

Relationship Between the Performance of Students in Physics at the SSCE Level and their Performance in Physics (Physics/Mathematics) At the NCE Level: A Pathway to Economic and Technological Development of Nigeria

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ABSTRACT

The study compared the relationship between the performance of students in physics at the SSCE level and their performance in Physics (Physics/mathematics) at the NCE level in Federal College of Education (Technical), Gombe, Gombe State. The objectives are to: determine the relationship between the performance of the students in Physics at the SSCE level and their performance in Physics (Physics/Mathematics) at the NCE level and secondly, to see whether the success in Physics at the SSCE level can be used to predict success in Physics (Physics/Mathematics) at the NCE level. The instrument used for data collection was secondary data; the students' results in 'O' level Physics were got in their admission files in the college while Physics results (Physics/Mathematics) scores were got after academic board approved their semester results. The research data were gotten from students who graduated in the 2015/16 to 2018/19 academic session from FCE(T) Gombe. A Pearson Correlation analysis and t-test analysis were used to test the null hypothesis. The r values of +0.374, +0.444, +0.423 and +0.497 for 2015/16 to 2018/19 respectively indicated weak to moderate correlation. Analysis of Variance (ANOVA) revealed that there was a very strong relationship ($r = 0.903$) at $P \geq 0.05$ between the performance. The result of the study therefore showed a weak to moderate statistical relationship between the students' performance at the SSCE level and their performance in Physics (Physics/Mathematics) at the NCE level. The study further recommends that, conducive working and learning atmosphere should be provided and maintained in secondary schools as provided at the NCE levels, employ only qualified physics teachers to teach at the secondary school levels, provide well-equipped laboratories for effective practicals.

Keywords: Relationship, Performance, NCE, Physics, Technology, Economic Development.

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Introduction

Physics, one of the science education disciplines has positive impact on the economic and social development of a nation because of the vital role it plays in shaping the future of any nation [1]. It forms the basis for the nation's technological advancement and human resource development [2,3]. Furthermore, Physics is viewed as the most essential of all sciences responsible for real development and breakthrough in science

and technology, because it offers the greatest opportunity for discoveries of fundamental facts of nature and, engine that drives modern technology globally [4,5,3]. According to Aseidu-Addo and Ridana (2000), the power of Physics is found in its relevance to the solutions of the problems confronting humanity. In spite of Physics relevance to nation building and technological advancement, students' performance in Physics at all levels of education remain critical to the economic

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and technological development of every nation. To buttress the above point, Virginia and Sanda et al. were of the view that, we live in a world that increasingly and solely rely on Physics and facilitated via breakthroughs in researches [6,3].

Physics education is crucial for a country's economic and technological development and the global competitiveness which is influenced by the academic performances at different levels of education or learning. Performance of students at all levels of education is essential for nurturing future scientists, engineers and technologists; who are capable of driving innovations and economic growths (DN, 2024). Science is taught at every level of education system because of the keys it has for scientific and the socio-economic development of a country. The science which aims at comprehending the physical world we dwell on, is called Physics. Moreso, Physics is considered to be one of the most fundamentals of natural sciences; which involves the study of universal law and of the behaviours and relationship among broad spectrum of physical phenomena [7].

Over the years, several researchers have been trying to research ways of improving the academic performance of students in physics [7]. Academic performance was defined by Adebisi as the scholastic standing of a student at a given moment [8]. On the choice of effective methods of teaching physics at the secondary schools' level, a study conducted by Dangoje et al. found minds-on activity teaching method to be effective at improving the performance of students taught physics and attitudes towards physics among senior secondary school students in Gombe South, Northern Nigeria [9].

Physics is a subject taught at the senior secondary school level and examined at the SSCE level; in addition to being a pre-requisite for admission into the Physics/Mathematics programme of the Nigeria Certificate of Education (NCE) and that, the knowledge of physics at Senior Secondary (SS) level may have an influence on students' performance at the Nigeria Certificate of Education (NCE) level. Hence, this research seeks to find out the 'Relationship Between Performance of Students in Physics at the SSCE level and their Performance in Physics (Physics/Mathematics) at the NCE level in Federal College of Education (Technical) Gombe', Northeastern Nigeria.

Consequently, students' performance in Physics at all levels of learning remains a critical area of research considering its vast contributions to economic and technological development, which is a function of academic performances at all levels of education.

