



MULTIMEDIA UTILISATION AND ACADEMIC ACHIEVEMENT IN BIOLOGY: A CROSS-SECTIONAL SURVEY OF SECONDARY SCHOOL STUDENTS IN AWKA EDUCATION ZONE

Awosika, Opeyemi F. (Ph.D)^{*1}, Nwuba, Izunna S.², Oguejiofor, Chiamaka N. (Ph.D)³, Okaforagbala, Uzoamaka C. (Ph.D)⁴, & Ndinyelum Onyebuchi M.⁵
of.aluko@unizik.edu.ng^{*1}, is.nwuba@unizik.edu.ng², coguejiofor@unilag.edu.ng³, uc.okafor-agbala@unizik.edu.ng⁴, miraclendinyelum@gmail.com⁵

<https://orcd.org/0000-0003-4056-7776>¹, <https://orcd.org/0000-0002-6408-3912>²

^{1,2,4,5} Department of Science Education, Nnamdi Azikiwe University Awka

³ Department of Science Education, University of Lagos, Lagos State

***Corresponding author: of.aluko@unizik.edu.ng**

Abstract

This study examined the perceived influence of multimedia-integrated learning packages (MILPs) on students' learning of biology in secondary schools within Awka Education Zone. A descriptive survey design was adopted, and data were collected using a structured questionnaire administered to students. The study investigated students' perceptions of MILPs, their impact on academic engagement and understanding, as well as the challenges associated with their use. Findings revealed that MILPs positively influence students' learning of biology by enhancing comprehension, increasing interest, and promoting active participation during lessons. Students reported that multimedia tools such as videos, animations, and interactive content made abstract biological concepts easier to understand. However, several challenges were identified, including inadequate access to technological resources, poor infrastructure, limited teacher competence in multimedia usage, and irregular power supply. The study concludes that while MILPs have significant potential to improve biology education, their effectiveness is constrained by systemic and infrastructural limitations. It is therefore recommended that stakeholders invest in digital infrastructure, provide teacher training, and ensure consistent access to multimedia resources to optimize learning outcomes.

Keywords: Multimedia Integrated Learning Packages, Biology Achievement

Introduction

Education is a multifaceted process that involves the acquisition of knowledge, skills, values, beliefs, and habits through various methods such as teaching, training, research, and experiential learning. It plays a crucial role in individual development and societal progress, as well as being a vital cornerstone of society, it gives people the information, skills, and chances they need to advance both personally and professionally (Philip and Williams, 2019). A crucial part of education which involves the process of teaching and learning, with the goal of developing scientific literacy and promoting critical thinking and problem-solving skills, is known as science education (Awosika, Austin, Ikusika, Mbaegbu and Okafor-Agbala, 2025). The teaching and learning of science is achieved by splitting sciences into various subjects, with its basics truly



beginning in senior secondary classes. Among the science subjects is Biology; the study of living things and their natural environment.

The scientific approach in biology does not only enhance the knowledge of the natural world but also provides practical applications that improve human health and address ecological challenges (Mills & Bossomaier 2022). Through these scientific methods, biologists employ observation, experimentation, and analysis to understand the complex mechanisms that govern life (Awosika & Okoli, 2023). This includes exploring cellular and molecular processes, genetics, evolution, ecology, and physiology; by utilizing scientific principles, biologists can develop a deeper understanding of how organisms function, adapt, and evolve, leading to advancements in medicine, environmental conservation, and biotechnology (Eckardt, Ainsworth, Bahunga, Broadley, Busch, Carpita & Zhang, 2023).

In the context of biology education, academic achievement represents the measurable outcome of a student's learning process, typically reflected in their mastery of scientific concepts and practical skills (Ezugwu, Mbonu-Adigwe, Ibenegbu & Okoye, 2022). It is widely considered a cornerstone of individual development and societal progress, as it equips learners with the information and opportunities necessary for personal and professional advancement (Deshmane & Thombre, 2024). The achievement of the students in biology has been attributed to their perception of biology topics as boring, abstract and too difficult to understand and also problems of overcrowded classrooms, poor teaching methods, unavailable resources to aid teaching and learning process (Awosika & Okoli, 2023). Other factors include phobia for science subjects and erroneous belief that biology is a tedious subject (Allen, Reupert & Oades, 2021). Teachers are not left out as they sometimes evade teaching some aspects of the subject because of its abstractness. The state of most laboratory in schools has made the use of modern methods and experiments difficult, and the present economic recession and irregular payment of teachers' salaries are contributing factors to the already complicated situation (Awosika & Okoli, 2023).

