

Research Article

Impact of Special Intervention Course on the Academic Achievement of Physics Students in Colleges of Education Niger State, Nigeria

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Abstract: The study investigated Impact of Special Intervention Course on the Achievement of Physics Students in Colleges of Education Niger State, Nigeria. Quasi-experimental design, specifically Pretest, Posttest, non-equivalent, control group design was adopted for the study. Eighty-one (81) preservice teachers were sampled for the study. Two research questions were raised and Two corresponding null hypotheses were formulated and tested at 0.05 level of significance. Two experts validated the research instrument used for the study. Test-retest method was used to determine the reliability coefficient of Optics Achievement Test (OAT). The scores collected were analyzed using Pearson Product Moment Correlation Coefficient formula and reliability index of 0.96 was obtained. The data collected were analyzed using Mean, Standard Deviation and Analysis of Variance (ANOVA) with Statistical Package for Social Sciences (SPSS) version 23.00. The results of the study revealed that the preservice teachers in the Special Intervention Course performed significantly better than those taught Optics only from the indication on the p-value. Based on the finding revealed that using Special Intervention Course as a supplement in Physics, preservice teachers under the Experimental group perform better than the preservice teachers in the Control group of the study. NCE should adopted the use of Special Intervention Course pending the reintroduction of Optics I into NCE Minimum Standard of Physics and other subjects was among the recommendations made for this study.

Keywords: Special Intervention Course and Academic Achievement.

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INTRODUCTION

Advance nations of the world made it to a greater development and achievements in Science and Technology today with the backing of Science Education, hence Underdeveloped and Developing nations like Nigeria, must take Science Education as a very serious course in all institutions of learning (Aina, 2017). Basically, Science Education comprises of subjects as Biology, Chemistry, Mathematics and Physics and these subjects serves as a minimum requirement into any Science institution in the country and the subjects are also offered in most of the nation's tertiary institution. Tertiary institution, according to National Policy on Education (2004) are those institutions that cover the post-secondary section of national education system which is given in Universities, Polytechnics and Colleges including (Colleges of Education, the Advanced Teachers Training Colleges, Correspondence Colleges and Institution) as may be allied to where Teacher Education programmes are offered (Hamisu & Musa, 2015).

Teacher Education is a programme that trains men and women to become professional teachers with a goal of encouraging the spirit of enquiry and creativity in teachers, and providing teachers with the intellectual and professional background that will be adequate for assignments and also make the teachers adaptable to a changing situation's (FRN, 2004). Teacher Education involves making students in training to acquire requisite knowledge in various subject areas, theories and principles that guides the practice of teaching (Ojediran, 2016). The men and women undergoing teacher education programme are simply referred to as Pre-service teachers. Buabeng, Conner, and Winter, (2016) defined Pre-service teachers as an initial teacher educator who assumes an overwhelming responsibility when preparing to become effective and pedagogically competent classroom practitioners. The Pre-service teacher programme offer education in addition to both Art courses, Social Science and Science courses for instance Physics.

Physics is the most basic and fundamental natural science which involves universal laws and the study of the behaviour and relationships among a wide range of important physical phenomena (Cutnell & Johnson, 2007). Physics also encompasses the study of the universe from the largest galaxies to the smallest subatomic particles. Physics comprises of various aspects such as Mechanics, Thermal physics, Electromagnetism, Modern Physics and Optics which knowledge are very useful in virtually all occupational fields. The Physics learning experiences in schools provided by Physics teachers are therefore very important thereby making Physics teachers to be key factor to be considered when considering development of Physics education in any nation.

The Colleges of Education in Nigeria are the institutions charged with the responsibility of awarding the Nigerian Certificate in Education (NCE) to students after satisfactorily completing minimum of three years of teacher training. The Nigerian Colleges of Education are coordinated by the National Commission for Colleges of Education (NCCE). The NCCE prescribes many programs for the colleges of education, one of which is Physics education. The Federal Ministry of Education, through NCCE publishes a document that entails and serves as a Minimum Standard for Teacher Education programs. The document called Nigerian Certificate for Colleges in Education Minimum Standard stipulate clearly the curriculum contents for all NCE programs. Kuiper *et al.*, (2008) noted that these standards are organized around three broad themes; Professional knowledge, Professional practice and Professional engagement of the minimum standard for best practices in curriculum implementation which agrees with the main focus on training teachers of 21st century with skills. Teacher- training institutions have been critiqued for the inability to produce teachers that are properly grounded in pedagogy and content as well as having the ability to collaborate professionally in a working environment. To this end the NCCE suggested that the curriculum and practicum of initial teacher training programmes at NCE certificate should be based on stipulated standards thereby calling for revision of previous existing NCE minimum standard which in some cases vital courses are either being added or removed as in the case of Optics I in physics (NCCE Minimum Standard, 2012).

