

The Effect of Biology Teaching Materials on the Academic Performance of Senior Secondary School Students in Ilorin West, Ilorin, Kwara State

Florence Omosholape Abidoye*, A. Adekunle Abidoye , Malik S. Olaide

Department of Science Education, University of Ilorin, Ilorin, Kwara State, Nigeria

*Corresponding Author: abidoye.fo@unilorin.edu.ng

ABSTRACT

This study examined the impact of Biology instructional materials on the academic performance of senior secondary school students in Ilorin West LGA, Kwara State, Nigeria. It employed a descriptive survey research design and targeted Biology students in senior secondary schools. A random sampling technique was used to select 120 students. Data was collected using a questionnaire and analyzed using frequency count, percentage, mean, standard deviation, independent t-test, and ANOVA. The findings revealed a significant positive effect of Biology instructional materials on students' academic performance. Students taught with these materials outperformed those without them. However, no significant differences were found based on gender and class size. The study also highlighted the importance of school type, showing a substantial influence of Biology instructional materials on academic performance. Recommendations include the Ministry of Education providing instructional materials, Biology teachers incorporating them in lessons to foster competition, government support for public schools in obtaining instructional materials, and additional infrastructure like classrooms and laboratories..

ARTICLE HISTORY

Received 2023-02-13

Accepted 2023-07-11

KEYWORDS

Biology Instructional Materials

Effect on Students

Academic Performance

Senior School

INTRODUCTION

Biology is a subject taught at the secondary school level to give students an in-depth understanding of biological concepts, principles, theories, and laws (Bello et al., 2020). It encompasses the study of living organisms, from microscopic cellular molecules to the entire biosphere, including ecosystems and the Earth's surface. Biology has a significant global impact and plays vital roles in various fields, such as microbiology, biotechnology, genetics, botany, medicine, zoology, and bioinformatics (Kulak & Newton, 2015). Developing a comprehensive knowledge of biological concepts is crucial for students to comprehend the complexities of the living world. Through biology, students can explore diverse aspects such as organism structures and functions, ecosystem interactions, evolution, genetics, and practical applications in health, agriculture, and the environment. A solid understanding of biology empowers students to actively contribute to environmental sustainability, engage in scientific research, and make informed decisions in the increasingly complex biological realm (Neji & Ntibi, 2019a). However, due to its abstract nature and intricate relationships, biology is often perceived as challenging to teach and learn (Cimer, 2012).

Learning is a continuous process that involves acquiring new knowledge, ideas, skills, values, and experiences, leading to behavioral modifications (Hale & Mauzerall, 2004). Effective presentation of learning concepts should engage students' diverse interests and abilities, progressing from familiar concepts to unfamiliar ones and promoting active participation in the classroom. Teachers cannot consider their instructional goals achieved until they observe the desired changes in student behavior. Instructional materials are valuable resources that facilitate learning and enhance students' understanding of the subject matter. They act as aids or tools that support effective teaching practices, contributing to a meaningful educational experience. These materials can take various forms, including visual aids, manipulatives, multimedia presentations, and technological resources. By integrating appropriate instructional materials into their teaching, educators encourage active participation and engagement among students, significantly when students can interact with and manipulate the materials (Abidoye et al., 2022).

In conclusion, biology plays a fundamental role in secondary school education, providing students with a comprehensive understanding of biological concepts and their applications. Instructional materials are indispensable pedagogical tools, effectively communicating these concepts and facilitating students' educational journeys. Teachers can improve students' understanding and academic achievements in biology by utilizing suitable instructional materials. This practice promotes an interactive and stimulating classroom atmosphere. This study examines the relationship between instructional materials and students' academic performance in Biology within senior secondary schools in Osun State. Findings revealed that students taught with instructional materials performed better than those taught without instructional materials (Awolaju, 2016). A study was conducted to examine students' attitudes towards the subject of Biology, investigating the impact of these attitudes on their academic performance in the same subject.