Furthermore, there are problems of overcrowded classrooms, poor teaching methods, unavailable resources to aid learning and teaching process (Allen *et al.*, 2021). To provide rich and captivating teaching-learning process, multimedia integrated learning packages; which uses a variety of digital media to improve the educational experiences by dynamically and aesthetically depicting appealing intricate biological processes such as cell division, DNA



replication, and ecological interactions in the context of biology are suggested. These packages integrate text, graphics, videos, animations, interactive simulations, and quizzes (Eze, Chinedu-Eze, Okike, and Bello, 2020). The goal of multimedia integrated learning packages is to cater to diverse learning styles, enhance understanding of complex concepts, and improve overall educational outcomes (Eze *et al.*, 2020). Additionally, the interactive components promote active learning processes that can increase students' motivation and retention of information (Moro, Stromberga & Stirling, 2017).

The implementation of multimedia learning packages has the potential to significantly enhance academic achievement by making learning more engaging, comprehensible, and personalized. (Klave and Cane, 2024). According to Ferri, Grifoni, and Guzzo (2020), access to diverse resources by enriching the content of libraries to provide access to a vast array of resources, including multimedia packages like articles, videos, e-books, and more; enriching the learning experience so that students can access information and viewpoints from around the world, broadening their horizons and fostering a deeper understanding of diverse subjects will also likely foster improved achievement. Empirical studies suggest that multimedia-supported instruction enhances students' motivation, retention, and overall learning experience (Akinbadewa & Sofowora, 2020; Moro *et al.*, 2017). Similarly, access to digital learning resources has been shown to broaden students' perspectives and improve academic outcomes (Ferri *et al.*, 2020).

Theoretically, this study is anchored on Mayer's Cognitive Theory of Multimedia Learning, which posits that students learn more effectively when information is presented through both visual and auditory channels, thereby improving cognitive processing and retention. In addition, the constructivist learning theory emphasizes that learners actively construct knowledge through interaction with learning materials, a process enhanced by multimedia environments.

Despite these theoretical and empirical supports, is limited empirical evidence on students' perceived influence of multimedia-integrated learning packages in biology, as well as the challenges hindering their effective utilization in secondary schools. Without such insights, efforts to integrate multimedia into biology instruction may remain ineffective and unsustainable. Therefore, this study investigates the perceived influence of multimedia-integrated learning



packages on students' learning of biology, the challenges associated with their use, and the strategies required to enhance their effective implementation in secondary schools within Awka Education Zone through looking into the following research questions;

1. What is the perceived influence of multimedia-integrated learning packages on the way students learn biology?
2. What are the challenges faced when using multimedia-integrated learning packages to learn biology?
3. What strategies can be implemented to overcome the challenges of using multimedia-integrated learning packages to learn biology?

Method

The study adopted a descriptive survey design and focused on Awka Education Zone in Anambra State. The population of the study consisted of all the five thousand and fifty-seven (5,057) SSII students and sixty-three (63) biology teachers in Awka education zone (Post primary schools service commission, Awka, 2024). Four (4) schools from two local governments were randomly selected from the education zone, and one hundred (100) students plus eight (8) teachers were randomly selected from these schools to make up the research participants.

The instrument for data collection was questionnaire adopted by the researchers and titled "Questionnaire on the perceived influence of multimedia integrated learning packages on academic achievement of biology students in senior secondary schools in Awka education zone (PIMILPs)". The instrument consisted of a two part survey, with part one enquiring on demographic data and part two aimed at answering the research questions with 10 items investigating on each research question. The instrument was validated by two experts from the Departments of Science Education and Economics Education for accuracy, appropriateness and clarity to provide the necessary result for the research.

To ascertain the reliability of the instrument, 20 copies of the questionnaire was administered to biology students in Nnewi Education Zone and 2 copies to teachers. The results of the analysis yielded a coefficient of 0.76 for teachers and 0.78 for the students which indicated that the instrument was reliable.



The data were collected through questionnaire; which was administered by the researchers face-to-face to the respondents (100 biology students and 8 biology teachers) in Awka Education Zone, and collected on the spot. Each item on the questionnaire was responded to by the research participants according to the 4 – point Likert scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD), which was used to judge the result at a mean cut off of 2.5. The data collected were analysed using mean and standard deviation to answer the research questions.