However, Optics is one of the main part of Physics which study the transmission of electromagnetic light and its various application (Wardani, *et al.*, 2017). Optics is also an important aspects of Physics which is divided into two parts Optics I for NCE I and Optics II for NCE II but Optics I was removed as a result of review in NCE Minimum Standard. The removal of Optics I is a great concern to Physics education at NCE level, this is because of the importance of the course to the students and the future

learners they will encounter. Optics I provides a good foundation for optics II which is taught to the students at the second year of their NCE program. It is agreed by educational psychologist that learning should be from simple to complex, general to specific so as to ease the understanding of the course. Therefore, Optics I provide the general background for Optics II since optics I covers topics like wave nature, rectilinear propagation of light, reflection, refraction, dispersion, deviation and optical instrument while optics II is an advancement of optics I include topics like wave theory of light, interference, diffraction, polarization and lasers. The second concern is that Optics I comprises of 70% topics in the Senior Secondary School II syllabus hence the pre-service teachers should be taught Optics I, that way pre-service teachers will be able teach Optics concepts in secondary schools effectively. Therefore, Optics I is very important to NCE Physics students for effective teaching and learning in secondary school physics but where there are such omissions in the NCE curriculum contents then an intervention be provided to bridge the gap.

Intervention can simply be defined as the systematic and explicit instruction provided to accelerate growth in an area of identified need (Kaggwa, 2003). In education, Intervention is used to refer to programmes or activities that aim to improve teaching and learning in order to raise achievement and improve learning experiences in education. Intervention can be a method of teaching, new computer assisted packages for Physics Education, altering ways in which Physics curriculum are implemented, new classroom, and laboratory equipment aims at solving or improving the present rate of performance in Physics. Interventions can be provided by both special and general teachers, the interventions are designed to improve performance relative to a specific and measurable goal. Interventions are generally based on valid information about current performance, whereby realistic implementation and ongoing student progress monitoring are essential (Jacob & Gedion, 2015). In another vein Intervention was regarded by Collier, (2016) as both a technique for and a time period during which at-risk students receive targeted instruction to address specific learning needs. The term is sometimes used to refer to the time period following an indication by a teacher, or other concerned person, that the student has some kind of learning or behavior problem. Intervention should be able to address the needs of the students in their institution, given that schools operate in different contexts, also approaches varies according to the school context, Student support programmes, behavior modification, life skills programmes, parental involvement and capacity building are some intervention strategies to enhance students' academic achievement (Kaggwa, 2003).

Achievement is the measures of accomplishment in a specific field of study (Okwara, Anyagh, & Ikyaan, 2017). The authors maintained that achievement of the students is the demonstration of the students' abilities to attain certain levels of instructional objectives outcome of classroom instruction and experience. In the same vein Learning and academic achievement are inseparable in Physics teaching (Aina, 2017). Once learning truly takes place it will be reflected in students' academic achievement. According to Anene (2005) achievement is quantified by a measure of the student's academic standing in relation to those of other students of his age. Academic achievement from different perspectives of numerous authors shows academic achievement to be a key component in education and as a result of that over the years in Nigeria, academic achievement in Physics has been a major focus even within the two genders.

Gender is a fact of being a Male or a Female. The influence of gender in achievement in science education especially Physics is crucial. Various studies for example Jugović, (2017), Nissen and Shemwell, (2016) and Okwara, Anyagh, and Ikyaan, (2017) in the area of gender influence on achievement and interest were inconsistent. Some studies favors males against females in Physics achievement while others studies are in favour of female's students. The males are said to be in right hemisphere spatial reasoning more than the females reasoning, Hence the males dominate Science and Technology courses, while females use more of the left hemisphere of the brain than males, hence perform better in verbal task (James 2011). Girls had a lower self-concept of ability and lower expectancies of success in physics compared to boys, in spite of their higher physics school grades (Jugović, 2017).