Additionally, the study aimed to determine the extent to which the availability of teaching and learning resources influenced students' performance in Biology (Mukhwana, 2013; Muraya & Kimamo, 2011). The results indicate that students with a favorable disposition toward Biology demonstrate superior academic performance in examinations. Additionally, the presence of adequate teaching and learning resources within educational institutions has a positive influence on students' achievement in Biology exams. This study investigated the impact of instructional materials on the academic performance of Biology students in the Aniocha North Local Government Area of Delta State (Osamor & Odebisi, 2019). The study's target population consisted of Biology Teachers and Students in Aniocha North LGA. The result of the study reveals that instructional materials in schools are inadequate, and the teachers utilize the available ones. It also shows that instructional materials used in the teaching and learning of Biology enable students to achieve more, unlike situations where instructional material is inadequate.

The present study examines the impact of instructional materials on student's academic achievement in Biology within Surulere Local Government Area, Lagos. The study's findings indicate that instructional materials notably impact the pedagogy of Biology. Moreover, utilizing instructional materials substantially impacts knowledge acquisition biology (Ali et al., 2014). Instructional resources are essential for quality education (Oakes & Saunders, 2002). Instructional resources assist teachers in uniquely transmitting knowledge, making learning more effective as they help learners acquire knowledge. It encourages participation, especially if students are allowed to manipulate material use. The availability of instructional materials makes teaching and learning very pleasant to primary science teachers (Gick, 1986). He added that the factors could be poor laboratory facilities, the inability of the biology teachers to put across ideas clearly to the students and an inadequate number of learning facilities in Ilorin West, Kwara State, the lack of availability and the credibility of instructional materials in the teaching of biology in terms of effectiveness and appropriateness of instructional materials have to remain significant problems and issues of interest in schools in Nigeria.

Instructional materials play a crucial role in teaching and learning as they stimulate students' interests, help overcome physical limitations, and enhance the presentation of subject matter. Research conducted in senior secondary schools in Osun State examined the correlation between the use of instructional materials and student's academic performance in Biology, revealing that students taught with instructional materials performed better than those taught without them. It highlights the significance of instructional resources in facilitating effective teaching and learning experiences. The abstract nature of science subjects, including Biology, often poses challenges for educators, making instructional materials necessary to enhance students' comprehension and engagement (Neji & Ntibi, 2019b). Insufficient availability and inadequate utilization of instructional materials have been identified as significant factors contributing to the ineffectiveness of the school system and poor student performance.

Instructional materials encompass visual resources that engage the sense of sight, audio materials that engage the sense of hearing, and audio-visual materials that integrate visual and auditory elements. Engaging in several vital steps is crucial to effectively utilize instructional materials, including previewing the materials, preparing the learning environment, and ensuring the audience's attention, motivation, and comprehension. Private schools generally possess superior material resources compared to public schools, which consequently results in enhanced academic performance in external examinations has been shown that larger class sizes have a detrimental effect on student's academic achievement (Timilehin & Ogbomida, 2012). Furthermore, class size management is of utmost importance in facilitating effective learning as research. Additionally, managing class sizes is crucial for effective learning, as increasing class sizes has negatively impacted students' academic performance (Garrett, 2014).

Previous studies have explored the relationship between class size and academic achievement. Schools with smaller class sizes yielded better quality output than larger ones (Owoeye & Yara, 2011). They have also concluded that the output quality in secondary schools significantly differed between schools with average class sizes of 35 students and below and those above 35 (Adeyemi, 2005). They have investigated the effects of class size on the academic performance of Biology students in senior secondary schools in Lagos State, revealing that large class sizes harmed students' academic performance (Ehebha & Adeyinka, 2022). They also found no significant influence of class size on gender differences but noted its impact on students' ability levels in Biology. Given the importance of instructional materials in teaching Biology and the impact of class size on academic performance, this research examines the influence of Biology instructional materials on student's academic performance in senior secondary school. By exploring the relationship between instructional materials and academic achievement in the context of class size, this study contributes to our understanding of effective teaching strategies in Biology education.

Purpose of the study

The main purpose of this study examined Biology instructional materials effect on students' academic performance of Senior Secondary Students in Ilorin West, Kwara State, Nigeria. Specifically, the study investigated:

1. if Biology instructional materials effect on students' academic performance in senior secondary schools in Ilorin West LGA, Kwara State, Nigeria.
2. Biology instructional materials effect on students' academic performance based on school type.
3. Biology instructional materials on students' academic performance based on class size.

Research Questions.

In this work, the following research questions are set for answering;

1. What are the influences of Biology instructional materials on students' academic performance?
2. Does Biology instructional materials have effect on students' academic performance based on school type?