Objectives of the Study

The main objective of the study was to determine the 'Relationship between the Performance of Students in Physics at the SSCE level and their Performance in Physics (Physics/Mathematics) at the NCE level in Federal College of Education (Technical), Gombe'. Specifically, the study sought to:

1. Determine relationship between the performance of NCE III students in Physics at the SSCE level and their subsequent performance in PHY 321 (Electromagnetism III), PHY322 (Atomic & Quantum Physics II) and PHY 323 (Physics

Practical III) at the NCE level in 2015/2016, 2016/2017, 2017/2018 and 2018/2019 academic sessions respectively.

2. To see whether success in Physics at the SSCE level can be used to predict success in Physics at the NCE level.

Research Hypothesis

H_{01} : There is no significant relationship between the performance level of students in Physics at SSCE level and their performance in Physics/Mathematics at the NCE level in FCE(T) Gombe.

Research Methodology

The study adopted a descriptive survey design that employs a simple Pearson Correlation analysis and t-test analysis to test the null hypothesis.

Sampling Technique

Sample is any group in which information is obtained or part of a population, while sampling is the process of selecting individuals for study. For this reason, the researchers adopted a simple random sampling technique at the cause of carrying out the research work because it is a straight forward method to be used in carrying out research.

Population of the Study

The population of the study covered 43 students, 38 were males and 5 were females, who were admitted into NCE programme to study Physics/Mathematics in the School of Science of the Federal College of Education (Technical) Gombe in 2013/2014, 2014/2015, 2015/2016 and 2016/2017 sessions and graduated in 2015/2016, 2016/2017, 2017/2018 and 2018/2019 academic sessions respectively.

Instrument for Data Collection

The instrument used for data collection was secondary data; the students' results in 'O' level Physics were got in their admission files in the college while Physics results (Physics/Mathematics) scores were got after academic board approved their semester results. The research data were gotten from students who graduated in the 2015/16 to 2018/19 academic session from FCE(T) Gombe.

Method of Data Analysis

The research data were gotten from students who graduated in the 2015/16 to 2018/19 academic session from FCE(T) Gombe. A simple Pearson Correlation analysis and t-test analysis were used to test the null hypothesis. Analysis of Variance (ANOVA) was used to determine the overall relationship between the performance of the students in physics both at SSCE and NCE at $P \geq 0.05$ level of significance. The formular for Pearson correlation analysis is given by:

$$r_{xy} = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{(N \sum X^2) - (\sum X)^2} (N \sum Y^2 - (\sum Y)^2)}$$

Where: r = Pearson r correlation coefficient, N = number of respondents, X = students' performance in Physics at the SSCE level, Y = students' performance in Physics/Mathematics at the NCE level, $\sum X$ = sum of x scores, $\sum Y$ = sum of y scores, $\sum x^2$ = sum of squared of x scores, $\sum y^2$ = sum of squared of y scores, $\sum xy$ = sum of the product paired scores, Significant critical value: 0.05 and 0.01.

Results and Discussion

Table 1: Correlation between the Performance of the Students in Physics at the SSCE level and their Performance in Physics (Physics/Mathematics) at the NCE level

		SSCE2015/16	SSCE2016/17	SSCE2017/18	SSCE2018/19
PHY 321	Pearson Correlation	.563	-.111	.224	.385
	Sig. (2-tailed)	.090	.760	.534	.271
PHY 322	Pearson Correlation	.581	-.104	-.023	.120
	Sig. (2-tailed)	.078	.775	.949	.742
PHY 323	Pearson Correlation	.101	.720*	-.386	.665*
	Sig. (2-tailed)	.782	.019	.270	.036

*. Correlation is significant at the 0.05 level (2-tailed). (n = 10)

When the students' performance in PHY 321 (Electromagnetism III) was correlated against their performance in SSCE in the 2015/16 session, it showed a medium positive correlation ($r = 0.563$), however, in the 2016/17 session, it showed a weak negative relationship ($r = -0.111$) followed by a weak to moderate positive relationship ($r = 0.224$ and 0.385) in the 2017/18 and 2018/19 session respectively. When the students' performance in PHY 322 (Atomic & Quantum Physics II) was correlated against their performance in SSCE in the 2015/16 session, it showed a medium positive correlation ($r = 0.581$). However, in the 2016/17 and 2017/18 sessions, it showed a weak negative relationship ($r = -0.104$ and -0.023) and weak but correlation ($r = 0.120$) in 2018/19.

