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The Impact of Junior Secondary Basic Science on Senior Secondary Physics Outcome in Rivers State, Nigeria

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Abstract

The study investigated the impact of Basic Education Certificate Education (BECE), considering Basic Science as a predictor of Senior Secondary Certificate Examination (SSCE) Physics performance in public secondary schools in Port Harcourt metropolis. The study employed both ex-post facto and correlational design. A sample of 593 students was employed for the study and purposive sampling technique was utilized to select the sample. The study was anchored on the Motivational Systems Theory of Academic Achievement. Three research questions and three corresponding hypotheses were tested at 0.05 level of significance. Data used for the study was collected directly from the examining bodies. The data obtained was analyzed using simple linear regression statistics. The findings of the study showed BECE Basic Science performance does not significantly predict SSCE Physics performance ($R^2 = .001$; $\beta = 0.028$, $P > 0.05$), accounting for only 0.1% of the variance in students' Physics scores. Gender-based analysis indicated that female students' BECE Basic Science performance had no significant predictive effect on SSCE Physics ($R^2 = .004$; $\beta = -0.064$, $P > 0.05$), explaining only 0.4% of the variance, while male students' BECE Basic Science scores also showed no significant prediction ($R^2 = .005$; $\beta = 0.069$, $P > 0.05$), explaining 0.5% of the variance. Based on these findings, it was recommended that the Nigerian Educational Research and Development Council (NERDC) review the junior secondary Basic Science curriculum to incorporate more Physics-related content, ensuring early exposure to fundamental Physics concepts.

Keywords: Science, basic science, physics, BECE, SSCE

The Impact of Junior Secondary Basic Science on Senior Secondary Physics Outcome in Rivers State, Nigeria

Education in the 21st century has evolved to the use of Science and Technology in the process of instructing and training students, as well as a tool for development and making life more comfortable. It's no wonder, the National Policy on Education states "that education in secondary schools should prepare students to live effectively in the new era of' "science and technology" (Federal Republic of Nigeria-FRN, 2013). Indeed, the importance of science to national economic goals exert a great influence to the huge commitment and support which most developing countries are now giving to education in science and technology fields (Longjohn & Njigwum, 2022). Therefore, the emphasis of the study is on students' academic achievement in science education which prepares the individual to live effectively in a technology driven world. This study is apt to understand the impact of Basic Science at the basic education level on Senior Secondary Physics performance.

A holistic meaning of science views it as a body of knowledge, a method of inquiry or investigation, and a way of thinking (Scientific attitudes) in the pursuit of nature (Joshi, 2008 in Njigwum & Longjohn, 2019). This three-fold nature of science is what qualifies one to be science literate and to fit-in into the new era of science and technology. Science is not a solitary discipline, it studies about everything around us, no wonder it is linked with every human endeavour that can be studied either as a body of knowledge or as an approach to solving problems (Scientific method). While science is studied as separate disciplines (Physics Chemistry and Biology) in the senior secondary level, it is studied as a unified discipline which draws content from the different but related science subjects, thus, called "Basic Science" (formerly Integrated Science) in the junior secondary level.

Gbamanja (1992) in Njigwum and Longjohn (2019) describes Basic science as a programme that provides students with experiences that help them to develop an operational understanding of the structure of science that would enrich their lives and make them more responsive citizens in society. The Basic Science curriculum is a multi-disciplinary program that

covers a wide range of scientific disciplines, including Biology, Chemistry, Physics, Geography, Agricultural Science, and Information Communication Technology. Biology, Chemistry, and Physics make up the vast majority of the topics covered. The National Policy on Education stated that Biology has the most topics (39%), followed by Physics (27%) and Chemistry (9% while other disciplines including Agricultural Science, Geography, Health Science, and Technology, account for the rest (25%) (FRN, 2009 in Durojaiye et al. 2017). This distribution emphasizes the importance of key sciences in the Basic Science curriculum, particularly Biology and Physics. Additionally, Bajah in Gbamanja (1992) stated that about a fourth (24%) of the content in junior level Basic Science is Physics.