3. Biology instructional materials have effect on students' academic performance based on class size

METHODS

This study employed a descriptive survey research design. The target population was biology students from public and private senior secondary schools in Ilorin West Local Government Area (LGA) in Kwara State. Kwara State has 362 secondary schools, including 348 public and 114 registered private schools. In Ilorin West LGA specifically, there are 28 public secondary schools and 25 private secondary schools, totalling 53 secondary schools. Six secondary schools were selected to delimit the scope of the study, consisting of three private and three public schools. The target population for the study comprised 120 biology students from these selected schools, chosen through a simple random sampling technique.

The data collection instrument used in this study was an adapted questionnaire titled "Biology Instructional Materials Effect on Students' Academic Performance in Senior Secondary Schools." The questionnaire consisted of two sections: Section A collected the personal data of the respondents, such as the school's name, school type, and class size. Section B contained items organized according to the research questions, combining closed and open-ended questions. Section B was further divided into four subsections, with Likert scale options for respondents to choose from: S.A. (Strongly Agreed) with 4 points, A (Agreed) with 3 points, D (Disagreed) with 2 points, and S.D. (Strongly Disagreed) with 1 point.

To gain access to the sampled schools, the researcher presented a letter of introduction from the Head of the Department of Science Education at the University of Ilorin. Additionally, the principal of each selected secondary school was provided with a consent form before the questionnaires were administered to the students. The researcher personally administered the instruments to the sampled biology students, providing clear instructions for the exercise. To prevent the loss of questionnaires, the researcher immediately retrieved completed questionnaires.

The collected data was analyzed using descriptive and inferential statistics. Frequency and percentage (%) were used to analyze the demographic information, while the research questions were answered using mean and standard deviation. Hypothesis 1 was tested using a t-test, and the effect of instructional materials on students' academic performance (hypothesis 2) was examined using analysis of variance (ANOVA). These statistical analyses were conducted to provide insights and draw conclusions based on the data collected in the study.

RESULTS AND DISCUSSION

The data collected for this study were analyzed and presented in a table for straightforward interpretation. The data were the responses to the questionnaire items by the population on the influence of Biology Instructional material on students' academic performance in senior secondary school in Ilorin West, Kwara State. Frequency count and percentage were used to describe the demographic data; research questions will be analyzed using mean and standard deviation, while t-test statistic was used to test all the hypotheses formulated at $\alpha = 0.05$ significance level. All analyses used a statistical package for Social Science (SPSS) version 25.0.

Demographic Data

Table 1 shows the general data of respondents' personal information. Out of 120 students sampled in this survey, 60 students, which correspond with 50% of total respondents, were from public schools and also 50 students representing 50% from private schools. 40 students in SS1 were involved, which corresponds to 33.3%. Forty-nine were in SS11 (40.8), while 51 students were in SS111 (25.8) based on class size.

Table 1. Demographic Data of the Respondents

Variable	Frequency	Percentage
School Type		
Public	60	50
Private	60	50
Total	120	100
Class size		
SS1	40	33.3
SS2	49	40.8
SS3	31	25.8
Total	120	100

Analysis of Research Questions

To address the research inquiries, a set of 16 items was administered to assess the impact of Biology instructional materials on students' academic achievement in Ilorin West LGA, Kwara. A mean score of 2.5 or higher indicated agreement, while a mean score below 2.5 was considered indicative of disagreement.

Research Question One:

What are the influences of Biology instructional materials on students' academic performance?

Table 2 presents the mean and standard deviation of influences of Biology instructional materials on students' academic performance. The Table revealed that all the listed items are the Biology instructional materials' effect on students' academic performance because all the things had a mean greater than 2.50. These items include using textbooks and charts that make Biology appear natural when I am learning Biology. The use of charts makes it simpler and gives meaningful learning. Biology pictorial charts attract my attention during Biology lessons, the use of biological specimens in learning Biology makes me more interested in learning Biology, the use of realia encourages me to understand complex topics in Biology, and I can answer Biology questions on my own when instructional resources are used to break down the issues among others.

