

MULTIPLE REGRESSION ANALYSIS OF PREDICTIVE POTENCY OF SCHOOL ADMINISTRATIVE EFFECTIVENESS, ICT-MEDIATED LIBRARY USE, GUIDANCE SERVICES, AND CURRICULUM EFFECTIVENESS ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN PHYSICS

Francis Elochukwu Ikeh¹, Helen Chibuogwu Enwezor², Theresa Ugonwa Okafor³, Jerome Chibuike Ubabuike², John Chinedu Nnaemeka², Ngozika Ijeoma Ekwe², Monday Samuel Ude⁴, Adizetu Aneru Ali⁵*

Department of Science Education, University of Nigeria, Nsukka¹

Department of Educational Foundations, Chukwuemeka Odumegwu Ojukwu University, Igbariam²

Department of Science Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam³

Department of Arts Education, University of Nigeria, Nsukka⁴

Nnamdi Azikiwe Library, University of Nigeria, Nsukka⁵

*Corresponding Author: Adizetu Aneru Ali

ABSTRACT

This study investigated the predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria. Six research questions and six null hypotheses guided the study. The study adopted a predictive correlational research design. The population comprised all Senior Secondary School Two (SS II) Physics students in public secondary schools in South-East Nigeria. A sample size of 415 SS II students offering Physics in South-East, Nigeria was used for the study using multi-stage sampling procedure involving simple random sampling technique and stratified proportionate sampling technique. Five instruments were used for data collection, they are; School Administrative Effectiveness Questionnaire (SAEQ), ICT-Mediated Library Use Questionnaire (ICT-MLUQ), Guidance Services Questionnaire (GSQ), Curriculum Effectiveness Questionnaire (CEQ) and Physics Achievement Test (PAT). The instruments were subjected to face validation by five experts, each from Measurement and Evaluation, Educational Management, Library and Information Science, ICT, Guidance and Counselling, Curriculum and Physics Education. The reliability of the instruments (SAEQ, ICT-MLUQ, GSQ, CEQ and PAT) was determined using Cronbach's Alpha method. A reliability coefficient of 0.84, .89, .82 and .88 were obtained for SAEQ, ICT-MLUQ, GSQ, and CEQ respectively, while the reliability coefficient of .91 was obtained for PAT using Kuder Richardson 20 (KR-20). Data were analyzed using simple and multiple regression analyses at a 0.05 level of significance. The findings revealed that school administrative effectiveness significantly predicted students' achievement in Physics ($R = .573$, $R^2 = .328$, $p < .05$), accounting for 32.8% of the variance in achievement. ICT-mediated library use significantly predicted students' achievement in Physics ($R = .612$, $R^2 = .375$, $p < .05$), explaining 37.5% of the variance. Guidance services significantly predicted students' achievement in Physics ($R = .535$, $R^2 = .286$, $p < .05$), accounting for 28.6% of the variance, while curriculum effectiveness significantly predicted students' achievement in Physics ($R = .658$, $R^2 = .433$, $p < .05$), explaining 43.3% of the variance. The four predictor variables jointly exhibited significant predictive potency on students' achievement in Physics ($R = .897$, $R^2 = .804$, Adjusted $R^2 = .803$, $p < .05$), accounting for 80.4% of the variance in achievement. The relative predictive potency of the variables, based on standardized beta coefficients, showed that curriculum effectiveness ($\beta = .378$) was the strongest predictor, followed by ICT-mediated library use ($\beta = .348$), school administrative effectiveness ($\beta = .341$), and guidance services ($\beta = .277$). The study concluded that school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness are significant predictors of secondary school students' achievement in Physics, with curriculum effectiveness exerting the greatest influence. It was recommended, among others, that educational stakeholders should prioritize effective curriculum implementation, strengthen ICT-mediated library services, improve school administrative practices, and enhance guidance services to improve students' achievement in Physics.

KEYWORDS: School Administrative Effectiveness, ICT-Mediated Library Use, Guidance Services, Curriculum Effectiveness, Achievement in Physics, Multiple Regression Analysis

INTRODUCTION

Physics is universally recognized as one of the most important science subjects because it provides the theoretical and practical foundations for technological innovation, engineering advancement, industrial development, and scientific

inquiry. The subject contributes significantly to the achievement of national development goals by equipping learners with scientific knowledge, critical thinking skills, problem-solving abilities, and technological competencies necessary for participation in the modern economy. In Nigeria, Physics occupies a strategic position in the secondary school curriculum as a prerequisite for admission into science-related programmes in higher institutions, including engineering, medicine, architecture, and technology-based disciplines (Adebayo, 2010; Gambari, Yusuf, & Thomas, 2015). Despite its importance, students' achievement in Physics in Nigerian secondary schools, which South-East is not exceptional has remained persistently low, particularly in public examinations, thereby generating concerns among educators, policymakers, parents, and other stakeholders in the educational sector (Adeoye, 2021; Akwa & Olah, 2024). The persistent low achievement recorded by students in Physics therefore necessitates the investigation of school-related factors that may predict and improve students' academic achievement in the subject.