Physics on the other hand, is usually studied separately in senior secondary schools, it is one of the three disciplines that are incorporated into Basic Science. Anyakoha (2016) defined Physics as a natural science that involves the study of matter and energy and their interactions. The study of the fundamental components of the world, the forces they exert on one another, and the effects of these forces is the focus of physics as a distinct science (Omiwale, 2011 in Emmanuel et al., 2024). Brown and Weidner (2024) asserted that the goal of Physics is to discover a single set of principles governing matter, motion, and energy at small (microscopic) subatomic distances, at the human (macroscopic) scale of everyday life, and out to the greatest distances (e.g., outside the earth's space). Physics is one of the most fundamental scientific disciplines, and its main goal is to understand how the universe behaves. Ibeh et al. in Emmanuel et al. (2024, p.104) had referred to Physics as “a fulcrum subject among the science that requires special attention”. They further opined that technological inventions and scientific breakthrough rest heavily on the application of physics principles. For example, advances in the understanding of electromagnetism, solid-state physics, and nuclear physics led directly to the development of new products that have dramatically transformed modern-day society, such as television, computers, domestic appliances, and nuclear weapons; advances in thermodynamics led to the development of industrialization; and advances in mechanics inspired the development of calculus.

Physics as a discipline has numerous obstacles, including teachers' training, students'

misconceptions, insufficient physical resources, and poor instructional approaches (Awodun, 2021). Similarly, studies suggest that traditional lecture-based education is poor at addressing students' misconceptions and does not actively involve learners in skill development (Tarekgn, 2017 in Awodun, 2021). Many students fail to comprehend Physics concepts that contradict their existing knowledge, making it challenging for them to understand new ideas (Refik & Bahattin, 2018). Furthermore, poor students' interest and enrollment in Physics remain a continuous concern, with teachers unable to capture and maintain engagement in the subject (Awodun, 2021). According to studies, pupils from various cultural and social backgrounds have variable levels of conceptual understanding, which complicates training (Mac Dermott, 2017 in Awodun, 2021). These difficulties are reflected in the performance of students assessed using achievement test, which could be internal or external examinations. Although, the study will consider the use of external examinations for gauging science achievement.

For assessment of science education in secondary schools in Nigeria, two forms of test are taken: The Senior School Certificate Examination (SSCE) where science is offered as individual subjects (Physics, Chemistry and Biology) while, the other is the Basic Education Certificate Examination (BECE) where science is offered as Basic Science. Basic Science of Basic Education Certificate Examination (BECE) is an external examination (in Nigeria) written by students who have completed their ninth year of basic education (i.e. JSS III or Basic 9) in the field of Integrated Science (now Basic science). The BECE is used for selection or enrolment of students into Senior School (SSI) in Nigeria. While, Senior School Certificate Examination (SSCE) in Physics is also an external examination written by students who have completed their senior secondary school education (SS3) in the field of Physics.

The BECE Basic Science and SSCE Physics are achievement tests. An achievement test is any test given to determine how much the pupils have learned (Njigwum, 2019). Similarly, a candidate's performance in achievement test is an index of his mastery of the taught subject area. It is important to mention that a test has many functions, which includes prediction of future performance. Orluwene (2012) opined that results of tests are used to forecast how well an

individual will perform in future task. This feature of a test is called "predictive validity." This type of validity is described as the ability of a measuring instrument to estimate or tell some future events like academic achievement, specific aptitudes etc. (Njigwum, 2019 in Asuru et al. 2024). The validity of a test has implication on the tests, testees and the entire programme (Njigwum & Oye, 2020). In this study, the prior science skill or achievement (BECE Basic Science) was employed to predict future science outcome (SSCE Physics). Furthermore, the study is anchored on the Motivational Systems Theory of Academic Achievement.

