

Influence of Subject Combination and Gender on Achievement of NCE Physics Students in Physics

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Abstract: The study investigated the influence of subject combination and gender on the achievement of Physics students in physics at the Nigeria Certificate in Education (NCE) Level. The research design adopted was causal-comparative. The results of 2009/2010 Physics students' sectional performance across the various subject combinations were considered. A total of 119 physics students' result across the subject combinations and levels of the Federal College of Education, Kontagora were used for the study. The One way Analysis of Variance (ANOVA) and studentized t-test were used to analyze the data (students' results) collected. The findings revealed that students' subject combination is not a determinant of students' academic performance in Physics at NCE level except at NCE 1. It also revealed that sex is not a determinant of students' academic performance in Physics. Conclusions were drawn and recommendations such as Physics students should be made to offer relevant courses in mathematics irrespective of their subject combinations and that both sex should be given equal attentions among others were proffered.

Keywords: Subject combination, physics achievement, gender, NCE.

1. INTRODUCTION

The Philosophy of the Nigeria Certificate in Education (NCE) Physics programme is inspired by the desire to help students become intellectually informed in physics and to produce competent and effective Physics teachers with good mastery of contents and methods and consequently develop the knowledge of the learners (FGN 2012).

The NCE teacher education programme is such that students are expected to offer Physics in combination with other science subjects known as "subject combination". The term subject combination in colleges of education refers to the two teaching subjects offered along with general education courses. There are subject combinations that are 'single major' and some double major'. Single subject combinations are those in which students have to combine two subjects along with general education while double major subject combinations are those in which students take one subject carrying double weights along with the general education course.

In most of our secondary schools, physics and other science teachers are in short supply and the few available are more often not well equipped. This perception probably necessitated the introduction of physics single major combinations in Nigeria Colleges of Education: such combinations are Physics/Mathematics; Physics/Computer Science; Physics/Integrated Science; Physics/ Chemistry; Physics /Biology among others. This step is an attempt to increase students' population in the physics thereby meeting the shortage of man power in physics and other sciences.

Very few studies on the effects of subject combination on students performance in Colleges of Education are available. Studies, such as Arigbadu and Mji (2006), examined the influence of subject combinations on preservice mathematics teachers' examination performance in Nigeria. Also, Arigbadu (2004) examined the influence of subject combination on the performance of students in mathematics in Nigeria Colleges of Education. The results revealed that mathematics

students performed better than other students. In their view, Usman and Memeh (2007), assert that achievement of students in mathematics was a critical fitter in the physical sciences and technology. In another study, Ogundipe (1991), investigated the effects of gender on subject combinations as factors of students performance in economics and found no significant difference between the sexes in performance in the subject. Sex is another important factor that has been considered in the study of students' performance in physics.

In their various studies, Iorchugh (2006), Akinbobola and Afolabi(2009), Dania (2014), no significant difference between the performances of male and female in physics were found. However, Adeoye and Sataye (2003), and Okwo and Otuboh (2007), found significant sex based differences in students performance in physics in favour of male students.

The measurement of performance has posed in problem in academic circle. The validity of the test, the competency of the score and the conducive environment is questionable. More importantly when teachers award marks, the reliability is often required. Carter (1953) pointed out that when Grade Point Average (GPA) is used, errors are introduced in the process of aggregating marks from different sources in such computations. When it comes to the use of letter grades, there are usually variations in grade from subject and/or department. However, other available sources for the teacher to test the students' performance apart from the use of marks or grades are rarely used and are less meaningful. Also, there is no known study found to have examined the influence of subject combinations on students' performance in physics in Nigeria Colleges of Education.

The present study is therefore a study into these areas. It is hoped that the study would provide Colleges of Education and National Commission for Colleges of Education (NCCE) with relevant information about the state of physics students' performance in Colleges of Education on the basis of subject combinations and possible steps to address the situation of subject combination implementation in the area.

2. STATEMENT OF THE PROBLEM

There is a serious concern about the poor state of teaching and learning of physics worldwide. This has made educators to focus more on physics education. Inadequacies have been observed in science teacher education in general and physics education in particular in our Colleges of Education. This situation has apparently resulted to students' poor performance in the subject. Could this be as a result of students' deficient basic knowledge in mathematics? Or could it also be as a result of the nature of other subjects combined with physics.

In Colleges of Education where the "subject combination" are being implemented, there is equally a concern about how students with different subject combinations compare especially in the sciences. Do some combinations in physics give an edge over others in physics achievement? Does sex difference similarly results in performance differences in physics?