Given the persistent poor achievement of students in Physics, attention has increasingly shifted towards identifying school-related factors that could influence academic performance in the subject. Factors such as school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness have been recognized as critical components of the educational process that may significantly contribute to students' achievement in Physics. Therefore, examining the predictive potency of these variables on students' achievement in Physics becomes imperative. Among the institutional variables associated with students' achievement is school administrative effectiveness. School administration encompasses the coordination of human and material resources to achieve educational objectives. Effective school administrators provide instructional leadership, supervise teaching activities, maintain discipline, motivate staff, facilitate resource allocation, and establish a conducive learning environment. According to educational management scholars, school leadership significantly influences teacher productivity, instructional quality, school climate, and ultimately students' academic outcomes.

Schools characterized by effective administrative practices tend to exhibit higher levels of teacher commitment and improved student performance than schools with weak administrative structures (Nnamdi & Busa, 2023; Olajumoke, Babalola, & Alegbeleye, 2021). Effective school administration is also crucial in facilitating the provision, maintenance, and utilization of ICT facilities within the school environment. Through strategic planning, resource allocation, and policy implementation, school administrators can promote the integration of ICT-mediated library services that provide students with access to digital learning resources, electronic databases, online educational materials, and other information technologies that support academic achievement. Consequently, the effectiveness of school administration may influence the extent to which ICT-mediated library resources are available and utilized for learning purposes.

The emergence of Information and Communication Technology (ICT) has further expanded the scope of administrative effectiveness in schools. ICT applications have transformed school administration by enhancing communication, record management, curriculum supervision, decision-making, student monitoring, and data storage systems. Studies conducted in Nigerian secondary schools revealed that ICT utilization contributes significantly to administrative effectiveness and improves the management of educational processes (Nnamdi & Busa, 2023; Olajumoke et al., 2021). Administrators who effectively utilize ICT are better positioned to coordinate instructional programmes, monitor academic activities, and promote quality educational outcomes.

Another important determinant of students' academic achievement is access to and utilization of library resources. Traditionally, school libraries have served as repositories of knowledge that support teaching, learning, and research activities. However, technological advancements have transformed conventional libraries into ICT-mediated learning centres that provide access to electronic books, online databases, digital journals, internet resources, virtual laboratories, and multimedia instructional materials. ICT-mediated library use enables students to access current scientific information, engage in independent learning, and strengthen their understanding of complex academic concepts (Ugwuanyi, 2022; Suleiman, Hanafi, & Tanslikhan, 2018).

The significance of ICT-mediated library use is particularly evident in Physics education where students are often required to understand abstract concepts, mathematical relationships, and scientific phenomena. Digital library resources provide simulations, animations, video demonstrations, and virtual experiments that facilitate conceptual understanding. Research has shown that exposure to electronic library resources significantly improves students' achievement in Physics and enhances learning outcomes in science-related subjects (Ugwuanyi, 2022). Furthermore, Adewale (2009) found that library availability, frequency of library use, adequacy of library facilities, and accessibility of recommended Physics textbooks significantly predicted students' achievement in Physics. Consequently, guidance services have emerged as another important school-related factor that may influence students' academic performance in Physics.

Guidance services constitute another crucial school effectiveness variable associated with academic achievement. Guidance and counselling programmes are designed to assist students in addressing academic, vocational, personal-social, and psychological challenges that may hinder educational progress. Through counselling interventions, students receive support in study habits, career planning, decision-making, emotional adjustment, and academic goal setting. Effective guidance services contribute to improved self-concept, motivation, educational aspirations, and

academic performance (Akwa & Olah, 2024; Suleiman, 2021). The relevance of guidance services to Physics achievement is particularly important because many students perceive Physics as difficult, abstract, and mathematically demanding. Such perceptions often result in anxiety, low motivation, poor self-efficacy, and reduced achievement. Guidance counsellors can help students overcome these barriers through academic counselling, motivational programmes, career awareness activities, and study-skills development. Akwa and Olah (2024) reported that students who utilized counselling services demonstrated greater interest and better performance in Physics than those who did not participate in such services. This finding underscores the potential contribution of guidance services to achievement in Physics education, which is without effective curriculum.

Curriculum effectiveness is equally fundamental to students' achievement. Curriculum effectiveness refers to the extent to which educational objectives are achieved through successful implementation of curriculum content, instructional strategies, learning activities, and assessment procedures. An effective curriculum provides learners with relevant experiences that facilitate knowledge acquisition, skill development, and competence formation. The Nigerian Senior Secondary School Physics Curriculum was designed to promote scientific literacy, technological competence, inquiry skills, and problem-solving abilities among learners (Adebayo, 2010). However, concerns have been raised regarding the effectiveness of curriculum implementation in many Nigerian secondary schools.

Several studies have identified challenges associated with Physics curriculum implementation, including inadequate instructional facilities, shortage of qualified teachers, insufficient laboratory equipment, poor funding, overcrowded classrooms, and limited opportunities for practical activities. These challenges often prevent teachers from fully implementing curriculum objectives, thereby contributing to poor student achievement (Adebayo, 2010; Adeoye, 2021). Research further indicates that effective instructional approaches embedded within curriculum implementation significantly influence students' achievement in Physics. Computer-assisted instructional strategies, cooperative learning approaches, activity-based teaching methods, and systematic assessment procedures have been found to improve students' understanding and performance in science subjects (Gambari et al., 2015; Adeoye, 2021).

