EFFECTS OF AUDIO-VISUAL MATERIALS ON STUDENTS' ACADEMIC PERFORMANCE IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN ONDO STATE

Rantiade Adesola, OGUNBADEJO
Department of Science Education
(Physics Education)
Adekunle Ajasin University, Akungba-Akoko, Ondo State
rantiogunbadejo@gmail.com, 08162990987

Abstract

This study investigated the impact of audio-visual materials on student's academic performance in physics in public secondary schools in Ondo State. Ex post facto research design was used in this study. The sample of the study consisted of seventy (70) senior secondary school three science students (SSS 3) which were randomly selected from ten (10) secondary schools from two (2) senatorial districts in Ondo State. The research instruments used for the study are Physics Achievement Test (PAT) and structured questionnaire. Pearson Product Moment Correlation (PPMC) and independent sample t-test were employed to test the research hypotheses. Three (3) research hypotheses were formulated and tested at 0.05 level of significance. The study discovered that there is positive relationship between availability of audio-visual materials and academic performance of secondary school students in physics. The study showed that there is a significant difference between the achievement of secondary school students in physics in urban and rural areas. The study found that there is no significant difference between the achievement of male and female secondary school students in physics. The study concluded that there are few audio-visual materials for teaching and learning of physics in secondary schools. It was recommended that there should be constant power supply for the use of audio-visual materials in secondary schools. There should be provision of sufficient time for the use of audio-visual materials by the students and teachers.

Keywords: Audio-Visual, Materials, Physics, Academic Performance

Introduction

The traditional "chalk and talk" method of instruction has long been the cornerstone of the Nigerian educational system (Oluwatelure & Awofala, 2021). However, this teacher-centred approach often fails to engage students, particularly in complex and abstract subjects like Physics. Physics, with its intricate concepts, mathematical formulas, and practical applications, often presents a significant challenge to secondary school students, leading to low motivation, poor comprehension, and ultimately, low academic performance (Oluwatelure & Awofala, 2021). The abstract nature of many Physics topics, such as electromagnetism, quantum mechanics, and optics, makes it difficult for students to visualize and connect with the real-world implications of the subject matter. In response to these challenges, there has been a growing emphasis on adopting innovative and student-centred teaching methodologies. Audio-visual materials, which integrate both auditory and visual sensory inputs, have emerged as a promising tool to enhance the teaching and learning process (Ige & Adediran, 2020). Audio-visual materials are instructional resources that appeal to both the senses of hearing (audio) and sight (visual) to facilitate, enhance, and reinforce teaching and learning in secondary schools. These materials, which include videos, animations, simulations, interactive whiteboards, and

educational software, have the potential to make abstract concepts more concrete and relatable. By providing a multi-sensory learning experience, audio-visual materials can help students visualize complex phenomena, grasp difficult concepts, and retain information more effectively (Adeoye et al., 2023).

Several studies have highlighted the positive impact of audio-visual aids on students' academic performance across various subjects. For instance, a study by Akpan and Udoh (2019) in Nigeria found that the use of instructional videos significantly improved students' understanding of chemical reactions. Similarly, research in other parts of the world has shown that the integration of technology and multimedia in the classroom leads to enhanced student engagement, motivation, and achievement (Aliyu & Owo, 2022). In the context of Physics, audio-visual materials can be particularly effective in demonstrating experiments, illustrating theoretical principles, and providing virtual laboratory experiences that may not be feasible in a traditional school setting (Adebayo & Adedoyin, 2024).

Gender disparity in science-related fields has been a long-standing concern in education. While some studies suggest that there is no significant difference in the academic performance of male and female students in Physics (Oluwatelure & Awofala, 2021), others have reported a persistent gender gap, with male students often outperforming their female counterparts (Fagbemi & Adebayo, 2018). These disparities are often attributed to a variety of factors, including societal stereotypes, lack of female role models in STEM fields, and gender-biased classroom interactions (Ogunleye, 2023). Some research posits that boys may be more inclined to engage with the practical and hands-on aspects of Physics, while girls may prefer theoretical and collaborative learning environments. However, recent studies suggest that the integration of innovative teaching methods, such as the use of audio-visual materials, can help bridge this gender gap (Ogunleye, 2023). For example, interactive simulations and animations can provide a safe and engaging environment for both male and female students to explore complex concepts without the fear of making mistakes (Oluwatelure & Awofala, 2021). By providing a more engaging and inclusive learning experience, audio-visual materials may help to debunk stereotypes and encourage more female students to pursue careers in Physics and other STEM fields (Adeoye et al., 2023). This study will also examine the academic performance of male and female students in Physics to determine if there is a significant difference based on gender and how the use of audio-visual materials might impact this disparity.

