

TECHNOLOGY INTEGRATION AS CORRELATES OF STUDENTS' LEARNING OUTCOME IN
PUBLIC SECONDARY SCHOOLS IN ANAMBRA STATE

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Abstract

This study examined technology integration as correlates of students' learning outcomes in public secondary schools in Anambra State. Three research questions and three null hypotheses guided the study. The study adopted a correlational research design. The population comprised 21,667 SSII students in 267 public secondary schools in Anambra State. A sample of 650 students was drawn from the population. The instruments for data collection were researcher-structured questionnaires titled "Technology Integration Questionnaire (TIQ)" and "Mathematics Test Questions (MTQ)." The face validity of the instruments was established by three experts: one in Measurement and Evaluation and two in Educational Management, all from the Department of Educational Foundations, Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam Campus. Construct validity of the instruments was determined using the Principal Component Analysis (PCA) method. The Kaiser-Meyer-Olkin (KMO) statistic was used as a measure of sampling adequacy. The reliability of the instruments was determined using the Cronbach Alpha method, yielding an average coefficient of 0.76. Pearson Product Moment Correlation Coefficient (PPMC) was used to answer the research questions, while tests of significance of correlation were used to test the hypotheses at the 0.05 level of significance. The results revealed a moderate positive and significant relationship between the integration of projectors and students' learning outcomes. There was a low positive and non-significant relationship between the integration of interactive whiteboards and students' learning outcomes. Additionally, there was a high positive and significant relationship between the integration of computers and students' learning outcomes. Based on the findings, it was recommended that the government should provide adequate projectors and computers in public secondary schools in Anambra State, and teachers should be encouraged to utilize them effectively during instruction to enhance visibility of texts and images, thereby improving teaching and learning. This study contributes to knowledge by providing empirical evidence on the relationship between the integration of projectors, computers, and students' learning outcomes.

Keywords: Technology, Integration Students Learning Outcomes.

Introduction

Education is the process of learning new things so people can grow, think better, and make good choices. It is expected that at the completion of secondary education, young learners must have developed critical thinking, problem-solving and analytical skills needed for their career path and life generally. Students are learners taught and guided by teachers with expectation of high learning outcome. Students learning outcome is very important for ascertaining how much knowledge they have acquired. Voke et al. (2025) defined students' learning outcomes as the measurable indicators used to evaluate students' academic achievement and effectiveness of teaching strategies. It is the result of teaching and learning in a school. Chen et al. (2023) opined that students' learning outcome is the understanding, perseverance, intelligence and the quality of learning acquired by a learner which can be measured in different ways. The researchers defined students' learning outcome as the measure of their achievement from teaching and learning process which involves: interaction, acquiring new knowledge, acquiring problem solving skills, over a period of time. It is a measure of the knowledge students have gained through the delivery of the curriculum content by teachers.

Anambra State is classified as educationally advantaged State and there is need for this status quo to be maintained but observation revealed that the learning outcome in some public secondary schools in Anambra State is poor. This a serious problem that needs solution otherwise both the school, families and the entire society would be affected negatively. Poor students' learning outcome in some public secondary schools in Anambra State could be as a result of several factors. Suryabrata cited in Andrini (2016) maintained that internal and external factors which influence students' learning outcome include; intelligence, achievement motivation, cognitive ability, curriculum, poor classroom management practices of teachers, the type of school environment, students poor attitude to learning, family influence, stress, poor usage of instructional materials, the method of instructional delivery and poor technology integration in the teaching and learning process. Christensen (2019) pointed out that the integration of technology in teaching and learning beyond the traditional teaching methods expands

opportunities for immersive students' learning outcome. In the light of this, this study examined technology integration as correlates of students' learning outcome in public secondary schools in Anambra State.