3. PURPOSE OF THE STUDY

The purpose of this study is to investigate the influence of combination and sex on the performance of physics students at the NCE level.

The study specifically sought to find answers to the following questions.

1. Is there a difference in the achievements of physics students in Physics courses across the various subject combinations?
2. Is there a difference between the achievements of male and female students in physics courses across the various subject combinations?

4. RESEARCH HYPOTHESES

Hypotheses I There is no significant difference in the performance of physics students in physics across the various subject combinations

Hypotheses II There is no significant difference between the performance of male and female physics students in physics across the various levels.

5. METHOD OF THE STUDY

Research Design:

The research design adopted for this study was causal-comparative design. In this design, the research attempts to link already existing influences or observations to some variables as causative effect. It seeks to establish relationship between one variable and another. The independent variable is inherently non-manipulative because its manifestation has already occurred.

Data Collection:

The results of 2012/2013 physics students' sectional performance (Cumulative Grade Point Average (CGPA)) in physics across the various subject combinations and levels were obtained from the office of the Head of Department of Physics, Federal College of Education, Kontagora. These results represent the CGPA of 3, 2, 1 years for NCE III, II, I respectively, and represent the results from 2010/2011, 2011/2012, 2012/2013 sessions. The tabular presentation of the total number of students whose results were used for the study is shown in Table I.

The students' combinations with physics are integrated science, computer, and mathematics. The GPA of each of the students was considered and the average GPA of students in physics) mathematics (PM); physics/integrated Science (PI); and physics/computers science PC) were computed. Also computed were the average GPA for male and female physics students across the subjects combinations in NCE I; NCE I, NCE III.

Data Analysis:

The data (students' CGPA) collected from the College were analyzed using the One Way Analysis of Variance (ANOVA) and t-test analysis.

Table 1: Subject combination by level and sex of students for 2012/2013 academic session

Sub. Comb.	NCE I			NCE II			NCE III			Subj. Comb. Total
	Sex			Sex			sex			
	M	F	Total	M	F	Total	M	F	Total	
Phy/Math, PM	6	4	10	7	1	8	5	2	7	25
Phy, Int (PI)	9	3	12	8	6	14	10	6	16	42
Phy/Comp (PC)	11	4	15	13	6	19	8	10	18	52
Level/Sex total	26	11	37	28	13	41	23	18	41	119

6. RESULTS OF THE STUDY

From Table 1, 37 students of NCE I were considered with study with 10 in PM, (6 male, 4 female); 12 in (PI) with 9 male, 3 female, 15 in PC, with 11 male, 4 female. For NCE II, results of 41 students were considered 8 in PM with 7 male, 1 female; 14 in PI with 8 male, 6 female, 19 in PC with 13 male, 6 female. In the case of NCE III results of 41 students were also considered. 7 in PM with 5 male, 2 female, 16 in PI with 10 male, 6 female, 18 in PC with 8 male, 10 female. The total number of students whose results were considered was 119.

Table 2: Mean Grade Point Average (GPA) by Level, subject combinations and Gender

Level	Mean GPA by Subj. Comb.				Mean (CGPA) by Sex			
	PM	PI	PC	CGPA	Male		Female	
					\bar{X}_1	SD ₁	\bar{X}_2	SD ₂
NCE I	2.5	1.15	2.75	2.13	2.25	1.48	1.87	1.13
NCE II	2.28	1.39	1.98	1.88	2.71	1.01	2.18	0.76
NCE III	2.68	2.37	2.33	2.46	2.71	1.01	2.18	0.70

Table 2 shows the result of the data in answer to the research questions 1 and 2. It indicates that students who have mathematics as second subject performed better than those that have computer or integrated science as their second subjects expect in NCE 1 where the mean GPA of the students in higher than that of students that have mathematics and

integrated science as their second combinations. The table also revealed that the Cumulative Grade Point Average (CGPA) of NCE III Physics across the subject combination is higher than that of NCE II and NCE I. The mean CGPA of male physics students is slightly higher than that of female physics students across the subject combinations in all the levels.

Hypotheses I: There is no significant difference in the performance of physics students across the various subject combinations.