When the students' performance in PHY 323 (Physics Practical III) was correlated against their performance in Physics at the SSCE level in the 2016/17 and 2018/19 session, it showed a high positive correlation to moderate positive correlation ($r = 0.720$ and 0.665) and very low but positive correlation ($r = 0.101$) to low but negative correlation ($r = -0.386$) in the 2015/16 and 2017/18 sessions respectively.

Table 2: t-Test Analysis of the Correlation between the Performance of students in Physics at the SSCE level and their Performance in Physics (Physics/Mathematics) at the NCE level in 2015/2016 academic Session.

Groups	N	M	SD	Df	r	t-cal.	t-critical	Remark
SSCE (PHY)	14	56.93	5.62	26	0.374	2.056	0.079	$P \leq 0.05$
NCE (PHY)	14	51.69	12.96					

From table 2, the results showed that the t-calculated value of 2.056 and t-critical value of 0.079 at $P \leq 0.05$. Since t-cal. (2.056) was greater than t-critical (0.079) at $P \leq 0.05$. Therefore, the null hypothesis which stated that, **there is no relationship between the performance of students in Physics at the SSCE level and their performance in Physics at the NCE level** was rejected and the alternative hypothesis was upheld. This showed that there is significant relationship between the performance of students in Physics at the SSCE level and their performance in Physics at the NCE level.

When the students' performance in SSCE Physics was correlated against their performance in Physics NCE III Second Semester (that is, Electromagnetism III, Atomic & Quantum Physics II and Physics Practical III) in the 2015/2016 academic Session, it showed a low positive relationship ($r = 0.374$).

Table 3: t-Test Analysis of the Correlation between the Performance of students in Physics at the SSCE level and their Performance in Physics at the NCE level in 2016/2017 academic Session

Groups	N	M	SD	Df	r	t-cal.	t-critical	Remark
SSCE (PHY)	10	56.60	5.66	18	0.444	2.101	0.12	$P \leq 0.05$
NCE (PHY)	10	58.52	13.76					

From table 3, the results showed that the t-calculated value of 2.101 and t-critical value of 0.12 at $P \leq 0.05$. Since t-cal. (2.101) was greater than t-critical (0.12) at $P \leq 0.05$. Therefore, the null hypothesis which stated that, **there is no relationship between the performance of students in Physics at the SSCE level and their performance in Physics at the NCE level** was rejected and the alternative hypothesis was upheld. Based on this analysis, it can be concluded that there is a significant relationship between the performance of students in Physics at the SSCE level and their performance in Physics at the NCE level.

In 2016/2017 academic session, when the students' performance in SSCE Physics was correlated against their performance in Physics at the NCE level, that is NCE III second semester (Electromagnetism III, Atomic & Quantum Physics II and Physics Practical III), there was a medium but positive relationship ($r = 0.444$).

Table 4: t-Test Analysis of the Correlation between the Performance of students in Physics at the SSCE level and their Performance in Physics at the NCE level in 2017/2018 academic Session.

Groups	N	M	SD	Df	r	t-cal.	t-critical	Remark
SSCE (PHY)	11	55.00	5.66	20	0.423	2.086	0.10	$P \leq 0.05$
NCE (PHY)	11	54.30	20.57					

Looking at table 4 above, the results showed that the t-calculated value of 2.086 and t-critical value of 0.12 at $P \leq 0.05$. Since t-cal. (2.086) was greater than t-critical (0.10) at $P \leq 0.05$. Therefore, the null hypothesis which stated that, **there is no significant relationship between the performance of students in Physics at the SSCE level** and their performance in Physics at the NCE level was rejected and the alternative hypothesis was upheld. This revealed that there is significant relationship between the performance of students in Physics at the SSCE level and their performance in Physics at the NCE level.

Considering 2017/2018 academic session, when the students' performance in SSCE Physics was correlated against their performance in Physics at the NCE level, that is NCE III second semester (Electromagnetism III, Atomic & Quantum Physics II and Physics Practical III), there was a medium but positive relationship ($r = 0.423$).

Table 5: t-Test Analysis of the Correlation between the Performance of students in Physics at the SSCE level and their Performance in Physics at the NCE level in 2018/2019 academic Session

Groups	N	M	SD	Df	r	t-cal.	t-critical	Remark
SSCE (PHY)	8	53.50	5.02	14	0.497	2.145	0.15	$P \leq 0.05$
NCE (PHY)	8	54.08	18.79					

Looking at the above table, the results showed that the t-calculated value of 2.145 and t-critical value of 0.15 at $P \leq 0.05$. Since t-cal. (2.145) was greater than t-critical (0.15) at $P \leq 0.05$, the null hypothesis which stated that, **there is no significant relationship between the performance of students in Physics at the SSCE level** and their performance in Physics at the NCE level was rejected and the alternative hypothesis was upheld. It can now be concluded that there was significant relationship between the performance of students in Physics at the SSCE level and their performance in Physics at the NCE level.