RESULTS

Table 1: Mean and standard deviation of how multimedia-integrated learning packages influence the way students learn Biology

S/N	Statement	Mean	SD	Remark
1.	Learning biology with Presentations with images and videos is not enjoyable	1.95	1.19	Rejected
2.	Online courses help me understand biology topics better	2.95	0.94	Accepted
3.	Using Learning CDs/DVDs makes me to lose interest in learning biology	1.75	0.85	Rejected
4.	I can learn biology at my own pace with online books	2.65	0.93	Accepted
5.	I retain biology knowledge better when using Educational videos and audios	3.50	0.76	Accepted
6.	I would be encouraged to study biology through Online classroom	3.05	0.88	Accepted
7.	Online tests prepare me for exams and reduces exams tension	3.30	1.03	Accepted
8.	Online practice exercises provide me with real time feedback on my teaching	3.45	0.82	Accepted
9.	My interest in biology would increase if I had access to Virtual reality headsets	3.20	1.00	Accepted
10.	My confidence around my peers increase if I learn with teaching apps	3.25	0.85	Accepted
	Grand Mean	2.90		Accepted

The result in Table 1 shows that items 1 and 3 were rejected since their mean scores were below the mean cut-off point of 2.50, the standard deviations of these two items are slightly high to moderate, and suggesting high spread in the responses of the participants, showing that more diversified responses was gotten from the respondents. Items 2, 4, 5, 6, 7, 8, 9 and 10 were accepted since their mean scores were above the mean cut-off of 2.50, although standard



deviations range from moderate to slight high. The grand mean was also accepted since it is above the mean cut-off of 2.50. This indicates that multimedia-integrated learning packages has high influence on the way students learn biology. This is because the respondents accepted that online courses helped them to understand biology topics better, they can learn biology at my own pace with online books, they retain biology knowledge better when using educational videos and audios, they would be encouraged to study biology through online classroom, online tests prepare them for exams and reduces exams tension, online practice exercises provide them with real time feedback on what they are taught and their confidence around their peers increase if they learn with teaching apps.

Table 2: Mean and standard deviation of the challenges faced when using Multimedia-Integrated learning packages to learn biology

S/N	Statement	Mean	SD	Remark
1.	I do not have access to presentations with images and videos for learning.	3.15	0.93	Accepted
2.	No supervision from teachers on the right online courses to support my biology learning.	2.60	0.94	Accepted
3.	I experience technical problems when using Learning CDs/DVDs.	3.00	1.07	Accepted
4.	Online books are inaccessible and hard to understand.	2.35	0.98	Rejected
5.	It is difficult to stay focused when using Educational videos and audios for biology lessons	2.30	1.21	Rejected
6.	I find it hard to use online classroom because it is not common and encouraged.	2.55	1.27	Accepted
7.	I experience internet problems when participating in an online test.	2.90	0.96	Accepted
8.	I need a conducive environment to participate in online practice exercises.	3.55	0.68	Accepted
9.	I easily get frustrated and discouraged when using Virtual reality headsets.	2.35	1.13	Rejected
10.	I experience difficulties in navigating teaching apps for biology learning	2.60	1.04	Accepted
	Grand Mean	2.73		Accepted

The result in Table 2 shows that items 4, 5 and 9 were rejected since their mean scores were below the mean cut-off point of 2.50. They also have slightly high standard deviations suggesting great spread in the participants' responses. Items 1, 2, 3, 6, 7, 8 and 10 were accepted since their mean scores were above the mean cut-off point of 2.50; with mostly moderate spread



in the standard deviations. The result also has a grand mean of 2.73 which is accepted as it is above the mean cut-off. This indicates that the challenges faced when using multimedia-integrated learning packages to learn biology are lack of access to presentations with images and videos for learning, no supervision from teachers on the right online courses to support my biology learning, technical problems when using Learning CDs/DVDs, difficulty in using online classroom because it is not common and encouraged, internet problems when participating in an online test, no conducive environment to participate in online practice exercises, difficulties in navigating teaching apps for biology learning.