Table 3: One way Analysis of variance PM, PI and PC; NCE I, NCE II, and NCE III, students compared in performance

Variable	Source of variation	Ss	df	ms	f-ratio	f-critical
NCE I	Between Group	17.65	2	8.84	5.59	4.13
PM, PI and PC Student	Within Group	53.88	34	1.58		
	Total	71.55	36			
NCE II	Between Group	134.8	2	67.41	-12.89	3.28
PM, PI and PC Student	Within Group	198.65	38	5.23		
	Total	63.84	40			
NCE II	Between Group	1.03	2	0.52	0.55	3.28
PM, PI and PC Student	Within Group	35.25	38	0.94		
	Total	36.78	40			

*Not significant at $p < 0.05$

For NCE I, the f-ratio, 5.59 is greater than f-critical, 4.13. This implies that there is significant difference ($P < 0.05$) in the achievement of physics students across the various subject combinations. This implies that the subject combination is a determinant of students' academic performance in physics.

In the case of NCE II Physics students, the f-ratio obtained, -12.89 is less than f-critical. This shows that there is no significant difference at 0.05 confidence level across the various subject combinations. Through the mean CGPA of Physics/Mathematics is found to be greater than the mean CGPA of Physics/Computer and Physics/Integrated Science Students, but the difference was not found to be statistically significant.

Also, in NCE III, the F-ratios obtained, 0.5 is less than the F-critical, 3.28. This implies that the students' academic achievement in physics across the various subject combinations is not statistically significant. The null hypothesis is therefore retained for NCE III and NCE II while it is rejected in the case of NCE I.

Hypothesis 2: There is no significant difference between the academic achievement of male and female physics students across the various level.

Table 4: t-test analysis of the difference between the mean scores of male and female students in NCE I, NCE II and NCE III

Gender	N	Mean	Sd _{1/sex}	Sd _{2/level}	df	t-cal	t-critical	Decision
NCE I								
Male	26	2.25	1.48	0.45	35	0.78	2.042	NS*
Female	11	1.37	1.13					
NCE II								
Male	28	2.71	1.01	0.28	39	1.89	2.042	NS*
Female	13	2.17	0.76					
NCE III								
Male	23	2.71	1.01	0.28	39	1.89	2.042	NS*
Female	18	2.18	0.70					

*Not significant at the $p < 0.05$

Table 4 Reveals that the mean CGPA of male is greater than that of female across NCE I, NCE II and NCE III, but the differences were not found to be statistically significant ($p < 0.05$) in all the cases. The null hypothesis, which states that there is no significant difference between the academic performance of male and female across the various levels, was retained.

7. DISCUSSION OF RESULTS

Evidence from the research findings reveal that the students' subject combinations do not significantly influence academic performance in physics. Across the various subject combinations, no statistically significant differences were found in physics achievement among the students of the different combinations for NCE II and NCE III physics, except for NCE I where there was a significant difference in the achievement of physics students across the various subject combinations. However, the mean scores of student who have mathematics as their second combination was found to be slightly higher (though not statistically significant) at all level and across subject combinations, except also in NCE I where students in computer/physics performed higher than students in math/physics and physics/integrated science. This results seem to agree with the findings of Arigbabu (2004), Arigbadu and Mji (2006), Usman and Memeh (2007), that mathematics students performed better than other students across subject combinations in physical sciences. Though no significant difference was found between the achievement of male and female physics students across the levels (NCE I, NCE II, NCE III), the mean scores of male physics students across the levels were found to be slightly higher than their female counterpart. This finding agrees with the findings of Iorchugh (2006); Akinbobola and Afolabi. (2009); Dania (2014), who did not find any significant difference between the performance of male and female physics students. However, the result is in contract to the findings of Adeoye and Sataye (2008); Okwo and Otuboh (2007), who found a significant difference in favour of male physics students.

8. CONCLUSION

This study underscores the importance of mathematics at start of NCE physics programme (NCE I) in enhancing students performance in the physical sciences and in physics in particular. Physics as a subject is characterized with mathematics and manipulations and the interpretation of concepts using mathematical notations. However, the influence of mathematics gradually pales as students' progress in their study to levels I and II. Mathematics cannot therefore be separated from physics and other physical sciences. Therefore, physics students need a strong mathematics background in order to do well in their study of physics.

9. RECOMMENDATIONS

Based on the findings and their implications the following recommendations were made:

1. Students offering physics at NCE level should be made to offer relevant courses in mathematics as the main problem most students have in physics class is calculation.
2. Both male and female students should be carried along in physics class as the findings did not call for separate method of teaching on the basis of sex.
3. Students admitted to read physics in College of Education should have at least credit pass in mathematics. Students having subject combinations other than mathematics should be given remedial classes in mathematics so as to enhance their knowledge in manipulation and calculation.
4. Those employed to teach physics in our Colleges of Education should have a teaching qualification and experience that would enable them understand the principle of teaching and learning that would help them to handle physics students with difference combinations.

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