The study is underpinned on the Motivational Systems Theory of Academic Achievement (MST) proposed by Martin Ford (1992). The MST explains academic success as a function of four key components: motivation, skill, biological structure, and a responsive environment. Among these, the skill component, which includes prior academic knowledge, cognitive abilities, and study habits, is particularly relevant in predicting future performance. Studies have shown that past academic achievements significantly influence future success (Njigwum & Longjohn, 2019; Asuru et al. 2024; Emmanuel et al. 2024), supporting the idea that BECE Basic Science performance may impact SSCE Physics achievement. This study applies to the skill component of MST to examine the relationship between students' BECE Basic Science performance and their SSCE Physics results, while keeping other factors constant. By evaluating the predictive strength of foundational science knowledge, the research aims to provide insights for curriculum development and teaching strategies, that enhance students' preparedness for advanced science subjects. Understanding this relationship can help improve science education and overall academic performance in senior secondary schools.

However, Njigwum and Longjohn (2019) averred that the general performance of students in SSCE conducted by West African Examination Council has been drastically low, especially, between 2012-2015 with an average pass of 36 percent. Notably, the recurrent failure rate in SSCE Physics in Nigeria remains a major concern, as indicated by previous performance data. As reported by Adolphous (2018) in Onah and Anamezie (2022), between 2001 and 2009 (excluding in 2006), less than half of students enrolled in Physics received a credit level pass or higher,

limiting their opportunities to pursue Physics-related courses at university. Failure rates were particularly troubling from 2007 to 2009, with 42.9%, 47.1%, and 46.2% of students failing, respectively, with a similar trend reported in 2013. While there were improvements in 2010 (50.2%), 2011 (62.6%), and 2012 (67.2%), there was still inconsistency in performance. -related courses at university. Onah and Achufusi (2022) also noted the recurrence of high failure rates in 2015 (47.83%), 2017 (41%), and 2020 (36%), despite significant improvements in 2016 (71%), 2018 (87%), and 2019 (80%). These changing tendencies point to systemic issues in Physics education, needing immediate actions to improve students' understanding and performance in the subject.

Unlike the SSCE, students' academic performance in BECE conducted by the Rivers State Ministry of Education has been consistently high over the years; with an average pass of 91% (Njigwum &Longjohn, 2019). However, it is expected that skill or prior academic achievement in the same or related discipline is a predictor of academic performance in future learning. Consequently, in a bid to understand the problem of dwindling SSCE Physics performance, researchers had carried out several studies to ascertain the predictive validity of BECE on SSCE performance. As such, the following empirical literature provides evidence on the predictive impact of BECE Basic Science on SSCE Physics outcome. Emmanuel et al. (2024) investigated the predictive strength of students' BECE/JSSCE Basic Science performance on their WASSCE Physics achievement using a correlational research design. The study sampled 275 students from six schools across three southeastern states in Nigeria (Ebonyi, Anambra, and Imo) and analyzed their academic records through linear regression analysis. The results showed that BECE/JSSCE Basic Science scores had an R^2 value of 0.00106, meaning that only 0.1% of the variance in WASSCE Physics performance could be explained by students' earlier Basic Science achievement. When analyzed by gender, male students' scores showed no predictive power (R^2 = 0.000), while female students' scores explained just 0.4% of the variation (R^2 = 0.00368) in WASSCE Physics performance. These findings suggest that BECE/JSSCE Basic Science achievement does not significantly predict students' success in senior secondary Physics.

Similarly, Opara et al. (2017) investigated BECE Basic Science as predictor of Senior