The influence of school location on the academic performance of students of secondary schools has been the concern of many educationists. Abamba (2021) opined that school locations are known to influence students learning through quality of teaching staff, class size and availability of infrastructure. The choice and location of school site have been an indispensable aspect of any effective school planning (Oluwateru & Awofala, 2021). This is so because; it is the site that can influence the type of school to be built and the quality and quantity of the buildings. A child's environment that is rural or urban exerts considerable influence on his intellectual development (Sumida & Kawata, 2021). Abiodun (2024) pointed out that school in rural areas are likely to face the problem of poor learning outcome due to the inequality in provision of human and material resources required for positive educational achievement. This in turn will perpetuate inequality of access to education provision of adequate number and quality of teachers, contents and methods of teaching (Ojo & Abiodun, 2020).

An urban child has an edge over the rural ones in terms of "life chances" such as better education and the socialization pattern. There are three social classes that exist - higher, middle

and lower social classes (Adebayo & Adedoyin, 2024). The urban, higher and middle classes through improved "life chances are exposed to better environment with access to libraries, adequate space, continuation classes and mass media. The rural children are hardly exposed to those facilities because they are mainly from lower social class. As a result, children from this background have low academic performance (Ode & Ogah, 2021). Adeduyigbe et al (2024) contended that in terms of facilities and structures, urban schools are worse because of high enrolment figures. In urban schools, the facilities are grossly inadequate making it necessary to run a sort of shift system especially in secondary schools (Ige & Adediran, 2020). This has been strongly condemned as it does not make for effective teaching and learning. Agube et al (2024) noted that because of lack of social amenities in remote rural area, teachers sent there do not like to stay even if they agree to work; they prefer to live in towns and shuttle to such areas. Aliyu and Owo (2022) said that the teacher is one of the most important factors in the child's environment that influences his learning outcome. Some experts in the field have agreed that rural secondary schools are poorly staffed, with few professionally qualified teaching personnel. This poor staffing of rural secondary schools must have accounted for better academic performance of urban secondary schools (Awodun & Oyeniyi, 2018).

Despite the potential benefits, the adoption and utilization of audio-visual materials in Physics education in secondary schools, particularly in a state like Ondo, remain a subject of interest. A study by Ojo and Abiodun (2020) pointed out that many schools still lack adequate access to and infrastructure for these modern teaching aids.

All parties involved in the education sector in Nigeria have expressed great concern over the poor learning outcomes (academic performance) of secondary school students in physics on external tests. This problem has been mostly ascribed to the physics instructors' methods of instruction. According to the WAEC Review of Physics (2018-2022), there have been differences in the way that students have performed in the subject of physics in the Senior School Certificate Examinations (SSCE) in Nigeria between 2018 and 2022.

Table 1: Statistics of the West African Examination Council on students' performances in Physics between 2018 and 2022 in Nigeria

Year	Total Enrolment for Examination in all Subjects	Total Entry For Examination in Physics	Total No Of Candidates That Sat For Physics Examination	Number and percentage of candidates that sat and obtained the given Grade A1 to F9			Total Number of candidates absent as % of Entry
				Total Credit A1-C6	D7- D8	F9	
2018	1470338	431089 (29.32)	429556 (99.64)	306006 (71.24)	110673 (25.76)	7598 (1.77)	5279 (1.23)
2019	1596161	498571 (31.24)	489552 (98.19)	299886 (61.26)	118059 (24.12)	66472 (13.58)	5135 (1.04)
2020	1549740	629896 (40.65)	622095 (98.76)	298768 (48.03)	205875 (33.09)	107118 (17.22)	10334 (1.66)
2021	1573849	695602 (44.20)	694893 (99.89)	405121 (58.30)	187621 (26.99)	94214 (13.57)	7937 (1.14)
2022	1621853	710064 (43.78)	699725 (98.54)	396052 (56.60)	181056 (25.88)	115724 (16.53)	6893 (0.99)

Source: WAEC Physics, 2018 - 2022

It can be inferred from table 1 that students' performance in physics was inconsistent between 2018 and 2022. Based on the data presented in the table, it can be observed that in 2018, 71.24% of students who took physics exams had grade ranges between A1 and C6, while 27.53% of students had ranges between D7 and F9. In 2019, 61.26% of students took physics exams had grades range between A1 and C6, with 37.70% of students having ranges between D7 and F9. In 2020, 48.03% of students took physics exams had grades range between A1 and C6, with 50.31% of students having ranges between D7 and F9. Furthermore, 58.30% of students who took the physics exam in 2021 had grade ranges between A1 and C6, and 40.56% of students had ranges between D7 and F9. Generally speaking, of the 2,935,821 students (or 37.58% of the total population of students who registered for WAEC exams) who took the physics test in WAEC between 2018 and 2022, only 1,705,833 students (or 58.10%) had grade ranges between A1 and C6, while 1,194,410 students (or 40.68% of the total) had grade ranges between D7 and F9.