In today's world technology plays a big role on how students learn. Kimmons (2020) asserted that technology integration in education is the meaningful use of technology to achieve learning objectives. Since integration means bringing several things to function as a unit, technology integration in schools involves the utilization of technology in teaching and learning. Technology integration in teaching is the use of educational technologies (specialized hardware or software applications) by teachers in the classroom to realize particular teaching objectives (Danniels et al., 2020). In this study, technology integration is the application of technology tools or resources in instructional delivery by teachers for the achievement of school goals. Technology integration has to do with the way teachers utilize digital devices and software to improve teaching and learning experience in order to realize school goals. It is how digital tools are used by teachers to support teaching and learning in schools. Technology integration play a pivotal role in shaping the educational trajectories of individuals and driving innovation and progress within society (Nwogbo et al., 2024). Technology integration in teaching and learning can be conceptualized quantitatively and qualitatively. Technology integration on a quantitative basis is defined as the frequency of technology integration while qualitatively technology integration is the determination of how the technology used has improved teaching quality (Fraillon cited in Manar & Ouhammou, 2024). This means that technology integration quantitatively has to do with the number of technological tools used in teaching while the qualitative approach deals with the effect or result of the technologies employed in teaching

A lot of technologies could be utilized during teaching and learning process. Manar and Ouhammou (2024) opined that technologies that could be used in teaching include; computers, tablets, interactive whiteboards, projectors and educational software. In the same vein Kendari (2021) maintained that technology tools that could be used by teachers for teaching include; computer screens, amplified speakers, projectors, video recorders, and interactive whiteboards. This study examined the integration of projectors, interactive whiteboards and computers in teaching and learning as they relate to students' learning outcome in public secondary schools in Anambra State.

Projectors are one of the technology tools that can be used by teachers while delivering the curriculum content in the classroom. Adizu et al. (2022) defined projector as a technology tool that uses light to project an enlarged image on a screen, allowing the view of a small document or picture to be shared with a large audience. A Projector is a tool that is capable of displaying large images and it is used for presentation of information (Kendari 2021). They are used to display information so that all the students in the classroom can see the information clearly because the information is made bigger. Projector is a device that transmits images from a source, projects and enlarges them on a surface. Projectors serve many purposes in schools. They are used as aid or support for lessons. Teachers can use projectors to enlarge lessons prepared in power points software. Projectors could be used by teachers in classrooms during teaching and learning as well as interactive whiteboards.

An interactive whiteboard is another type of teaching device that can be used in classrooms. Interactive whiteboards are a type of board in the classroom that provides more function than the traditional chalkboard or ordinary white, marker or dry-erase boards, which are usually white surfaced for making non-permanent writing. The interactive whiteboard (IWB) is a part of the Information and Communication Technologies (ICT) integration process in the educational system. An interactive whiteboard, is an advanced display tool that operates interactively, either directly or through other devices, serving as a technological advancement over traditional whiteboards (Katie, 2024). The interactive whiteboard (IWB) is a pedagogical tool which promotes creative teaching, facilitates discussion and motivates students in absorbing information for learning (Onal & Demir, 2017).

The interactive whiteboard (IWB) is a teaching device used by teachers to make teaching and learning more interesting. Students could have better learning experience when teaching is interesting. Interactive whiteboards are educational tools that can be used to share messages, present information, engage in team work in the classroom and idea development. Teachers can show images, presentations and videos to the whole class at the same time using the interactive whiteboard. Teachers using interactive whiteboards in the classroom does not need chalk or marker pens unlike the traditional chalkboards or whiteboards. Interactive whiteboards were developed to serve as a modern alternative to traditional chalkboards or whiteboards. Some interactive whiteboard can be used for delivering curriculum content alongside with computer.

Computer is another type of technology that could be integrated in teaching and learning. A computer is an electronic device which is used to store, manipulate, and communicate information, perform complex calculations, control or regulate other devices (Neumann cited in Rapaport, 2018). Computer is capable of receiving data and of processing it in accordance with variable procedural instructions to give out meaningful information. In the view of Williams (2021), a computer is a digital electronic device or machine capable of receiving, computing, processing, and outputting data in various forms. This means that computers perform

arithmetic and logical operations fast and the input determines the output. A computer is an electronic tool that can transform raw data into meaningful information for improved teaching and learning experience.

There are software and hardware components of computer. Computers can be used at homes in schools and offices. Computers can be used by teachers and students in schools during teaching and learning or at homes. It could also be used alongside other devices. Computers can be used for handling text, images, music, and video, accessing and using the Internet, communicating with other people and playing games in and outside the school (Narayanan et al., 2018). Computers are vital tools in education especially in teaching and learning. Computers could be used to prepare lessons using tests, images and videos to make the lesson more concrete and understandable to students. In other words, the use of computer could aid students in fast assimilation of subject matter.