School Certificate Examination in Physics, Chemistry and Biology in Aba Metropolis of Abia State, Nigeria. The design of the study is correlational. A sample size of 472 students was used. Simple regression analysis was used for data analysis. Specifically, the result showed that Students' JSCE Basic Science scores significantly predict their SSCE performance in physics in Aba metropolis of Abia State. With and R^2 of .281 which indicates that students' performance in JSCE Basic Science accounts for 28.2% of the variance in the performance of students in SSCE physics. The above work differed from the current work in terms of sample size and area of study. Also, Adeyemi (2008) predicted Students' Performance in Senior Secondary Certificate Examination from Performance in Junior Secondary Certificate Examinations in Ondo State, Nigeria." Results showed that JSCE was a good predictor of performance at SSCE, since the performance level was generally low in both examinations. Integrated science (physics, r= 0.13; Chemistry, r= 0.62; & Biology, r = 0.65). Generally, from the above JSCE is a good predictor, but specifically Integrated Science is a poor predictor of SSCE Physics (with r^2 of .017). Adeyemi's study is similar, as it included integrated science prediction of SSCE physics; but differs in location, year of study and sample used.

However, Osadebe and Orubu (2020) conducted a study to examine the extent to which JSCE Integrated Science scores predict students' performance in SSCE science subjects (Biology, Chemistry, and Physics). Using an ex-post facto design and a multi-stage sampling procedure, the researchers selected 1,800 students from six Local Government Areas each in Delta and Edo States. The study revealed that JSCE Integrated Science scores, gender, and location were significant predictors of students' SSCE Physics performance. These findings highlight the influence of early science education and demographic factors on students' success in advanced science subjects. Also, Durojaiye et al. (2017) studied Basic Science as a Predictor of Students' Performance in Senior Secondary School Science Subjects in Ekiti State, Nigeria. Their finding showed that the results of students in Basic Science and Senior School Sciences showed a positive significant correlation. It also showed that students performed better in Physics than in Biology and Chemistry. The results showed that BECE/JSSCE Basic Science scores had an R^2 value of 0.00106, meaning that only 0.1% of the variance in WASSCE Physics performance could be

explained by students' earlier Basic Science achievement. When analyzed by gender, male students' scores showed no predictive power ($R^2 = 0.000$), while female students' scores explained just 0.4% of the variation ($R^2 = 0.00368$) in WASSCE Physics performance.

Nonetheless, the varying findings of researchers on the subject about predicting SSCE from BECE performance and the discouraging performances of students in SSCE examinations had prompted the execution of the current study. It was also observed that there is a gap in literature, as most of the findings reviewed were conducted outside the study area, thus, necessitating a need to understand the impact of BECE Basic Science on SSCE Physics in Public Secondary Schools in Rivers State. A review of the literature indicated a gap, as most relevant studies were conducted outside of the study area. This underscores the need to investigate the impact of BECE Basic Science on SSCE Physics performance in Rivers State.

Statement of the Problem

The persistent decline in students' performance in the Senior School Certificate Examination (SSCE) Physics, despite their consistently high achievements in the Basic Education Certificate Examination (BECE) Basic Science, raises concerns about the predictive validity of early academic success. Given that Basic Science serves as an introductory foundation for Physics, it is expected that students who perform well in BECE should seamlessly progress to success in SSCE Physics. However, reports indicate varying conclusions, as many of these students struggle with Physics at the senior secondary level, leading to widespread failure. Amidst the numerous challenges affecting Physics performance, it is a fact that the subject is inherently abstract and complex, making it difficult for students to grasp concepts that contradict their pre-existing knowledge. Additionally, poor student interest and declining enrollment, coupled with ineffective instructional methods, inadequate teaching resources, and limited practical exposure, further exacerbate the problem. Studies also highlight that students from diverse cultural and social backgrounds struggle with the abstract nature of various aspects of Physics instruction. These issues raise the fundamental question of whether BECE Basic Science can reliably predict SSCE Physics performance or if other underlying factors are responsible for the observed decline. Addressing this knowledge gap is essential for refining science education strategies and improving

students' outcomes in Physics in Rivers State. Thus, the study examines the impact of Junior Secondary Basic Science on Senior Secondary Physics outcome.

Research Questions

This study was guided by the following research questions:

1. To what extent does Students' BECE Basic science performance predict their SSCE Physics performance?
2. To what extent does female Students' BECE Basic Science performance predict their SSCE Physics performance?
3. To what extent does male Students' BECE Basic Science performance predict their SSCE Physics performance?