The result in Table 1 above consistently shows a high failure rate in Physics, which can be attributed to several factors (Ojo & Abiodun, 2020). The prevailing teaching methodology in many secondary schools in the state is predominantly the lecture-based "chalk and talk" approach, which is often passive and fails to effectively convey the abstract and practical nature of Physics concepts (Ige & Adediran, 2020). This traditional method often leads to rote memorization rather than deep understanding, hindering students' ability to apply principles to real-world scenarios and solve complex problems (Adeoye et al., 2023).

The abstract nature of many topics in the Physics curriculum, such as wave-particle duality, atomic structure, and electromagnetism, presents a significant challenge for both teachers and students. Without proper visual aids, students struggle to visualize these concepts, leading to misconceptions and a lack of interest in the subject. A study by Oluwatelure and Awofala (2021) highlighted that students' inability to connect theoretical knowledge with practical applications is a major contributor to their poor performance. Furthermore, many schools in Ondo State lack well-equipped laboratories, making it difficult for teachers to conduct practical experiments that are crucial for a hands-on understanding of Physics (Adebayo & Adedoyin, 2024). This limitation further reinforces the reliance on theoretical instruction, which is often insufficient to build a strong conceptual foundation.

While audio-visual materials have been widely recognized as effective tools for enhancing teaching and learning, their utilization in Physics classrooms in Ondo State is still limited and inconsistent (Ojo & Abiodun, 2020). The available literature suggests that while some schools may have access to these materials, a lack of teacher training, inadequate infrastructure, and a shortage of relevant content tailored to the curriculum hinder their effective integration into the teaching process (Aliyu & Owo, 2022). Consequently, students are deprived of the multi-sensory learning experience that could significantly improve their understanding and retention of complex Physics concepts. Furthermore, there is a need to understand if the impact of audio-visual materials on academic performance varies across gender. While some research suggests that these materials can help bridge the gender gap in science education (Ogunleye, 2023), it is not clear whether this holds true for Physics students in Ondo State. This study therefore aims to investigate the impact of audio-visual materials on student's academic performance in physics in secondary schools in Ondo State.

Statement of the Problem

Despite the acknowledged importance of Physics as a foundational subject for science, technology, engineering, and mathematics (STEM) fields, students' academic performance in the subject at the secondary school level in Ondo State has been a persistent concern**.** As revealed in Table 1 above, there has been a consistent failure of senior secondary school students in physics in external examination. Therefore, a gap exists in the literature regarding the specific impact of audio-visual materials on students' academic performance in Physics in secondary schools in Ondo State, as well as their influence on gender-based performance differences. This study seeks to bridge this gap by investigating the extent to which the use of audio-visual materials can improve students' academic performance in Physics and to determine if there is a significant difference in performance based on gender, and school location.

Objectives of the Study

The objective of this study is to investigate the impact of audio-visual materials on student's academic performance in physics in secondary schools in Ondo State. Specifically, the study seeks to:

1. determine the relationship between availability of audio-visual materials and academic performance of secondary school students in physics.
2. find out the difference between the academic performance of secondary school students in physics in urban and rural areas.
3. investigate the difference between the academic performance of male and female secondary school students in physics.

Hypotheses

H_O1: There is no significant relationship between availability of audio-visual materials and achievement of secondary school students in physics.

H_O2: There is no significant difference between the achievement of secondary school students in physics in urban and rural areas.

H_O3: There is no significant difference between the achievement of male and female secondary school students in physics.

Methodology

Ex post facto research design was used in this study. It is a systematic empirical inquiry in which the researcher does not manipulate the independent variable because the presumed cause has already occurred, unchangeable characteristics of the subjects. Moreover, it allowed the researcher to ascertain the effect of the intervention (audio-visual materials) on the sampled population, the design is appropriate for this study. All of the chosen Secondary School Science (III) Students in Ondo State made up the study's target population. A multistage sampling technique was used in selecting ten (10) public secondary schools out of three hundred and three (303) public secondary schools in Ondo State. First, a simple random sampling technique was used to select two (2) senatorial districts out of three (3) senatorial districts in Ondo State. Second, five (5) secondary schools were randomly selected from each of the two senatorial