The integration of ICT into teaching and learning has also strengthened curriculum effectiveness. ICT-supported instructional practices facilitate interactive learning, improve content delivery, enhance student engagement, and provide opportunities for individualized learning experiences. Studies have consistently demonstrated positive relationships between ICT utilization and students' academic achievement in science subjects, including Physics (Gambari et al., 2015; Ugwuanyi, 2022). The South-East geopolitical zone of Nigeria has historically demonstrated a strong commitment to educational development. Nevertheless, concerns regarding students' achievement in Physics persist across many secondary schools in the region. While previous studies have independently examined the influence of administrative effectiveness, library services, guidance services, and curriculum implementation on academic achievement, limited empirical evidence exists regarding their collective and relative predictive contributions to students' achievement in Physics, particularly within the South-East region of Nigeria (Adewale, 2009; Suleiman, 2021; Akwa & Olah, 2024).

Given the multidimensional nature of educational achievement, there is a need to investigate these variables simultaneously using multiple regression analysis. Multiple regression provides a robust statistical procedure for determining both the individual and combined predictive potency of several independent variables on a dependent variable. Understanding the relative contributions of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness will provide empirical evidence capable of informing educational policy, school management practices, curriculum reforms, and intervention programmes aimed at improving Physics achievement among secondary school students in South-East Nigeria. Therefore, this study seeks to determine the predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Purpose of the Study

The purpose of the study is to determine the multiple regression analysis of predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics. Specifically, the study sought to determine the;

1. predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria;
2. predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria;
3. predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria;
4. predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria;
5. joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria;

6. regression model of prediction of secondary school students' achievement in Physics based on school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness in South-East Nigeria.

Research Questions

The following research questions guided the study:

1. What is the predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria?
2. What is the predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria?
3. What is the predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria?
4. What is the predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria?
5. What is the joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria?
6. What is the regression model of prediction of secondary school students' achievement in Physics based on school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness in South-East Nigeria?

Hypotheses

The following hypotheses tested at .5 level of significant were formulated to guide the study;

1. There is no significant predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria.
2. There is no significant predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria.
3. There is no significant predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria.
4. There is no significant predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.
5. There is no significant joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

METHODS AND MATERIALS

This study adopted a correlational research design. Correlational design allows for the examination of relationships among naturally occurring variables and the prediction of outcomes based on observed data (Field, 2018; Tabachnick & Fidell, 2019). The design is appropriate because it seeks to determine the extent to which school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness predict secondary school students' achievement in Physics without manipulating any of the variables. The study was conducted in the South-East geopolitical zone of Nigeria, which comprises Abia, Anambra, Ebonyi, Enugu, and Imo States. The population of the study comprised all the Senior Secondary School Two (SS II) students offering Physics as a subject in public secondary schools in South-East Nigeria. The sample size of 415 SS II students offering Physics in South-East, Nigeria was used for the study. The sample was determined through multistage sampling procedure. Five instruments were used for data collection, they are; School Administrative Effectiveness Questionnaire (SAEQ), ICT-Mediated Library Use Questionnaire (ICT-MLUQ), Guidance Services Questionnaire (GSQ), Curriculum Effectiveness Questionnaire (CEQ) and Physics Achievement Test (PAT). The instruments were subjected to face validation by five experts, each from Measurement and Evaluation, Educational Management, Library and Information Science, ICT, Guidance and Counselling, Curriculum and Physics Education. The experts were asked to ensure that items adequately measured the constructs, and aligned with the objectives of the study. However, the content validity of the Physics Achievement Test was determined with the use of table of specifications. The reliability of the instruments (SAEQ, ICT-MLUQ, GSQ, CEQ and PAT) was determined using Cronbach's Alpha coefficient after a pilot test conducted using SS 2 Physics students in Imo State who were not sampled for the study. A reliability coefficient of 0.84, .89, .82 and .88 were obtained for SAEQ, ICT-MLUQ, GSQ, and CEQ respectively. Meanwhile, the reliability coefficient of .91 was obtained for PAT using Kuder Richardson 20 (KR-20). The researchers administered the questionnaire (SAEQ, ICT-MLUQ, GSQ, and CEQ) directly to respondents with the assistance of their classroom teachers who served as research assistants. Physics Achievement test was administered to the students in the sample schools in the second day with

the help of research assistants. Data collected were analyzed using regression analysis. Specifically, research questions 1–4 were answered using linear regression analysis, while research question 5 (joint prediction) was analyzed using multiple regression analysis. However, research question 6 (relative prediction/regression model) was analyzed using standardized regression coefficients (β weights). For all hypotheses, a 0.05 level of significance was adopted. The null hypothesis was rejected when the calculated p-value was less than 0.05; otherwise, it was not rejected.

RESULTS

Research Question One

What is the predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria?