Hypotheses

The following hypotheses were postulated for the study. These hypotheses were tested at 0.05 level of significance.

Ho_1: Students' BECE Basic Science performance does not significantly predict their SSCE Physics performance.

Ho_2: Female students' performance in BECE Basic Science does not significantly predict their SSCE Physics performance.

Ho_3: Male students' performance in BECE Basic Science does not significantly predict their SSCE Physics performance.

Method

The study employed an ex-post facto and correlational research design. Ex-post facto design involves collecting and analysing data about some variables retrospectively or about variables which are already in place without manipulating any of them, to gain insight about the relationships that exist among the variables (Nwankwo, 2016). Kpolovie (2010) stated “that correlational research is very suitable for investigations aimed at prediction of one variable on another.” The study adopted ex-post facto design because the data was collected retrospectively (secondary data) while a correlational design was employed to carry out prediction of the

dependent variable (SSCE Physics) by the independent variable (BECE Basic Science).

The population for this study consists of 3,209 public secondary school students who sat 2014 SSCE Physics in Port Harcourt metropolis (Source: WAEC Zonal Office, Port Harcourt). A sample size of 593 students was used for the study, and this was statistically drawn using Taro Yamen formulae for sample size determination. A simple random sampling method was used to select 17 public schools for the study while a purposive sampling technique was used to select 593 students (consisting of 303 males and 290 females) who sat for both 2011 BECE Basic Science and 2014 SSCE Physics in Port Harcourt metropolis.

The study made use of a secondary data, which is 2011 BECE Basic Science and 2014 WASSCE Physics results. The data was collected directly by the researcher from examining bodies (Rivers State Ministry of Education and WAEC zonal office in Port Harcourt) using an inventory form titled "Students Grade Chart (SGC)" for BECE and SSCE Results. Data collected were analysed using linear regression analysis; and all the hypotheses were tested at 0.05 alpha level of significance.

Results

Research Question One: To what extent does Students' BECE Basic science performance predict their SSCE Physics performance?

Hypothesis One: Students BECE Basic Science performance does not significantly predict their SSCE Physics performance.

Table 1

Summary of Regression Analysis of Students' BECE Basic Science on SSCE Physics Performance

1. Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.028[a]	.001	-.001	13.15022

a. Predictors: (Constant), BECE Basic Science

Table 1b

Omnibus ANOVA Test

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	82.541	1	82.541	0.477	.490[b]
Residual	102200.6	591	172.928		
Total	102283.1	592			

a. Dependent Variable: SSCE Physics
b. Predictors: (Constant), BECE Basic Science

c) Test of significance of Regression Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	43.798	6.335		6.913	.000
	BECE BSC	.064	.093	.028	.691	.490

a. Dependent Variable: SSCE PHYSICS

The linear regression statistics was applied to determine the extent to which BECE Basic Science performance predicted SSCE Physics performance. The linear regression results in Table 1b indicated a non-significant model ($F(1, 592) = 0.477, p > .05$), with an R^2 of .001. The R^2 of .001 in the regression model suggests that students' BECE Basic Science accounts for a near zero percentage (0.1%) variance in their SSCE Physics performance in public secondary schools in

Rivers State. This shows a very low association between both variables.

For hypothesis testing, the regression coefficient for BECE Basic Science (B = 0.064, p = 0.49) is not statistically significant, implying that BECE Basic Science scores do not have a substantial influence on SSCE Physics performance. Therefore, the null hypothesis is not rejected. This means that students' BECE Basic Science performance does not significantly predict their SSCE Physics performance. This non-significant result indicates that BECE Basic Science performance is not a predictor SSCE Physics performance. This implies that BECE Basic Science cannot produce a fitted regression model for prediction of SSCE Physics performance.

Research Questions Two: To what extent does female students' BECE Basic Science performance predict their SSCE Physics performance?

Hypothesis Two: Female students' performance in BECE Basic Science does not significantly predict their SSCE Physics performance.