Statement of the problem

Quality Students' learning outcome is instrumental to achieving societal development. Anambra State is one of the States classified as educationally advantaged State and there is need for continuous improvement in the learning outcome of students. Observation by the researcher revealed that learning outcome in some public secondary schools in Anambra State seem poor. This is a serious concern because if the learning outcome of students in some public secondary schools in Anambra State continues to dwindle, the school, families and the society would be affected negatively. The statement of the problem is posed as a question: what could be the cause of poor students' learning outcome in some public secondary schools in Anambra State? The poor students' learning outcome in some public secondary schools in Anambra State could be as a result of family influence, stress, peer pressure, the leadership style of the principal, students' negative attitude to learning, lack of integration of technology in teaching and learning and so on. It is on this premise that this study examined integration of technology as correlates of students' learning outcome in public secondary schools in Anambra State.

Purpose of the Study

The main purpose of this study was to examine technology integration and instructional delivery as correlates of students learning outcome in public secondary schools in Anambra State. Specifically, the study sought to:

1. determine the correlation between the integration of projector and students' learning outcome in public secondary schools in Anambra State.
2. examine the correlation between the integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State.
3. find out the correlation between the integration of computer and students' learning outcome in public secondary schools in Anambra State.

Research Questions

This study was guided by the following research questions:

1. What is the relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State?
2. What is the relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State?
3. What is the relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State?

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State.
2. There is no significant relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State.
3. There is no significant relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State.

Method

Correlational research design was adopted for this study. The population of this study consisted of 21,667 SS2 students in the 267 public secondary schools in the six education zones of Anambra State. The sample size of 650 SSII students was drawn from the population of the study using proportionate stratified and simple random sampling techniques. The study was guided by three research questions and three null hypotheses were tested at 0.05 level of significant. The instruments for data collection was researcher-structured instrument titled: "Technology Integration Questionnaire (TIQ)", and "Mathematics Test Questions (MTQ)". The face validity of

the instruments was established by three experts; one from Measurement and Evaluation and two experts from Educational Management. The experts were all from the Department of Educational Foundations in the Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam Campus. The construct validity of the instruments was explored using Principal Component Analysis (PCA) Method. The Kaiser-Meyer-Olkin (KMO) value which was used as measure of sampling adequacy. The reliability of the instrument was determined using Cronbach Alpha method and the average coefficient of 0.76 was obtained. The instruments were administered to the respondents with the help of five research assistants using on-the-spot administration and retrieval method. Pearson Product Moment Correlation Coefficient (PPMC) was used to answer the research questions and Test of significance of correlation was used to test hypotheses at 0.05 level of significance. All the analysis was carried out using Statistical Package for Social Sciences (SPSS) version 27.

Results

The data collected were statistically analyzed in line with the research questions and hypotheses that guided the study and the results were presented in tables below:

Research Questions 1: What is the relationship between integration of projector and students’ learning outcome in public secondary schools in Anambra State?

Table 1: Pearson (r) of the relationship between integration of projector and students’ learning outcome in public secondary schools in Anambra State.

Sources of variation		Integration of projector	Students’ learning outcome	Remark
Integration of projector	Pearson (r) N	1.00 626	0.510 ^{xx} 626	Moderate positive relationship
Students’ learning outcome	Pearson (r) N	0.510 ^{xx} 626	1.00 626	

^{xx}(0.510) = High positive relationship

In Table 1 the Pearson (r) of the relationship between integration of projector and students’ learning outcome in public secondary schools in Anambra State was shown. Pearson (r) value of 0.510 was obtained which showed moderate positive relationship with (r = 0.510, N = 626) between integration of projector and students’ learning outcome in public secondary schools in Anambra State

Research Questions 2: What is the relationship between integration of interactive whiteboard and students’ learning outcome in public secondary schools in Anambra State?

Table 2: Pearson (r) of the relationship between integration of interactive whiteboard and students’ learning outcome in public secondary schools in Anambra State.

Sources of variation		Integration of interactive whiteboard	Students’ learning outcome	Remark
Integration of interactive whiteboard	Pearson (r) N	1.00 626	0.321 ^{xx} 626	Low positive relationship
Students’ learning outcome	Pearson (r) N	0.321 ^{xx} 626	1.00 626	

^{xx}(0.321) = low positive relationship

Table 2 indicated that Pearson (r) value of 0.321 was obtained from the relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State. This revealed a low positive relationship ($r = 0.321$, $N = 626$) between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State.