Table 2. Mean and Standard Deviation on Biology Instructional Materials effect on Students' Academic Performance

Items	Mean	SD
The use of textbook and charts makes Biology appear real.	3.35	0.61
When I am learning Biology with the use of charts, it makes it simpler and gives meaningful learning.	3.44	0.57
The use of instructional resources by my teacher makes Biology easy to apply in daily activities.	3.43	0.59
The use of microscope by my teacher makes it easy for me to interpret biology abstract.	3.25	0.65
Biology pictorial charts attracts my attention during Biology lessons.	3.30	0.73
The use of biology specimen in learning Biology makes me to be more interested in learning Biology.	3.40	0.60
I concentrate a lot when my teacher is giving examples using instructional resources	3.27	0.67
The use of microscope by the teacher makes me participate actively in Biology class.	3.20	0.77
The use of Biology related resource persons motivates me to learn Biology.	2.91	0.77
The use of instructional resources reduces the movement of students during biology lessons.	3.30	0.70
The use of Illustrations and charts in teaching Biology makes the class interactive during the lesson.	3.38	0.65
Biology field trips makes leaning Biology fun to me.	3.21	0.62
The use of realia encourages me to understand difficult topics in Biology.	3.30	0.70
I am able to answer Biology question on my own when instructional resources are used to break down the topics.	3.40	0.67
Instructional resources help me to have a wider knowledge about the topics learnt in Biology.	3.42	0.66
I can answer questions better in Biology when learning with the use of instructional resources.	3.42	0.66

Research Question Two:

Does Biology instructional materials affect students' academic performance based on school type?

H₀₁: There is no significant effect on school type in using Biology instructional materials on students' academic performance in Senior Secondary School.

The data obtained regarding the question and hypothesis is presented in Table 3.

Table 3. t-test Analysis on Biology instructional materials effect on students' academic performance based on school type.

School Type	N	Mean	SD	Cal. t-value	df	Sig (2-tailed)
Private School	60	54.11	4.25	-2.75	118	0.007
Public School	60	51.98	4.23			

Table 3 shows that the mean score of private school students is 54.11(SD=4.25) while that of public school students is 51.98 (SD=4.23). at df =118, t-value =-2.75 and $p < .05$ level of significance. It implies that the private schools engaged in Biology instructional material more than the public schools. Therefore, the null hypothesis is rejected since the hypothesis stated that there is no significant effect on school type.

Research Question Three:

Biology instructional materials affect students' academic performance based on class size

H₀₃: There is no significant effect of using Biology instructional materials on students' academic performance in Senior Secondary School based on class size.

The data obtained regarding the question and hypothesis is presented in Table 4.

Table 4. Analysis of variance(ANOVA) showing the Biology Instructional materials effect on students' academic performance based on class size

	Sum of squares	df	Mean square	F	Sig.
Between Group	90.73	2	45.3	2.44	0.09
Within Group	2172.97	117	18.57		
Total	2263.70	119			

Table 4 presents an analysis of variance (ANOVA) showing the effect of Biology Instructional materials on students' academic performance based on class size. The Table revealed that the F-value of 2.44 with a p-value of 0.09 computed at a 0.05 significant level. Since the p-value is greater than 0.05, the null hypothesis States that there was no significant effect on class size in the use of Biology instructional materials on students' academic performance in Senior Secondary School is therefore not rejected.

Summary of Major Findings

The following is the summary of the significant findings of this study:

1. Biology instructional materials affect students' academic performance in Senior Secondary School Ilorin.
2. There was a significant difference between private and public schools in using Biology instructional materials on students' academic performance in Senior Secondary School Ilorin.
3. There was no significant difference in class size in the use of Biology instructional materials on students' academic performance in Senior Secondary School

Discussion of Findings

The study analyzed the data from a questionnaire survey to investigate the influence of Biology instructional materials on student's academic performance in senior secondary schools in Ilorin West, Kwara State. The data were analyzed using various statistical methods in SPSS version 25.0. Table 1 provides the

demographic data of the respondents. The sample consisted of 120 students, with an equal distribution of 60 students from public schools and 60 from private schools. In terms of class size, 40 students were in SS1 (33.3%), 49 in SS2 (40.8%), and 31 in SS3 (25.8%). Research question one aimed to determine the influences of Biology instructional materials on students' academic performance. Table 2 presents the mean and standard deviation of the items assessing the impact of Biology instructional materials. All the listed items had a mean score greater than 2.50, indicating agreement. The items included the use of textbooks and charts, the use of biological specimens, the use of realia, and the use of instructional resources to break down topics, among others.