Table 2

Summary of Regression Analysis of Female Students' BECE Basic Science on SSCE Physics Performance

1. Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.064[a]	.004	.001	.4454

a. Predictors: (Constant), BECE Basic Science

Table 2b

Omnibus ANOVA Test

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	0.214	1	0.214	0.001	.973[b]
Residual	54381.94	288	188.826		
Total	54382.16	289			

a. Dependent Variable: SSCE Physics

b. Predictors: (Constant), BECE Basic Science

c) *Test of significance of Regression Coefficients*[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2.076	.231		8.968	.000
	BECE BSc	-.086	.080	-.064	-1.080	.281

a. Dependent Variable: SSCE PHYSICS

The results indicate a weak relationship (R = 0.064) between BECE Basic Science and SSCE Physics. The R^2 of .004 suggests that female students' BECE Basic Science accounts for a negligible percentage (0.4%) variance in SSCE Physics performance of public secondary schools in Rivers State. The ANOVA test indicates that the regression model is not statistically significant ($F(1, 592) = 0.001, p > .05$). This means that BECE Basic Science performance does not provide a meaningful explanation for variations in SSCE Physics scores.

For hypothesis testing, the regression coefficient for BECE Basic Science (B = -0.086, p = 0.281) is also not statistically significant, confirming that BECE Basic Science scores do not have a meaningful impact on SSCE Physics performance. Therefore, the null hypothesis is not rejected. In sum, this means that female students' BECE Basic Science performance does not significantly predict their SSCE Physics performance. The weak R^2 value further supports this conclusion, indicating that other extraneous factors, not included in this model had a more substantial influence in determining female students' SSCE Physics outcomes.

Research Questions Three: To what extent does female students' BECE Basic Science performance predict their SSCE Physics performance?

Hypothesis Three: Male students' performance in BECE Basic Science does not significantly predict their SSCE Physics performance.

Table 3

Summary of Regression Analysis of Male Students' Basic Science BECE on SSCE Physics Performance

1. Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.069[a]	.005	.001	.49539

a. Predictors: (Constant), BECE Basic Science

Table 3b

Omnibus ANOVA Test

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	105.714	1	105.714	0.689	.407[b]
Residual	46168.47	301	153.384		
Total	46274.19	302			

a. Dependent Variable: SSCE Physics
b. Predictors: (Constant), BECE Basic Science

c. Test of significance of Regression Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.594	.259		6.152	.000
	BECE BSC	.105	.088	**.069**	**1.203**	**.230**

a. Dependent Variable: SSCE PHYSICS

The regression analysis examined whether male students' BECE Basic Science performance significantly predicts their SSCE Physics performance. The model summary results showed a weak relationship, with an R-value of 0.069 and an R^2 value of 0.005, indicating that only 0.5% of the variance in SSCE Physics performance is explained by BECE Basic Science scores.

The ANOVA test results further support this finding, as the F-statistic and its p-value (***F*(1,**

592) = 0.689**, *p* > .05**) indicate that the regression model is not statistically significant at the 0.05 level. Additionally, the regression coefficient for BECE Basic Science (B = 0.105, t= 1.20, p = 0.230) is not significant, meaning there is no strong evidence that BECE Basic Science scores influence SSCE Physics outcome.

In conclusion, since the p-value for BECE Basic Science is greater than 0.05, the null hypothesis is not rejected. This means that male students' BECE Basic Science performance does not significantly predict their SSCE Physics performance. The weak R^2 value further supports this conclusion, indicating that other unexamined factors have a more significant impact on SSCE Physics outcomes.