Research Questions 3: What is the relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State?

Table 3: Pearson (r) of the relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State.

Sources of variation		Integration of computer	Students' learning outcome	Remark
Integration of computer	Pearson (r)	1.00	0.730 ^{x x}	High positive relationship
	N	626	626	
Students' learning outcome	Pearson (r)	0.730 ^{x x}	1.00	
	N	626	626	

^{x x}(0.730) = High positive relationship

In Table 3 the result of the Pearson (r) of the relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State was shown. The result of ($r = 0.730$, $N = 626$) revealed a high positive relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State.

Test of Hypotheses

The following null hypotheses were tested at 0.05 level of significance

Hypothesis 1: There is no significant relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State.

Table 4: Test of significance of correlation between integration of projector and students' learning outcome in public secondary schools in Anambra State.

Sources of variation		Integration of projector	Students' learning outcome	Decision
Integration of projector	Pearson (r) sig. (2-tailed)	1.00	0.510 ^{x x}	Significant
		626	0.001	
	N		626	
Students' learning outcome	Pearson (r)	0.510 ^{x x}	1.00	
	sig. (2-tailed)	0.001		
	N	626	626	

^{x x} correlation is significant at the 0.05 level (2-tailed).

Table 4 showed that the correlation between integration of projector and students' learning outcome in public secondary schools in Anambra State was 0.510 with a probability value of 0.001. The obtained p-value of 0.001 was less than 0.05 level of significance. Therefore, the null hypothesis of no significant relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State was rejected ($r, 626 = 0.510$, $p\text{-value} = 0.001$). This meant that there is significant relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State.

Hypothesis 2: There is no significant relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State.

Table 5: Test of significance of correlation between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State.

Sources of variation		integration of interactive whiteboard	Students' learning outcome	Decision
Integration of interactive whiteboard	Pearson (r) sig. (2-tailed)	1.00	0.321 ^{xx}	Not Significant
	N	626	626	
Students' learning outcome	Pearson (r) sig. (2-tailed)	0.321 ^{xx}	1.00	
	N	626	626	

^{xx} correlation not significant at the 0.05 level (2-tailed).

Table 5 revealed the result of the correlation between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State. The correlation was 0.321 and a probability value of 0.06 was obtained. The p-value of 0.06 obtained was less than 0.05 level of significance ($r, 626 = 0.321, p\text{-value} = 0.06$). The null hypothesis of no significant relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State was not rejected. Thus, there is no significant relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State.

Hypothesis 3: There is no significant relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State.

Table 6: Test of significance of correlation between integration of computer and students' learning outcome in public secondary schools in Anambra State.

Sources of variation		Integration of computer	Students' learning outcome	Remark
Integration of computer	Pearson (r) sig. (2-tailed)	1.00	0.730 ^{xx}	Significant
	N	626	626	
Students' learning outcome	Pearson (r) sig. (2-tailed)	0.730 ^{xx}	1.00	
	N	626	626	

^{xx} correlation is significant at the 0.05 level (2-tailed).

Result in Table 6 showed that the correlation between integration of computer and students' learning outcome in public secondary schools in Anambra State was 0.730 with a probability value of 0.024 and the value was less than 0.05 level of significance. Therefore, the null hypothesis of no significant relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State was rejected ($r, 626 = 0.730, p\text{-value} = 0.024$). Invariably, there is significant relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State.

Discussion of findings

The discussion of the findings was presented in line with the responses from the research questions and hypotheses. It was presented as follows:

Relationship Between Integration of Projector and Students' Learning Outcome in Public Secondary Schools in Anambra State.