Table 1: Linear regression analysis of the predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.573 ^a	.328	.326	2.83536

(R²) = Coefficient of Determination

Result in Table 1 presents the results of a linear regression analysis on the predictive power of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria. The result shows a correlation coefficient of 0.573, which indicates a moderate positive relationship between school administrative effectiveness and students' achievement in Physics. This implies that improvement in school administrative effectiveness is associated with an improvement in students' achievement in Physics. The coefficient of determination (R² = 0.328) shows that school administrative effectiveness accounts for 32.8% of the variation in students' achievement in Physics. This means that about one-third of the differences observed in students' Physics achievement can be explained by the effectiveness of school administration, while the remaining 67.2% is explained by other factors not included in the model. The adjusted R² value of 0.326 indicates that after adjusting for sample size and possible error, school administrative effectiveness still explains 32.6% of the variation in students' achievement in Physics. The closeness of the R² and adjusted R² values suggests that the model is stable and not over fitted. The standard error of the estimate (2.83536) indicates the average deviation of observed scores from the regression line. This suggests a reasonable level of accuracy in predicting students' achievement in Physics using school administrative effectiveness.

Hypothesis One

There is no significant predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Table 2: Regression t-test analysis of significant predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	25.156	1.059		23.759	.000
	Openness	.356	.025	.573	14.200	.000

The result in Table 2 shows that t-value of 14.200 with associated exact probability value of .000 was obtained. This probability value of 0.000 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant since the obtained probability value of 0.000 is less than 0.05. Thus, the null hypothesis of no significant predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria was rejected. The researchers therefore, conclude that there is a significant predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Research Question Two

What is the predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria?

Table 3: Linear regression analysis of the predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.612 ^a	.375	.373	2.73537

(R²) = Coefficient of Determination

Result in Table 3 presents the results of a linear regression analysis on the predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria. The correlation coefficient ($R = 0.612$) indicates a moderate to strong positive relationship between ICT-mediated library use and students' achievement in Physics. This suggests that increased use of ICT-based library resources is associated with improved students' performance in Physics. The coefficient of determination ($R^2 = 0.375$) shows that ICT-mediated library use explains 37.5% of the variation in students' achievement in Physics. This implies that more than one-third of the differences in students' Physics achievement can be attributed to their level of access to and use of ICT-mediated library resources, while the remaining 62.5% is due to other factors not included in the model. The adjusted R^2 value of 0.373 indicates that after adjusting for sample size and estimation error, ICT-mediated library use still accounts for 37.3% of the variation in students' achievement in Physics. The closeness of the R^2 and adjusted R^2 values suggests that the model is reliable and stable. The standard error of the estimate (2.73537) shows the average deviation of observed values from the regression line, indicating a relatively good level of accuracy in predicting students' achievement in Physics using ICT-mediated library use.

Hypothesis Two

There is no significant predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria.

Table 4: Regression t-test analysis of significant predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.279	1.138		19.570	.000
	Openness	.441	.028	.612	15.729	.000

The result in Table 4 shows that t-value of 15.729 with associated exact probability value of .000 was obtained. This probability value of 0.000 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant since the obtained probability value of 0.000 is less than 0.05. Thus, the null hypothesis of no significant predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria was rejected. The researchers therefore, conclude that there is a significant predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria.

Research Question Three

What is the predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria?

Table 5: Linear regression analysis of the predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.535 ^a	.286	.284	2.92286

(R^2) = Coefficient of Determination

Result in Table 5 presents the results of a linear regression analysis on the predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria. The correlation coefficient ($R = 0.535$) indicates a moderate positive relationship between guidance services and students' achievement in Physics. This suggests that improvements in guidance services are associated with better academic performance in Physics among secondary school students. The coefficient of determination ($R^2 = 0.286$) shows that guidance services account for 28.6% of the variation in students' achievement in Physics. This implies that approximately one-third of the differences in students' Physics achievement can be explained by the availability and effectiveness of guidance services, while the remaining 71.4% is due to other factors not captured in the model. The adjusted R^2 value of 0.284 indicates that after adjusting for sample size and model complexity, guidance services still explain 28.4% of the variation in students' achievement in Physics. The closeness between R^2 and adjusted R^2 suggests that the model is stable and provides a reliable estimate of the predictive relationship. The standard error of the estimate (2.92286) represents the average distance between observed and predicted values of students' achievement in Physics. This indicates a moderate level of accuracy in the regression model.

Hypothesis Three

There is no significant predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria.

Table 6: Regression t-test analysis of significant predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.267	1.159		21.795	.000
	Openness	.378	.029	.535	12.861	.000

The result in Table 6 shows that t-value of 12.861 with associated exact probability value of .000 was obtained. This probability value of 0.000 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant since the obtained probability value of 0.000 is less than 0.05. Thus, the null hypothesis of no significant predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria was rejected. The researchers therefore, conclude that there is a significant predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria.

Research Question Four

What is the predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria?

Table 7: Linear regression analysis of the predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.658 ^a	.433	.432	2.60396

(R²) = Coefficient of Determination

Result in Table 7 presents the results of a linear regression analysis on the predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria. The correlation coefficient (R = 0.658) indicates a strong positive relationship between curriculum effectiveness and students' achievement in Physics. This implies that improvements in curriculum effectiveness are associated with higher levels of students' achievement in Physics. The coefficient of determination (R² = 0.433) shows that curriculum effectiveness accounts for 43.3% of the variation in students' achievement in Physics. This means that nearly half of the differences observed in students' Physics achievement can be explained by the effectiveness of curriculum implementation, while the remaining 56.7% is due to other factors not captured in the model. The adjusted R² value of 0.432 indicates that after adjusting for sample size and estimation bias, curriculum effectiveness still explains 43.2% of the variation in students' achievement in Physics. The very small difference between R² and adjusted R² suggests that the model is stable, reliable, and not over-fitted. The standard error of the estimate (2.60396) indicates the average deviation of observed scores from the predicted regression line. This relatively low value suggests a good level of precision in predicting students' achievement in Physics using curriculum effectiveness.