Discussion

The first result indicates that students' BECE Basic Science performance does not significantly predict their SSCE Physics performance, as evidenced by the R^2 value of .001, which accounts for only 0.1% variance in SSCE Physics performance. This finding aligns with Emmanuel et al. (2024), who found that BECE Basic Science scores explained a mere 0.1% of the variation in WASSCE Physics performance. Similarly, Adeyemi (2008) reported that Integrated Science had a weak predictive power for SSCE Physics (r^2 = .017), supporting the claim that students' early science performance does not necessarily translate into strong performance in advanced Physics. However, this result contradicts the findings of Opara et al. (2017) and Osadebe and Orubu (2020), which demonstrated a significant relationship between JSCE Basic Science and SSCE Physics performance. Opara et al. (2017) reported an R^2 value of .281, indicating that 28.2% of the variance in SSCE Physics performance was explained by JSCE Basic Science scores. The discrepancy between these studies and the current findings may be due to differences in location, sample sizes, and educational policies affecting science education across regions. Furthermore, Durojaiye et al. (2017) found a positive correlation between Basic Science and SSCE Sciences, suggesting that students who perform well in Basic Science are likely to excel in Physics. These conflicting results highlight the need for further investigation into contextual factors that may influence the predictive strength of BECE Basic Science on SSCE Physics performance.

Regarding gender differences as shown by the second and third findings, the study found that female students' BECE Basic Science performance does not significantly predict their SSCE Physics performance, with an R^2 value of 0.004, meaning only 0.4% of the variance in SSCE Physics was explained. Similarly, male students' BECE Basic Science performance showed no significant predictive power, with an R^2 value of 0.005, explaining only 0.5% of the variance. These findings align with Emmanuel et al. (2024), who reported that male students' BECE Basic Science scores had no predictive power ($R^2 = 0.000$), while female students' scores accounted for just 0.4% of the variation in WASSCE Physics performance. This suggests that both male and female students struggle with the transition from Basic Science to Physics, irrespective of prior academic achievement in science at the junior secondary level. However, Osadebe and Orubu (2020) found that gender and location were significant predictors of SSCE Physics performance, indicating that demographic factors might influence academic success in Physics. The inconsistency between these studies suggests that external variables such as teaching methodologies, school resources, and students' learning environments may play a crucial role in Physics performance rather than prior BECE Basic Science achievement alone. The lack of gender-based differences in predictive strength further emphasizes the need for improved instructional strategies in Physics education to enhance students' comprehension and interest in the subject. Therefore, overwhelming statistical evidence has revealed that male and female students' BECE Basic Science performance could not significantly predict their SSCE physics performance.

Conclusion

The study concludes that BECE Basic Science performance is not a predictor of SSCE Physics performance in public secondary schools in Rivers State. Also, the study revealed that both male and female students' BECE Basic Science scores had no significant impact in the prediction of their SSCE Physics performance, indicating that prior achievement in Basic Science does not necessarily translate into success in senior school Physics. These findings suggest that other factors, such as teaching approaches, laboratory exposure, and student interest, may have a greater impact on senior secondary Physics outcome.

Educational policymakers and school administrators should consider other variables, such as the quality of Physics instruction, availability of laboratory facilities, and students' motivation, when designing interventions to improve Physics performance. Additionally, the lack of a strong predictive relationship calls for a re-evaluation of the transition from Basic Science at the junior secondary level to Physics at the senior secondary level, ensuring that students are adequately prepared for the conceptual demands of Physics.

Recommendations

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

1. Government should take science education at the secondary level seriously, through implementation of sustainable educational reforms and provision of relevant facilities such well-equipped laboratories to enhance science teaching.
2. Schools should train teachers to adopt more interactive and practical-based teaching methods in Physics to enhance students' conceptual understanding and application skills.
3. The Nigerian Educational Research and Development Council (NERDC) should review Junior secondary Basic Science curriculum to accommodate more Physics content. This will increase students' exposure to the basics of Physics at the junior level.
4. Schools should implement motivation programs that enhance students' interest in Physics, such as science fairs, Physics clubs, and mentorship programmes with professionals in the field.
5. Examining bodies and school owners should bring back reward system so as to encourage academic excellence especially in science subjects.
6. Examination authorities should device stricter methods of test administration and scoring to avoid loopholes that may affect test scores such as examination mal-practice.

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