Research question two examined whether Biology instructional materials affect students' academic performance based on school type. The null hypothesis (H_{01}) stated that school type has no significant effect on the use of Biology instructional materials. Table 3 shows the t-test analysis results. The mean score for private school students was 54.11 ($SD=4.25$), while for public school students, it was 51.98 ($SD=4.23$). The t-value was -2.75 with a $p < .05$ level of significance. It indicates that private schools engaged more in Biology instructional materials than public schools. Thus, the null hypothesis is rejected. Research question three investigated whether Biology instructional materials affect students' academic performance based on class size. The null hypothesis (H_{03}) stated that class size has no significant effect on the use of Biology instructional materials. Table 4 presents the analysis of variance (ANOVA) results. The F-value was 2.44 with a p-value of 0.09, computed at a 0.05 significance level. Since the p-value is more significant than 0.05, the null hypothesis is not rejected, suggesting any significant effect of class size on using Biology instructional materials.

In conclusion, the study found that Biology instructional materials have a positive influence on students' academic performance. Moreover, school type was found to have a significant effect, with private schools employing Biology instructional materials more than public schools. However, class size did not significantly affect the use of Biology instructional materials. This study examined the Biology instructional materials' effect on student's academic performance in biology in Ilorin West LGA, Kwara State. The result revealed that students performed better when taught with Biology instructional materials, which affects their academic performance. This may also be because Biology instructional materials are available and well utilized by the students. It is in line with the findings of Adalikwu & Iorkpilgh (2013) investigated the influence of instructional materials on the academic performance of Senior Secondary Students in Chemistry in Cross Rivers State, revealed that students taught with instructional materials perform significantly better than those taught without instructional materials. And also that using instructional materials generally improves students understanding of the concept and leads to high academic achievement.

The finding showed a significant difference between private and public schools in the use of Biology instructional materials on students' academic performance in Senior Secondary School Ilorin. It may be because private schools concentrate on Biology instructional materials more than public schools. This result corroborates the findings of (Adeyemi, 2005), who compared the academic performance between private and public schools in Osun State, Nigeria. The results indicate that students enrolled in private schools exhibited significantly higher academic performance than their counterparts attending public schools. Furthermore, the correlational study of Sheriff et al. (2019) on students' performance in Business studies in private and public school junior Secondary School Certificate Examinations showed a significant difference in students' performance in public and private schools. The finding showed a significant difference in the class size in the use of Biology instructional materials on students' academic performance in Senior Secondary School Ilorin. It may be because SS1, SS2, and SS3 students can pay attention to the instructional materials of biology during the lessons. This study agrees with the finding of Godsgift and Olalekan (2022) who investigated the effects of class size on the academic performance of Biology students in senior secondary schools in Lagos State, and the result indicated that there was no significant class size.

CONCLUSION

Based on the data analysis conducted in this study, it can be concluded that the use of Biology instructional materials positively influences students' academic performance. This finding is supported by the mean scores greater than 2.50 for all items measuring the impact of Biology instructional materials on students' academic performance. Furthermore, the study also found a significant difference in the use of Biology instructional materials based on school type. Private schools were more actively utilizing Biology instructional materials than public schools. It indicates a difference in teaching approaches and the utilization of learning resources between the two types of schools. However, the study did not find a significant effect of class size on using Biology instructional materials. In this regard, class size did not significantly affect utilizing Biology instructional resources. Based on these findings, it is recommended to enhance the use of Biology instructional materials in all types of schools, particularly in public schools. It is essential to consider teaching strategies that involve using Biology instructional resources to enhance students' interest and understanding of Biology concepts. However, it is essential to note that this study was conducted in a specific area (Ilorin West, Kwara State) and at the senior secondary school level. Therefore, the findings of this study may not be directly applicable to different educational contexts or levels. Further research is needed to broaden the scope of this study and generalize the findings to a broader range of educational settings.