Hypothesis Four

There is no significant predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Table 8: Regression t-test analysis of significant predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.652	.988		22.925	.000
	Openness	.456	.026	.658	17.769	.000

The result in Table 6 shows that t-value of 17.769 with associated exact probability value of .000 was obtained. This probability value of 0.000 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant since the obtained probability value of 0.000 is less than 0.05. Thus, the null hypothesis of no significant predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria was rejected. The researchers therefore, conclude that there is a significant predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Research Question Five

What is the joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria?

Table 9: Multiple regression analysis of the joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.897 ^a	.804	.803	1.53521

(R²) = Coefficient of Determination

Result in Table 9 presents the results of a multiple regression analysis on the joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria. The multiple correlation coefficient ($R = 0.897$) indicates a very strong positive relationship between the combined predictor variables and students' achievement in Physics. This implies that school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness jointly have a strong association with students' achievement in Physics. The coefficient of determination ($R^2 = 0.804$) shows that the four predictor variables jointly explain 80.4% of the variation in students' achievement in Physics. This means that a very large proportion of the differences observed in students' Physics achievement is accounted for by the combined influence of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness, while the remaining 19.6% is explained by other factors not included in the model. The adjusted R^2 value of 0.803 indicates that after adjusting for sample size and potential estimation error, the model still explains 80.3% of the variation in students' achievement in Physics. The closeness between R^2 and adjusted R^2 suggests that the model is highly stable and reliable. The standard error of the estimate (1.53521) indicates the average deviation between the observed and predicted values of students' achievement in Physics. The relatively low value suggests a high level of accuracy in the regression model.

Hypothesis Five

There is no significant joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Table 10: Regression ANOVA of significant joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3974.953	4	993.738	421.635	.000 ^b
	Residual	966.317	410	2.357		
	Total	4941.270	414			

The result in Table 10 shows that F-ratio of 421.635 with associated exact probability value of .000 was obtained. This probability value of 0.00 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant since the obtained probability value of 0.000 is less than 0.05. Thus, the null hypothesis no significant joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria was rejected. The researchers therefore, conclude that there is a significant joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria.

Research Question Six

What is the regression model of prediction of secondary school students' achievement in Physics based on school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness in South-East Nigeria?

Table 11: Multiple regression analysis showing the regression model of prediction of secondary school students' achievement in Physics based on school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness in South-East Nigeria

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.454	.903		3.823	.000
	School_Administrative_Effectiveness	.212	.015	.341	14.050	.000
	ICT_Mediated_Library_Use	.251	.018	.348	13.979	.000
	Guidance_Services	.196	.018	.277	11.155	.000
	Curriculum_Effectiveness	.262	.017	.378	15.268	.000

The result in Table 11 presents the results of the multiple regression analysis showing the regression model for predicting secondary school students' achievement in Physics based on school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness in South-East Nigeria. The regression model derived from the unstandardized coefficients (B) is expressed as: $Y = 3.454 + 0.212X_1 + 0.251X_2 + 0.196X_3 + 0.262X_4$. Where:

Y = Students' achievement in Physics

X_1 = School administrative effectiveness

X_2 = ICT-mediated library use

X_3 = Guidance services

X_4 = Curriculum effectiveness

The constant value of 3.454 indicates the predicted level of students' achievement in Physics when all the predictor variables are held constant at zero. The regression coefficient for school administrative effectiveness ($B = 0.212$, $t = 14.050$, $p < .05$) indicates that for every one-unit increase in school administrative effectiveness, students' achievement in Physics is expected to increase by 0.212 units, holding all other variables constant. This result shows that school administrative effectiveness is a positive and significant predictor of students' achievement in Physics. The regression coefficient for ICT-mediated library use ($B = 0.251$, $t = 13.979$, $p < .05$) indicates that a one-unit increase in ICT-mediated library use would result in a corresponding increase of 0.251 units in students' achievement in Physics, all other variables being held constant. This implies that ICT-mediated library use is a positive and significant predictor of achievement in Physics.

The regression coefficient for guidance services ($B = 0.196$, $t = 11.155$, $p < .05$) shows that a one-unit increase in guidance services would lead to an increase of 0.196 units in students' achievement in Physics, when other variables are controlled. This indicates that guidance services significantly contribute to the prediction of students' achievement in Physics. Similarly, curriculum effectiveness recorded a regression coefficient of 0.262 ($t = 15.268$, $p < .05$), indicating that a one-unit increase in curriculum effectiveness would result in a 0.262-unit increase in students' achievement in Physics, holding other variables constant. This demonstrates that curriculum effectiveness is a positive and significant predictor of students' achievement in Physics. The significance values ($p = .000$) for all predictor variables are less than the 0.05 level of significance, indicating that each variable makes a statistically significant contribution to the prediction of students' achievement in Physics.

