2 focused on questions about the idea of reproduction. There were twenty-five (25) multiple-choice questions with four (4) options (A–D), each worth two marks.

To determine the instrument's applicability and dependability, a pilot study was carried out. For the pilot project, twenty SS2 Biology students from a school outside the study area were employed. A reliability coefficient of 0.83 was found by statistically analyzing the data gathered for the pilot research using the Pearson Product Moment Coefficient (PPMC). The trial process took six weeks to complete.

The experimental group received instruction for six weeks using the blended learning approach, which combines in-person instruction with online learning via devices. Under the researcher's guidance, the students completed a variety of tasks and investigations during the class. The lesson's "student-centered" design is one of its most crucial features. The purpose of the activities was to help students become more informed and accustomed to using science process abilities. For six weeks, the 58 students in the control group received instruction in accordance with the conventional approach.

Four steps made up the process utilized to collect the data:

Step 1: An introduction letter was issued to the participating schools' administrators requesting permission to use their kids and their class hour once a week for six (6) weeks in each of the experimental and control schools.

Step two: To establish the performance level for comparison, the study's students (control and experimental groups) underwent a pre-test in the same conditions. The research assistant assisted in gathering the results.

Step three: Six (6) lesson plans were created, one for the experimental group and one for the control group. Biology lessons were given to the two groups. For six (6) weeks, the experimental group received instruction using a blended learning approach, and the control group received instruction via a discussion method.

Step four: At the conclusion of each six-week period, a post-test consisting of the identical items from the pre-test was given to the experimental and control groups in each of the sampled schools. This was done in order to calculate the two groups' mean scores.

The mean and standard deviation were used to analyze the data for the research questions, and the student t-test was used for the hypotheses.

OUTCOMES

Investigate First question: What is the average difference in biology education between students receiving blended learning and those receiving discussion-based instruction?

Table 1 shows the mean and standard deviation of biology students receiving blended learning instruction versus those receiving discussion-based instruction.

Method of Instruction N Prior to testing After the test Average profit Combined learning Mean Standard Deviation Mean Standard Deviation Discussion 42 17.92 2.00 43.58 3.83 25.66 15.10, 2.84, 34.96%, 3.55, and 19.86

The experimental group's mean pre-test score was 17.92 with a standard deviation of 2.00, and their mean post-test score was 43.58 with a standard deviation of 3.83, according to the table above. After therapy, the experimental group's mean gain score was 25.66. The Control group, on the other hand, had a mean score of 15.10 with a standard deviation of 34.96 for the pre-test and 34.96 with a standard deviation of 19.86 for the post-test. After therapy, the control group's mean gain score was 19.86.

HO1: The mean score of students taught biology using a blended learning approach and those taught using a conversation method do not differ significantly.

Table 2: t-test analysis on difference in the mean score of students taught Biology with Blended learning and those taught with discussion method.

Teaching Method	N	Mean	Std.dev	Df	t-cal	Sig	Decision
Blended learning	42	43.58	3.83	98	3.47	0.00	S
Discussion	58	34.96	3.55				

From Table 2, the result revealed that t-cal was 3.47 and a p-value of 0.00 was recorded at $df = 98$. Since the p-value of $p=0.00$ is less than 0.05, it implies that there is a significance difference in the mean score of students taught Biology with Blended learning and those taught with discussion method. Thus, the null hypothesis that says there is no significant difference is rejected.

Research Questions 2: What is the Mean difference between male and female students taught Biology with Blended learning.

Table 3: mean and standard deviation showing the difference between male and female students taught Biology with Blended Learning.

Gender	N	Mean	Std. Deviation
Male	25	44.04	3.12
Female	17	43.00	4.63

The data above reveals the difference in mean and standard deviation of male and female students taught Biology with blended learning, it could be observed that the males had a mean score of 44.04 with a standard deviation of 3.12, while their female counterparts had a mean score of 43.00 with a standard deviation of 4.63.

HO₂: There is no significance difference between male and female students taught Biology with Blended learning.

Table 4: t-test analysis on the achievement of male and female students when taught Biology with blended learning.

Gender	N	Mean	Std.dev	Df	t-cal	Sig	Decision
Male	25	44.04	3.12	40	0.87	0.39	NS
Female	17	43.00	4.63				

Table 4.4 presented the results, which showed that the t-cal was 0.87 and the p-value at $df = 40$ was 0.39. It is implied that there is no significant difference between the mean scores of male and female students taught biology via blended learning because the p-value of $p=0.39$ is greater than 0.05. As a result, the null hypothesis, which states that there is no meaningful difference, was not disproved.

Summary of Findings

1. The mean score of students taught biology using a mixed learning approach and those taught using a conversation method differs significantly.
2. When teaching biology through integrated learning, there are no appreciable differences between male and female pupils.

IV. DISCUSSION

The findings shown in Tables 1 and 2 indicate a statistically significant variation in the average score between students who were taught biology through blended learning and those who were taught through discussion. This outcome supports the findings of Areji and Onuba (2022), who found a statistically significant difference in the academic performance of students taught Genetics in a blended learning environment compared to students taught in a regular classroom. The results are consistent with Obe and Oladepo's (2023) assertion that blended learning raises students' academic performance.

Moving forward, table 3 and table 4 data demonstrated that there is no statistically significant difference between male and female biology students who are taught through blended learning. This result is consistent with the findings of Areji and Anuba (2022), who found no discernible difference in the academic performance of male and female students taught in a mixed learning setting. In contrast, previous research (Panetta, 2017) found that when blended learning was used in the classroom, male students fared better than female students. Panetta explained this achievement gap by pointing out that male pupils are more digitally savvy than female students. The results of recent research show that blended learning is gender friendly and can be used to teach all students, regardless of gender, suggesting that female students have clearly closed the technological knowledge gap.

V. SUMMARY

Blended learning, which combines traditional classroom instruction with online or digital resources, has been studied for its impact on students' academic achievement in Biology in senior secondary schools and the result revealed that Blended learning often incorporates interactive digital materials, videos, quizzes, and discussions, which enhances students' engagement and motivation to learn Biology allowing the students to access course content online at their own pace, enabling personalized learning and accommodating different learning styles. These online resources, such as animations and simulations, can provide visual and interactive

explanations of complex biological concepts, leading to better comprehension and encourages students to take an active role in their learning by participating in discussions, collaborative projects, and online assessments.

VI. CONCLUSION

Studies investigating the impact of blended learning on students' academic achievement in Biology have reported varied outcomes. A properly designed blended learning approaches lead to improved learning outcomes, as students benefit from the combination of face-to-face interaction and online resources. However, the effectiveness of blended learning can depend on factors such as the quality of online content, teacher-student interaction, and individual student characteristics. Overall, the blended learning method has the potential to positively impact students' academic achievement in Biology in senior secondary schools. When implemented effectively, it can enhance engagement, understanding, and active learning. However, addressing challenges related to technology access, teacher training, and pedagogical balance is crucial to realizing the full benefits of blended learning.

VII. RECOMMENDATIONS

Based on the findings, the following are recommended;

1. Biology teachers in secondary schools should be trained on the effective use of blended learning as the method improves the understanding of students in Biology classes, hence improving their academic performance.
2. Schools should give every student equal opportunity in accessing the internet and other online study tools as a means of carrying everybody along.

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