It was shown from the result of the analysis that there is moderate positive relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State. The study also indicated that there is significant relationship between integration of projector and students' learning outcome in public secondary schools in Anambra State. This showed that integration of projector in teaching and learning is vital. A projector helps to enlarged image on a screen, allowing the view of a small document or picture to be shared with a large audience. They are used to display information so that all the students in the classroom can see the information clearly because the information is made bigger. In a situation where the class size is large, some students will be sitting in front of the class while some will be at the middle or at the back,

integrating a projector in teaching in such class will help to ensure that all the students get the information the teacher is passing to them which is displayed on the board. Projector transmits and enlarges the information for the benefit of the whole class no matter the size. If the whole students get all the information from the teacher through the use of projector, their learning outcome would be improved. Thus, the need for integrating projector in teaching

This finding supports that of Adizu et al. (2022) which showed that very strong and significant relationship between projector facility and the self-development of students. The former study was conducted in Rivers State and this present one in Anambra State but the findings revealed that there is significant relationship between integration of projector and students' learning outcome. Study carried out by Kendari (2021) which determined the improvement of student learning outcomes through the use of multimedia projectors revealed that using multimedia projector shows 100% improvement in students' learning outcome. This finding is also in agreement with the finding of Emeli et al. (2019) which showed that the integration of projector in teaching was more effective in bringing about more students' learning outcome. This indicated that integration of computer as a learning tool by teachers would enhance students' learning outcome in public secondary schools in Anambra State.

Relationship Between Integration of Interactive Whiteboard and Students' Learning Outcome in Public Secondary Schools in Anambra State.

This study showed that a low positive relationship exist between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State. Also, there is no significant relationship between integration of interactive whiteboard and students' learning outcome in public secondary schools in Anambra State. Interactive whiteboards are a type of board in the classroom that provides more function than the traditional chalkboard or ordinary white marker boards, which are usually white surfaced for making non-permanent writing. A teacher using interactive whiteboards in the classroom does not need chalk or marker pens unlike the traditional chalkboards or whiteboards. Interactive whiteboards were developed to serve as a modern alternative to traditional chalkboards or whiteboards. Since interactive whiteboards serve the same major purpose as the traditional chalkboard or ordinary white marker boards, teachers can use traditional chalkboard or ordinary white marker boards in the absence of interactive whiteboards during teaching and learning in the class. The finding depicts that the use of interactive whiteboard in teaching does not necessarily improve students' learning outcome in public secondary schools in Anambra State.

This finding does not support the finding of Muhammad et al. (2018), and Gabatshwane et al. (2020) which maintained that there is significant relationship between the integration of interactive whiteboard in teaching and students' learning outcome. The difference in the results could be because the two studies were conducted in different geographical areas. Muhammad et al. (2018) conducted a study among students in Haripur District, Pakistan, Gabatshwane et al. (2020) conducted a study among students in Botswana but this present study was conducted in Anambra State, Nigeria. Probably, the education system in these countries is not the same and this could also be the reason for the disparity in the findings.

Relationship Between Integration of Computer and Students' Learning Outcome in Public Secondary Schools in Anambra State.

Findings from the analysis of this study revealed that there is high positive relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State. The result also showed that there is significant relationship between integration of computer and students' learning outcome in public secondary schools in Anambra State. Passing information by teachers to students using text, images, music, and video, even accessing the internet, is easier through the use of computer. The integration of computers in teaching by teachers is vital and because it could be used to prepare lessons using tests, images and videos to make the lesson more concrete and understandable to students. Therefore, the integration of computer could aid students in fast assimilation of subject matter.

This finding supports the findings of Chuchan (2018), Sharif-Nia et al. (2024) which also revealed that there is significant relationship between the integration of computer and students' learning outcome. Their studies found that computer-based learning influence students' learning outcome. The agreement in the finding could be due to the fact that when students understand the lesson delivered by teachers clearly and fast because the integration of computer made it concrete and easy to remember, they would improve in their learning outcome.

Conclusion

Conclusion was drawn in line with the results of this study. It was concluded that there is a moderate positive and significant relationship between the integration of projectors and students' learning outcomes in public secondary schools in Anambra State. There is a low positive and non-significant relationship between the integration of interactive whiteboards and students' learning outcomes in public secondary schools in Anambra State. Furthermore, there is a high positive and significant relationship between the integration of computers and students' learning outcomes in public secondary schools in Anambra State.

Recommendations

The following recommendations were made in line with the findings and conclusion of this study;

1. Teachers should use projectors when delivering instruction to make sure that the texts, and images are visible to all the students.
2. Principals should encourage teachers to use computers in teaching and learning.
3. Government should provide technology tools such as projectors and computers and also organize regular training programmes for teachers on the use of modern digital tools in teaching

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