districts in Ondo State. A sample of seven (7) Senior Secondary School (III) science students was selected as respondents in each of the ten (10) selected secondary schools. Two research instruments were used in this study. These are Physics Achievement Test (PAT) and structured questionnaire. Physics achievement test (PAT) was self-developed by the researcher based on some contents in the physics curriculum for senior secondary schools and were validated by experts in the field of Physics. Based on their suggestions and comments, necessary corrections were made by the researcher to the test instrument. The test contains 10 multiple choice objective test items. Structured questionnaire was self-designed by the researcher statement items that elicit information from the respondents on the availability of audio-visual materials for teaching of physics in secondary schools. The structured questionnaire was given to twenty (20) secondary school science students outside the research zone, using test and retest method within two weeks interval. Then the coefficient of the reliability was calculated using the Statistical Package for Social Sciences (SPSS) version 25 and a reliability coefficient of 0.916 was obtained using Pearson Product Moment Correlation Coefficient. This shows that the instrument is highly reliable and could be used to carry out the research. Physics Achievement Test (PAT) was trial tested on 20 students, who were not part of the main study. Reliability test was conducted using Kuder Richardson 20 and a reliability coefficient of 0.896 was obtained. This shows that the instrument is highly reliable and could be used to carry out the research. Data collected was analysed using inferential statistics using Statistical Package for Social Sciences (SPSS) Software version 25.

Results

Ho1: There is no significant relationship between availability of audio-visual materials and academic performance of secondary school students in physics.

Table 2: Pearson Product Moment Correlation of the relationship between availability of audio-visual materials and academic performance of secondary school students in physics

Correlations

		Audio-visual	Academic performance
Audio-visual	Pearson Correlation	1	.813
	Sig. (2-tailed)		.000
	N	70	70
Academic performance	Pearson Correlation	.813	1
	Sig. (2-tailed)	.000	
	N	70	70

$P < 0.05$

Table 2 reveals that, there is a significant relationship between availability of audio-visual materials and academic performance of secondary school students in physics ($r_{70} = 0.813$, N = 70, sig. = 0.000, $p < 0.05$). Hence, availability of audio-visual materials positively relates to the academic performance of secondary school students in physics.

Ho2: There is no significant difference between the academic performance of secondary school students in physics in urban and rural areas.

Table 3: Independent sample t-test on the significant difference between the academic performance of secondary school students in physics in urban and rural areas

	Location	N	Mean	St. D.	df	t-calc.	Sig.	Remarks
Academic performance	Rural	35	37.00	7.971	68	5.949	0.000	Significant
	Urban	35	47.43	6.512				

$P < 0.05$

Table 3 reveals that there is a significant difference between the academic performance (Rural = 37.00; Urban = 47.43) of secondary school students in physics in urban and rural areas ($t = 5.949$, $df = 68$, sig. = 0.000, $p < 0.05$). Furthermore, it shows that the mean achievement score of secondary school students in physics in rural areas is (37.00) is less than their counterparts in urban areas (47.43). Hence, secondary school students in urban area performed significantly better than their counterparts in rural area.

Ho3: There is no significant difference between the academic performance of male and female secondary school students in physics.

Table 4: Independent sample t-test on the significant difference between the academic performance of male and female secondary school students in physics

	Gender	N	Mean	St. D.	df	t-calc.	Sig.	Remarks
Academic performance	Male	27	39.26	7.299	68	1.791	0.078	Not significant
	Female	43	35.93	7.735				

$P > 0.05$

Table 4 shows that, there is no significant difference between the academic performance of male and female secondary school students in physics ($t = 1.791$, $df = 68$, sig. = 0.078, $p > 0.05$). This implies that, both male and female secondary school students had the same performance in physics.

Discussion of Findings

From the findings of the study, it was revealed that there was a significant relationship between availability of audio-visual materials and achievement of secondary school students in physics. Hence, availability of audio-visual materials positively relates to the achievement of secondary school students in physics. This corroborates the finding of Akpan and Udoh (2019) who revealed that there is a statistically significant relationship on the availability of audio-visual materials and their academic achievement. Also, Ige and Adediran (2020) revealed from their study that, using audio-visual materials to increase student knowledge is effective because the experimental group's post-assessment scores were significantly higher. The study further showed that there was a significant difference between the achievement of secondary school students in physics in urban and rural areas. Furthermore, it shows that the mean achievement score of secondary school students in physics in rural area is less than their counterparts in urban area. Hence, secondary school students in urban area performed better than their counterparts in rural area. This disagrees with the finding of Abamba (2021) who revealed that the achievement of students was not impacted by the location of their schools.