When the students' performance in SSCE Physics was correlated against their performance in Physics at the NCE level, that is NCE III second semester (Electromagnetism III, Atomic & Quantum Physics II and Physics Practical III), for the 2018/2019 academic session, there was also a medium but positive relationship ($r = 0.497$).

Table 6: ANOVA

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2140.882	4	535.221	34.781	0.903
Residual	660.192	1	660.192		
Total	2,801.074	5			

Significant at the 0.05 level

The ANOVA table above shows the summary of the relationship between the performance of students in Physics at the SSCE level and their performance in Physics/Mathematics at the NCE level. The overall results showed that there was a very strong positive relationship ($r = +0.903$) at $P \geq 0.05$ level of significance.

Discussion

It was discovered that in 2015/2016 session, there was a positive relationship ($r = 0.374$), majority of the students passed Physics at SSCE level with credit passes. However, most of them performed better in PHY321 and PHY 323 (which was Electromagnetism III and Physics Practical III) but performed less in PHY 322 (Atomic & Quantum Physics).

In 2016/2017 session, a medium positive relationship ($r = 0.444$) was recorded, out of the ten (10) students that were sampled for

the study, nine (9) passed physics at the SSCE level, eight (8) out of the ten (10) students passed PHY 321 (Electromagnetism III), while all the ten (10) students passed the two other courses (PHY 322 and PHY 323) with fairly good grades.

In 2017/2018 session, there was also a medium but positive relationship ($r = 0.423$). eleven students were sampled for the study and nine (9) has passed physics at the SSCE level with credit passes. Only two (2) students failed PHY 321 & PHY 322 (Electromagnetism III and Atomic & Quantum Physics) and all the eleven (11) students passed the Physics Practical III (PHY 323) with fair to good grades.

In the 2018/2019 session, similar but slightly higher medium but positive relationship was obtained ($r = 0.497$). The students didn't do well at the SSCE level when compared to their performance

at the NCE level. Out of eight (8) students that were sampled for the study, only a student failed PHY 321 and PHY 322, whereas all the eight (8) students passed PHY323.

Generally, When the performance of students in Physics at the SSCE level was correlated against their performance at the NCE level for the four sessions under study, the overall results indicated that, there was a very strong positive relationship ($r = +0.903$) at $P \geq 0.05$ level of significance between performance of students in Physics at the SSCE level and their performance in Physics (Physics/Mathematics) at the NCE level.

Based on this, therefore, it can be deduced that the influence of Physics at the SSCE level on the understanding of Physics at the NCE level was statistically significant. In other words, the performance of students in Physics at SSCE level related positively with their performance at the NCE level. These results agree with the findings of Dantani and Hassan (2021), Akura et al. (2022) and Sanda et al., but disagrees with the findings of Akanni et al. who conducted a study on critical thinking as a correlate of senior secondary school students' achievement in Physics in Sokoto [3,10]. Furthermore, the result of the findings indicated that, there was no statistically significant relationship between the critical thinking ability and Physics achievement [11,12,13].

Conclusion

The r values of +0.374, +0.444, +0.423 and +0.497 for 2015/16 to 2018/19 sessions respectively, indicated weak to moderate correlation between the students' performance at the SSCE level and their performance in Physics (Physics/Mathematics) at the NCE level. Analysis of Variance (ANOVA) revealed that there was a very strong relationship ($r = 0.903$) at $P \geq 0.05$ level of performance. Therefore, success in Physics at the SSCE level can be used to predict success at the NCE level.

Recommendations

Based on the above findings, the researchers recommended that government and private sector should:

1. Provide and maintain a conducive working and learning environment in our secondary schools as provided at the NCE.
2. Employ only qualified Physics teachers to teach at the secondary school level.
3. Retain employed teachers by providing adequate infrastructure and attractive remunerations and provide well-equipped laboratories and classrooms.
4. Organize seminars and workshops for the teachers intermittently and in-service training should be made available for re-training of teachers and lecturers.
5. Guarantee promotions and job security for secondary school Physics teachers to boost their morals which will enhance the performance of students in physics.

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