Table 3: Mean and standard deviation of the strategies implemented to overcome the challenges of using multimedia-integrated learning packages to learn Biology

S/N	Statement	Mean	SD	Remark
1.	Accessibility to Presentations with images and videos for learning would be beneficial	3.87	0.35	Accepted
2.	I would need supervision from teachers on suitable online courses to support my learning	2.62	1.30	Accepted
3.	Technical personnel should be stationed to operate Learning CDs/DVDs ahead of lessons	3.25	0.88	Accepted
4.	Online books should be made readily available by the school administration	3.37	0.51	Accepted
5.	The content of educational video and audios should be short and straight to the point	3.75	0.46	Accepted
6.	Online classrooms should be allowed and encouraged	3.50	0.53	Accepted
7.	Proper internet connection e.g. Wi-Fi & routers should be provided by school administrators	3.62	0.51	Accepted
8.	Conducive environment for online practice exercises should be provided and maintained	3.25	0.70	Accepted
9.	Proper and extensive tutorials should be done on how to use and maintain virtual reality headsets	3.50	0.75	Accepted
10.	Beginner friendly teaching apps should be made available for students by the government and NGOs	3.50	0.75	Accepted
	Grand Mean	3.42		Accepted

The result in Table 3 shows that all items 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 were accepted because the mean scores were above the mean cut-off points of 2.50. Only item 2 has a high spread in the standard deviation with others having moderate and little in their standard deviations. This indicates that accessibility to presentations with images and videos for learning, supervision from teachers on suitable online courses to support learning, availability of technical



personnel to operate learning CDs/DVDs ahead of lessons, availability of online books by the school administration, short and straight to the point content of educational video and audios, encouraging online classrooms, proper internet connection e.g. Wi-Fi & routers provided by school administrators, conducive environment for online practice exercises, proper and extensive tutorials on how to use and maintain virtual reality headsets and beginner friendly teaching apps made available for students by the government and NGOs are the strategies that can be implemented to overcome the challenges of using multimedia-integrated learning packages to learn biology.

Discussion of the Findings

The findings of this study indicate that multimedia-integrated learning packages (MILPs) significantly enhance students' understanding and engagement in biology. Students perceived multimedia tools as effective in simplifying complex and abstract concepts, thereby improving comprehension and retention. This aligns with earlier studies which report that multimedia-based instruction enhances motivation, participation, and academic performance.

The findings of this study indicate that multimedia-integrated learning packages (MILPs) significantly enhance students' understanding and engagement in biology. Students perceived multimedia tools as effective in simplifying complex and abstract concepts, thereby improving comprehension and retention. This aligns with earlier studies which report that multimedia-based instruction enhances motivation, participation, and academic performance. The results are consistent with the findings of Cleveland-Innes, Garrison and Vaughan (2018; Ferri *et al.*, 2020), who observed that multimedia-supported instruction offers flexibility in pacing and sequencing of content, thereby accommodating individual learning differences. Similarly, Moro *et al.*, (2017; Akinbadewa and Sofowora, 2020) reported that multimedia instructional packages enhance students' engagement and foster positive attitudes toward biology, making learning more interactive and enjoyable.

Despite these benefits, the study identified several barriers to effective implementation. Inadequate access to digital tools, poor infrastructure, and unreliable electricity supply were major constraints. Additionally, limited teacher proficiency in multimedia integration hindered optimal utilization of these resources. These challenges are consistent with findings from



previous studies in developing educational contexts, where technological adoption is often constrained by systemic limitations. The findings corroborate Ismail (2021), who reported that many secondary schools operate in uncondusive environments with insufficient instructional materials and technological facilities.

The study identified several strategies that could mitigate the challenges associated with multimedia-integrated learning packages. These include ensuring access to multimedia presentations, providing teacher supervision in selecting suitable online learning platforms, deploying technical personnel to manage digital equipment, making online books readily available, designing concise and focused educational videos, encouraging the adoption of online classrooms, improving internet infrastructure within schools, providing conducive learning environments for digital activities, offering training on the use of virtual reality tools, and supplying beginner-friendly teaching applications through government and non-governmental organizations. The findings support Afolabi, Ogunyemi, and Oyediran (2020), who advocated for collaboration between government and NGOs to provide multimedia resources and promote equitable access to digital learning tools, particularly in under-resourced schools.