REFERENCES

- Abidoeye, F. O., Aliyu, M. Z., Ahmed, A. R., & Oluwole, O. S. (2022). Instructional resources for teaching biology in secondary schools in Moro, Kwara State-Nigeria. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 8(2), 187–193. <https://doi.org/10.22219/jpbi.v8i2.18093>
- Adalikwu, S. A., & Iorkpilgh, I. T. (2013). The influence of instructional materials on academic performance of senior secondary school students in chemistry in Cross River State. *Global Journal of Educational Research*, 12(1), 39–46.
- Adeyemi, T. O. (2005). The influence of class-size on the quality of output in secondary schools in Ekiti State, Nigeria. *International Journal of Emotional Psychology and Sport Ethics*, 7, 1–13.
- Ali, A. R., Toriman, M. E., & Gasim, M. B. (2014). Academic achievement in biology with suggested solutions in selected secondary schools in Kano State, Nigeria. *International Journal of Education and Research*, 2(11), 215–224.
- Awolaju, B. A. (2016). Instructional materials as correlates of students' academic performance in biology in senior secondary schools in Osun State. *International Journal of Information and Education Technology*, 6(9), 705–708.
- Bello, G., Alabi, H. I., Ahmed, A. R., Sulaiman, M. M. S., Bello, Z. A. B., & Bello, A. A. B. (2020). Biology education and bio entrepreneur opportunities in Nigeria. *Nigerian Online Journal of Educational Sciences and Technology*, 1(2), 1–17.
- Cimer, A. (2012). What makes biology learning difficult and effective: Students' views. *Educational Research and Reviews*, 7(3), 61.
- Ehebha, G. A., & Adeyinka, O. L. (2022). A paper on the influence of classroom sizes on biology students' educational achievements. *International Journal of Innovative Science and Research Technology*, 7(7), 241–248.
- Garrett, T. (2014). *Effective classroom management: The essentials*. Teachers College Press.
- Gick, M. L. (1986). Problem-solving strategies. *Educational Psychologist*, 21(1–2), 99–120.
- Hale, T. N., & Mauzerall, D. L. (2004). Thinking globally and acting locally: can the Johannesburg partnerships coordinate action on sustainable development? *The Journal of Environment & Development*, 13(3), 220–239.

- Kulak, V., & Newton, G. (2015). An Investigation of the Pedagogical Impact of Using Case-Based Learning in a Undergraduate Biochemistry Course. *International Journal of Higher Education*, 4(4), 13–24.
- Mukhwana, W. J. (2013). The role of student-related factors in the performance of biology subject in secondary schools in Eldoret Municipality, Kenya. *Journal of Emerging Trends in Educational Research and Policy Studies*, 4(1), 64–73.
- Muraya, D. N., & Kimamo, G. (2011). Effects of cooperative learning approach on biology mean achievement scores of secondary school students' in Machakos District, Kenya. *Educational Research and Reviews*, 6(12), 726.
- Neji, H. A., & Ntibi, J. E. E. (2019a). Effect of E-learning devices on chemistry students' academic performance in Calabar Municipality, Cross River State. *Interdisciplinary Journal of Science Education*, 1(1), 170–178.
- Neji, H. A., & Ntibi, J. E. E. (2019b). Effect of E-learning devices on chemistry students' academic performance in Calabar Municipality, Cross River State. *Interdisciplinary Journal of Science Education*, 1(1), 170–178.
- Oakes, J., & Saunders, M. (2002). *Access to textbooks, instructional materials, equipment, and technology: Inadequacy and inequality in California's public schools*.
- Osamor, O. N. G., & Odebisi, P. (2019). Effect of instructional materials on the academic achievement of biology students in senior secondary schools in Delta state. *SOUTH EASTERN JOURNAL OF RESEARCH AND SUSTAINABLE DEVELOPMENT (SEJRSd)*, 2(1), 214–227.
- Owoeye, J. S., & Yara, P. O. (2011). Class size and academic achievement of secondary school in Ekiti State, Nigeria. *Asian Social Science*, 7(6), 184–189.
- Sheriff, A. A., Ifedayo, O. A., & Yetunde, T. O. (2019). Collaborative learning method: effects of ability levels and school-type on the junior secondary students' business studies achievement in Edo state. *International Journal of Educational Research*, 6(1), 198–207.
- Timilehin, E. H., & Ogbomida, A. H. (2012). Human and material resources as correlates of academic performance of private and public secondary school students in Ondo state, NIGERIA. *European Scientific Journal*, 8(10).