DISCUSSION OF FINDINGS

Predictive potency of school administrative effectiveness on secondary school students' achievement in Physics in South-East Nigeria

The finding of the study revealed that school administrative effectiveness accounted for 32.8% of the variation in secondary school students' achievement in Physics in South-East Nigeria. This implies that school administrative effectiveness is an important determinant of students' academic achievement in Physics, as it contributed substantially to explaining differences in students' performance. The hypothesis tested further revealed that the null hypothesis of no significant predictive potency of school administrative effectiveness on students' achievement in Physics was rejected. Consequently, it was concluded that school administrative effectiveness significantly predicts students' achievement in Physics in South-East Nigeria. The significant predictive influence of school administrative effectiveness on students' achievement in Physics may be attributed to the crucial role school administrators play in creating an enabling environment for teaching and learning. Effective school administrators ensure adequate supervision of instructional activities, proper allocation and utilization of educational resources, maintenance of discipline, provision of instructional materials, motivation of teachers, and effective implementation of educational policies. These administrative practices contribute to improved teaching effectiveness and enhanced student learning outcomes, particularly in Physics, which requires adequate instructional support and practical learning experiences (Leithwood et al., 2020).

The finding is consistent with systems theory, which posits that the effectiveness of one component of the school system influences the performance of other components. School administrators coordinate human and material resources, facilitate instructional delivery, and create conditions that support students' learning and academic success (Hoy & Miskel, 2013). Effective administration promotes teacher commitment, instructional quality, and a conducive learning environment, all of which contribute to improved student achievement. The finding agrees with Hallinger and Heck (1998), who found that school leadership significantly influences students' academic outcomes through its effects on school conditions, teacher effectiveness, and instructional processes. Similarly, Leithwood, Harris, and Hopkins (2020) reported that effective school leadership contributes substantially to students' learning by enhancing school climate, instructional practices, and teacher performance. The result also supports the findings of Adeyemi (2010), who observed that effective school administration positively affects students' academic performance through efficient management of school resources and instructional programmes. Furthermore, the finding corroborates the work of Robinson, Lloyd, and Rowe (2008), who reported that school leadership practices related to instructional

supervision and teacher support have significant effects on students' academic achievement. In Physics education, effective school administration may facilitate the provision of laboratory facilities, instructional materials, qualified teachers, and supportive learning environments that enhance students' understanding and performance in the subject.

Predictive potency of ICT-mediated library use on secondary school students' achievement in Physics in South-East Nigeria

The finding of the study revealed that ICT-mediated library use explained 37.5% of the variation in secondary school students' achievement in Physics in South-East Nigeria. This indicates that ICT-mediated library use is a substantial predictor of students' academic achievement in Physics. The hypothesis tested further revealed that the null hypothesis stating that there is no significant predictive potency of ICT-mediated library use on secondary school students' achievement in Physics was rejected. Consequently, it was concluded that ICT-mediated library use has a significant predictive potency on secondary school students' achievement in Physics in South-East Nigeria. The significant predictive influence of ICT-mediated library use on students' achievement in Physics may be attributed to the fact that ICT-based library resources provide students with access to a wide range of current and relevant learning materials, including electronic books, online journals, educational databases, simulations, virtual laboratories, and multimedia instructional resources. These resources enhance students' understanding of Physics concepts by providing opportunities for independent learning, information retrieval, collaborative learning, and exposure to diverse instructional materials. The use of ICT-mediated library resources also promotes inquiry-based learning, critical thinking, and problem-solving skills, which are essential for success in Physics (Aina, 2014).

The finding aligns with the constructivist learning theory, which emphasizes that learners actively construct knowledge through interaction with learning resources and environments. ICT-mediated library services provide students with opportunities to explore information, engage with digital content, and develop deeper conceptual understanding of scientific phenomena. Through access to digital learning materials, students can supplement classroom instruction and strengthen their understanding of complex Physics concepts (Jonassen, 1999). The finding is consistent with the study of Aina (2014), who reported that the use of ICT facilities in libraries significantly enhances students' academic performance by improving access to information resources and supporting independent learning. Similarly, Babalola and Haliso (2011) found that students who effectively utilize electronic information resources tend to demonstrate better academic performance than those who rely solely on traditional learning materials. The result also supports the findings of Issa, Amusan, and Daura (2009), who observed that library use contributes positively to students' academic achievement through improved access to educational resources and information services.

Furthermore, the finding corroborates the work of Tella, Tella, Ayeni, and Omoba (2007), who found that access to electronic information resources and effective utilization of library facilities significantly influence students' academic achievement. In the context of Physics education, ICT-mediated library use may enable students to access interactive simulations, virtual experiments, online tutorials, and current scientific information, thereby improving their understanding of abstract concepts and enhancing academic performance. The finding is also supported by studies on technology integration in education, which suggest that ICT tools facilitate active learning, improve students' engagement, and increase academic achievement. Students who regularly utilize ICT-mediated library resources are more likely to develop information literacy skills, engage in self-directed learning, and access up-to-date scientific information that supports classroom teaching and learning process (Kuhlthau et al., 2015).