Conclusions

This study establishes that multimedia-integrated learning packages positively influence students' learning of biology by enhancing understanding, engagement, and interest. However, their effectiveness is limited by challenges such as inadequate infrastructure, insufficient access to technology, and lack of teacher competence. Addressing these constraints is essential for maximizing the benefits of multimedia in education. Therefore, effective integration of MILPs requires not only availability of resources but also adequate training and institutional support.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Provision of Infrastructure: Schools should be equipped with adequate multimedia facilities, including computers, projectors, and internet access.
2. Teacher Training: Regular training programs should be organized to improve teachers' competence in integrating multimedia into teaching.



3. Policy Support: Government and educational stakeholders should develop policies that promote the integration of technology in secondary school education.
4. Improved Power Supply: Reliable electricity should be ensured to support the effective use of multimedia tools.
5. Access to Digital Resources: Schools should provide students with access to relevant digital learning materials to enhance independent learning.

References

- Afolabi, A. O., Ogunyemi, I. A., & Oyediran, O. O. (2020). Exploring the role of multimedia in enhancing students learning outcomes in Nigerian secondary schools. *Journal of education and human development*, 9(2), 1-12.
- Akinbadewa, B. O., & Sofowora, O. A. (2020). The Effectiveness of Multimedia Instructional Learning Packages in Enhancing Secondary School Students' Attitudes toward Biology. *International Journal on Studies in Education*, 2(2), 119–133.
- Allen, K., Reupert, A., & Oades, L. (2021). Building Better Schools with Evidence-based Policy. In *Routledge eBooks*. <https://doi.org/10.4324/9781003025955>
- Awosika, O. F., Austin, N., Ikusika, B. A., Mbaegbu, C. S., & Okafor-Agbala, U. C. (2025). Mitigating Insecurity Challenges in Nigeria: Transformative Roles of Science Education. *STEM Journal of Anambra STAN*, 5(1), 83-93.
- Awosika, O. F., & Okoli, J. N. (2023). Nurturing Secondary Schools Students' Academic Interest in Biology using Mind Mapping Instructional Strategy. *International Journal of Research and Innovation in Social Science*, VII(X), 848–856.
- Cleveland-Innes, M., Garrison, D. R., & Vaughan, N. (2018). The community of inquiry theoretical framework: Implications for distance education and beyond. In *Handbook of distance education* (pp. 67-78). Routledge.
- Deshmane, P. H., & Thombre, K. (2024). The Impact of Education on Human Development in the 21st Century: Needs, Challenges & Opportunities. *InSight*, 1(3), 4-9.
- Eckardt, N. A., Ainsworth, E. A., Bahuguna, R. N., Broadley, M. R., Busch, W., Carpita, N. C., & Zhang, X. (2023). Climate change challenges, plant science solutions. *The Plant Cell*, 35(1), 24-66.
- Eze, S. C., Chinedu-Eze, V. C. A., Okike, C. K., & Bello, A. O. (2020). Factors influencing the use of e-learning facilities by students in a private Higher Education Institution (HEI) in a developing economy. *Humanities and Social Sciences Communications*, 7(1).
- Ezugwu, I. J., Mbonu-Adigwe, B. U., Ibenegbu, Q., & Okoye, M. N. (2022). Students' academic achievement in Basic Science and task persistence as predictors of achievement in senior secondary school Biology. *Journal of the Nigerian Academy of Education*, 5(4), 277-296.
- Ferri, F., Grifoni, P., & Guzzo, T. (2020). Online Learning and Emergency Remote Teaching: Opportunities and Challenges in Emergency Situations. *Societies*, 10(4), 86.
- Ismail, S. A. (2021). *Factors affecting the implementation of information literacy education in Malaysian primary schools*. <https://doi.org/10.26686/wgtn.17008336.v1>
- Klave, E., & Cane, R. (2024). Digital Transformation of Higher Education: Integrating Multimedia Systems into the Study Process. *Vide. Tehnologija. Resursi/Environment. Technology. Resources*, 2, 168–174.



- Mills, K. A., Unsworth, L., & Scholes, L. (2022). Literacy for Digital Futures. <https://doi.org/10.4324/9781003137368>
- Moro, C., Štromberga, Z., Raikos, A., & Stirling, A. (2017). The effectiveness of virtual and augmented reality in health sciences and medical anatomy. *Anatomical Sciences Education*, 10(6), 549–559.
- Philip, L., & Williams, F. (2019). Remote rural home-based businesses and digital inequalities: Understanding needs and expectations in a digitally underserved community. *Journal of Rural Studies*, 68, 306–318