Finally, the finding of the study discovered that there was no significant difference between the achievement of male and female secondary school students in physics. This implies that, both male and female secondary school students had the same performance in physics. This disagrees with the finding of Ogunleye (2023), and Ojo and Abioudn (2020) who revealed that the achievement scores of male and female students were significantly different by the use of audio-visual aided instruction.

Conclusion

Based on the findings of this research, it is concluded that there is positive association of audio-visual materials on the learning outcome of secondary school students in physics. Moreover, secondary school students in urban area performed better than their counterparts in rural area. It is concluded that there was no significant difference in the academic performance of secondary school students in physics based on gender; both male and female secondary school students had the same achievement in physics. However, this study is without limitation because of the research design adopted for this study which restricts the ability to establish definitive cause-and-effect relationships due to the lack of the researcher control and random assignment of key variables. State and local education boards should formulate policies for sustained funding and teacher training to ensure the effective integration, maintenance, and maximum utilisation of audio-visual resources across all public secondary schools.

Recommendations

The study recommended that, there should be availability of enough/sufficient audio-visual materials in secondary schools. Also, there should be support from the school management towards the use of audio-visual materials. Moreover, there should be sufficient funds for the purchase of relevant audio-visual materials in secondary schools. Similarly, there should be provision of technical support for the students on the use of audio-visual materials. Finally, there should be constant power supply for the use of audio-visual materials in secondary schools.

References

Abamba, E. I. (2021). The effects of school location on students' academic achievement in senior secondary physics based on the 5E learning cycle in Delta State, Nigeria. *LUMAT: International Journal on Math, Science and Technology Education, 9*(2), 70-84.

Abiodun, G. A. (2024). Effect of school location on senior secondary school students' achievement in English language essay writing in Lokoja. *Nigerian Journal of Literacy and English Education.*

Adebayo, A. M., & Adedoyin, M. A. (2024). The effectiveness of virtual laboratory simulations on students' understanding of optics in Nigerian secondary schools. *Journal of Educational Technology and Research, 12*(1), 45-60.

Adeduyigbe, A. M., Ukoh, E. E., & Okeke, U. K. (2024). Influence of school type on senior secondary school physics students' learning difficulties and misconceptions about electricity in Ondo West Local Government, Ondo State, Nigeria. *ResearchGate*.

Adeoye, E. A., Abiodun, A. A., & Olatunji, S. T. (2023). Multimedia instructional materials and students' engagement in science education. *International Journal of Modern Education Studies, 9*(2), 215-230.

Agube, E. O., Ntibi, J. E., & Neji, H. A. (2021). *Impact of school location on academic performance of science students in Nasarawa North Senatorial District of Nasarawa State*. Journal of Technology and Education in Science and Engineering, 10(2), 23-38.

Akpan, I. J., & Udoh, E. A. (2019). *Effects of instructional video on students' academic achievement in chemistry in secondary schools*. Journal of Science Education and Technology, 28(4), 481-492.

Aliyu, A., & Owo, A. (2022). Influence of digital learning tools on students' performance in physics. *African Journal of Educational Research and Development, 16*(3), 101-115.

Awodun, A. O., & Oyeniyi, S. O. (2018). Influence of school location on students' achievement in Basic Science. *Journal of Science, Technology, and Education, 6*(3), 12-25.

Fagbemi, O. A., & Adebayo, S. A. (2018). Gender differences in students' performance in physics among senior secondary school students in Ekiti State. *Journal of Research in Science Teaching, 23*(1), 1-15.

Ige, T. A., & Adediran, S. A. (2020). Utilization of audio-visual aids and academic performance of secondary school students in Osun State. *Journal of Education and Practice, 11*(16), 112-120.

Ode, E. A., & Ogah, S. T. (2021). Classroom environment and academic achievement of students in secondary schools in Nigeria. *Journal of Educational Research and Development, 15*(4), 56-70.

Ogunleye, A. J. (2023). *Bridging the gender gap in STEM education: The role of technology in the classroom. Journal of Educational Technology, 32*(4), 567-580.

Ojo, D. A., & Abiodun, C. (2020). Availability and utilization of instructional materials for teaching physics in secondary schools in Ondo State. *International Journal of Academic Research in Education and Review, 8*(3), 11-20.

Oluwatelure, T. A., & Awofala, A. O. A. (2021). Effects of gender and teaching methods on students' performance in physics concepts in secondary schools in Lagos State. *Journal of Educational Research and Reviews, 9*(1), 1-10.

Sumida, K., & Kawata, S. (2021). Urban-rural gap in education performance in Peruvian public institutions during 2018: an analysis using the Oaxaca-Blinder decomposition. *Frontiers in Education, 9*, 1394938.