Predictive potency of guidance services on secondary school students' achievement in Physics in South-East Nigeria

The finding of the study revealed that guidance services accounted for 28.6% of the variation in secondary school students' achievement in Physics in South-East Nigeria. This indicates that guidance services constitute an important predictor of students' academic achievement in Physics. The result further revealed a significant predictive potency of guidance services on secondary school students' achievement in Physics, suggesting that effective guidance services contribute meaningfully to improving students' performance in the subject. The significant predictive influence of guidance services on students' achievement in Physics may be attributed to the role of guidance and counselling programmes in assisting students to develop positive study habits, academic motivation, self-confidence, career awareness, and effective decision-making skills. Guidance services help students identify and overcome personal, social, emotional, and academic challenges that may hinder their learning. Through academic counselling, students receive support in setting educational goals, managing their study time effectively, and adopting appropriate learning strategies that enhance their achievement in Physics (Gysbers & Henderson, 2012).

The finding is consistent with the principles of student development theory, which posit that students' academic success is influenced not only by cognitive abilities but also by psychosocial and environmental factors. Guidance services provide students with the support needed to address challenges that may affect their academic engagement and performance. By fostering positive attitudes toward learning and helping students cope with academic pressures, guidance programmes contribute to improved educational outcomes (Santrock, 2018). The finding agrees with the study of Lapan, Gysbers, and Petroski (2001), who found that students in schools with comprehensive guidance and

counselling programmes demonstrated higher academic achievement and more positive educational outcomes than their counterparts in schools with limited counselling services. Similarly, Carey and Dimmitt (2012) reported that effective school counselling programmes significantly contribute to students' academic success by promoting educational planning, academic engagement, and personal development.

The result also supports the findings of Nwachukwu (2008), who observed that guidance services enhance students' academic performance by helping them overcome educational and personal difficulties that may impede learning. Likewise, Oye, Obi, Mohd, and Bernice (2012) reported that counselling services positively influence students' academic achievement by improving study habits, motivation, and academic adjustment. Furthermore, the finding corroborates the work of Whiston, Tai, Rahardja, and Eder (2011), whose meta-analysis revealed that school counselling interventions have positive effects on students' academic outcomes, including achievement, school engagement, and educational attainment. In the context of Physics education, guidance services may help students overcome anxiety associated with science subjects, improve their attitudes toward Physics, and develop effective strategies for mastering difficult concepts and solving scientific problems.

Predictive potency of curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria

The finding of the study revealed that curriculum effectiveness accounted for 43.3% of the variation in secondary school students' achievement in Physics in South-East Nigeria. This indicates that curriculum effectiveness is a major predictor of students' academic achievement in Physics, explaining a substantial proportion of the differences observed in students' performance. The result further revealed a significant predictive potency of curriculum effectiveness on secondary school students' achievement in Physics, implying that effective curriculum implementation contributes significantly to students' success in the subject. The significant predictive influence of curriculum effectiveness on students' achievement in Physics may be attributed to the fact that an effective curriculum provides clearly defined learning objectives, relevant content, appropriate instructional strategies, and suitable assessment procedures that facilitate meaningful learning. When the Physics curriculum is properly designed and effectively implemented, students are more likely to acquire the knowledge, skills, and scientific competencies required for academic success. Effective curriculum implementation also ensures that learning experiences are organized in a manner that promotes students' understanding of scientific concepts and their application to real-life situations (Ornstein & Hunkins, 2018).

The finding is consistent with curriculum theory, which emphasizes that the quality of curriculum content and its implementation are critical determinants of educational outcomes. A well-implemented curriculum provides direction for teaching and learning activities, promotes consistency in instructional delivery, and ensures that educational objectives are achieved. In Physics education, curriculum effectiveness may be reflected in the adequacy of content coverage, practical activities, learner-centered instructional approaches, and alignment between instructional objectives and assessment practices (Tyler, 1949). The finding agrees with the study of Tyler (1949), who emphasized that effective curriculum planning and implementation are essential for achieving desired educational outcomes. Similarly, Ornstein and Hunkins (2018) asserted that curriculum effectiveness enhances students' learning by ensuring that instructional activities, learning resources, and evaluation procedures are aligned with educational goals. The result also supports the findings of Offorma (2016), who reported that effective curriculum implementation positively influences students' academic achievement by providing relevant learning experiences and promoting the attainment of educational objectives.

Furthermore, the finding corroborates the work of Ivowi (2009), who observed that curriculum effectiveness is a major determinant of educational quality and students' academic performance. According to the author, the extent to which curriculum objectives are achieved depends largely on the effectiveness of curriculum implementation, instructional resources, and teacher competence. In the context of Physics education, effective curriculum implementation ensures that students are exposed to practical activities, laboratory experiences, and problem-solving tasks that enhance conceptual understanding and academic achievement. The finding is also in agreement with studies on science education, which have shown that curriculum effectiveness significantly influences students' learning outcomes. When Physics curricula are effectively implemented through appropriate teaching methods, adequate instructional materials, and continuous assessment practices, students develop better understanding of scientific concepts and demonstrate improved academic performance (Akinsola & Igwe, 2002).

Joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on secondary school students' achievement in Physics in South-East Nigeria

The finding of the study revealed that school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness jointly explained 80.4% of the variation in secondary school students' achievement in Physics in South-East Nigeria. This indicates that the four predictor variables collectively exert a very strong influence on students' academic achievement in Physics. The result further revealed a significant joint predictive potency of school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness on students' achievement in Physics. This implies that the combined effect of these school-

related factors significantly predicts students' achievement in Physics and plays a crucial role in determining learning outcomes. The finding suggests that students' achievement in Physics is not influenced by a single factor but rather by the interaction of multiple educational variables operating within the school system. Effective school administration provides leadership, coordination, supervision, and resource management that create a conducive environment for teaching and learning. ICT-mediated library use enhances students' access to current information resources and digital learning materials. Guidance services support students' academic, personal, and career development, while curriculum effectiveness ensures that instructional objectives, content, learning experiences, and assessment procedures are properly aligned to facilitate learning. When these factors function effectively together, they create a supportive educational environment that enhances students' achievement in Physics.

The finding is consistent with systems theory, which views the school as an interconnected system in which various components work together to achieve educational goals. According to the theory, the effectiveness of the educational system depends on the interaction and coordination of its constituent parts. School administration, instructional resources, counselling services, and curriculum implementation are interdependent components that collectively influence students' academic outcomes (Hoy & Miskel, 2013). Therefore, improvements in these areas are likely to produce corresponding improvements in students' achievement. The finding agrees with the work of Hallinger and Heck (1998), who reported that school effectiveness is influenced by multiple organizational and instructional factors that operate collectively to improve students' academic performance. Similarly, Leithwood, Harris, and Hopkins (2020) emphasized that educational outcomes are enhanced when leadership, instructional practices, learning resources, and student support services work together to create favourable learning conditions.

The finding is also supported by the work of Marzano (2003), who identified school leadership, curriculum, instructional resources, and school climate as important determinants of students' academic success. Likewise, Creemers and Kyriakides (2008) argued that students' achievement is influenced by multiple school-level factors, including effective leadership, quality instruction, supportive learning environments, and adequate educational resources. Their dynamic model of educational effectiveness emphasizes that academic achievement is best explained by the combined influence of several interacting factors rather than isolated variables. Furthermore, the finding corroborates studies on science education that emphasize the importance of a holistic approach to improving students' achievement. Effective administration ensures the availability of qualified teachers and instructional materials; ICT-mediated library services provide access to digital learning resources; guidance services help students develop positive attitudes and study habits; and effective curriculum implementation ensures meaningful learning experiences. Together, these factors strengthen students' engagement, understanding, and performance in Physics (Ornstein & Hunkins, 2018).

CONCLUSION

Based on the regression model ($Y = 3.454 + 0.212X_1 + 0.251X_2 + 0.196X_3 + 0.262X_4$), it can be concluded that school administrative effectiveness, ICT-mediated library use, guidance services, and curriculum effectiveness are positive predictors of secondary school students' achievement in Physics in South-East Nigeria. The positive regression coefficients indicate that improvements in any of these variables are associated with corresponding increases in students' achievement in Physics. The model further demonstrates that curriculum effectiveness contributes the highest predictive influence on students' achievement in Physics, followed by ICT-mediated library use, school administrative effectiveness, and guidance services. Therefore, the achievement of students in Physics can be effectively predicted from the combined influence of these four school-related factors. The finding underscores the importance of adopting a comprehensive approach to educational improvement by strengthening curriculum implementation, enhancing ICT-mediated library services, improving school administrative effectiveness, and providing effective guidance services to promote higher achievement in Physics among secondary school students in South-East Nigeria.

RECOMMENDATIONS

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

1. School administrators should strengthen administrative effectiveness by ensuring proper supervision of instructional activities, effective management of school resources, provision of adequate learning facilities, and continuous monitoring of teachers' performance. This will create a conducive learning environment that promotes students' achievement in Physics.
2. Government and educational stakeholders should improve ICT-mediated library services in secondary schools by providing functional digital libraries, internet facilities, computers, electronic databases, and other ICT resources. This will enhance students' access to relevant learning materials and improve their academic achievement in Physics.
3. School authorities should strengthen guidance and counselling services through the employment of qualified guidance counsellors and the provision of adequate counselling facilities. Counsellors should regularly organize

programmes that help students develop positive study habits, academic motivation, career awareness, and effective learning strategies for Physics.

4. Curriculum planners and educational authorities should ensure effective implementation of the Physics curriculum by providing adequate instructional materials, laboratory facilities, and continuous professional development programmes for Physics teachers. This will enhance curriculum delivery and improve students' achievement in the subject.

5. Teachers should integrate ICT resources and library materials into Physics instruction to encourage independent learning, inquiry, critical thinking, and problem-solving skills among students. Such practices will improve students' understanding of Physics concepts and academic performance.

6. School principals should promote collaboration among teachers, librarians, and guidance counsellors to provide holistic academic support for students. Such collaboration will ensure that students benefit from effective administration, access to learning resources, academic guidance, and quality curriculum implementation.

7. State Ministries of Education and educational agencies should organize regular capacity-building programmes for school administrators, librarians, guidance counsellors, and teachers to improve their competencies in supporting students' achievement in Physics.

8. Parents and community stakeholders should support schools in providing educational resources and conducive learning environments that complement school efforts in enhancing students' achievement in Physics.

9. Educational policymakers should adopt an integrated school improvement strategy that simultaneously addresses administrative effectiveness, ICT-mediated library services, guidance services, and curriculum effectiveness, since these variables jointly account for a substantial proportion of the variation in students' achievement in Physics.

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