Reeves and Honig (2015), investigated the effectiveness of data literacy interventions aimed at promoting educators' use of data to support teaching and learning. pretest-posttest design was used to investigate 64 pre-service teachers' perceptions of the impact of a 6-h data literacy intervention. The study also examined changes in participants' self-reported attitudes and beliefs and objectively-measured data literacy during the intervention. Findings from the study shows that the intervention increased the pre-service teachers' knowledge and skills related to data literacy. The study Ukoh, (2013) titled Determining the Effect of Interactive Invention Instructional Strategy and Gender on NCE Pre-Service Teachers' Acquisition of Science Process Skills, the study determined the effect of interactive invention strategy on NCE pre-service teachers' achievement in physics. The study adopted a quasi-experimental research design with 98 females and 94 males from six colleges of education in South Western Nigeria which constituted the sample. Two research question and two null hypotheses were formulated and tested at 0.05 alpha level. The data were

analyzed using the analysis of covariance (ANCOVA). The result showed there was no significant main effect of gender on pre-service teachers' acquisition of science process skills. This shows that both males and females could do well in the course if they are exposed to appropriate learning situations. Another related study conducted by Alma Williams, (2013) Investigated the effects of intervention using guided questioning on the epistemological and pedagogical content knowledge over six weeks of six undergraduate pre-service teachers in literacy education in university-based reading tutorial. The study was guided by three research questions. The primary data collection tools used to collect data were interviews, observations, and collected artifacts. Shulman's (1987) model of Pedagogical Reasoning and Action was used by the researcher as a coding system to analyze the collected data. The findings from the study, were changes in the undergraduate pre-service teachers' initial ideas about literacy instruction.

Statement of the Problem

The NCE minimum standard specifies among other the facilities, teaching equipment, personnel, number of courses, the topics to be covered in each course including the objectives of the course in all NCE programmes including Physics. Optics I is for NCE I Physics students which helps to provide a background for optics II which they do in their second year of the NCE programme. Optics I knowledge is meant to ease students understanding of optics II which will in turn prepare students for future teaching occupation and in implementing Senior Secondary School Physics Syllabus of optics and also helps the students to perform better in Optics II. The review of 2008 NCE minimum standard resulted in the removal of Optics I for the Year ONE NCE programme course in Physics leaving optics II in the second NCE programme (NCE Minimum Standard, 2012). The reason for the removal was to create space that will accommodate NCE III first semester courses that were reviewed to NEC I second semester so that NCE III can use first semester for Teaching Practice. Optics plays a vital role in the world of technology from optical instruments such as, mirrors, camera, phones, cars headlamp, medical eye classes hence the need for good achievement in optics II (know optic). The previous records on performance in optic has been poor over the years despite its importance. Though many factors such as lack of interest of the students, method of teaching by the lecturer and curriculum content and organization affects students' performance in optics II. While orientation is given to students to address the issue of poor attitude towards Physics, various methods of teaching are also employed in teaching Optics II to improve the students' performance in Optics II, there has been a continuous poor records on the performance of Optics II as seen in empirical evidence from 2015-2018. In a bid to address the present problem in Physics, this study sought to

investigate the impact of intervention course on the achievement of Physics students in Colleges of education in Niger State.

Purpose of Study

The purpose of this study is to investigate the impact of special intervention course on the achievement Physics students in colleges of education Niger state, Nigeria. Specifically, the study will attempt to achieve the following objectives;

- Design a special intervention course as optics I, which will stand as a pre-requisite course for preservice teachers II.
- Examine the impact of special intervention course on the academic achievement of preservice teachers II in Physics.
- Determine the impact of special intervention course on the academic achievement of male and Female preservice teachers II in Physics.

Research Questions

1. What is the impact of special intervention course on the achievement scores of preservice teachers II taught Physics?
2. What is the impact of special intervention course on the achievement scores of Male and Female preservice teachers II taught Physics?

Research Hypotheses

HO₁: There is no significant difference in the mean achievement scores of preservice teachers II taught Physics with special intervention course and those taught without special intervention course.

HO₂: There is no significant difference in the mean achievement scores of Male and Female preservice teachers II taught Physics with special intervention course.

METHODOLOGY

The research design to be adopted for this study was a quasi-experimental design specifically a pretest-posttest control group design. The population of this study comprised of all the National Certificate in Education Two (NCE II) Physics Education Students from all the two Colleges of Education in Niger State with a targeted population of One hundred and Twenty-Eight (128) pre-service teachers who registered for Physics Education during 2019/2020 session (82 Male and 46 Female pre-service). For the purpose of this study a simple random sampling technique was adopted

to assigned the schools that were used as the experimental and the control group respectively. The National Certificate in Education Two (NCE II) intact classes was used for the research exercise. The pre-service teachers in each of the intact class constituted the sample used for the study as an experimental or the control group (43 and 38 respectively).

The instrument used in collecting data for this study was Optics Test Instrument. The Achievement Test instruments was developed by the researcher and named as Optics Achievement Test (OAT) which contained forty (40) multiple choice items with five options (A-E). The forty (40) items of the Optics Achievement Test developed by the researcher and was subjected to validation from two lecturers in Physics Education, from Niger State College of Education, Minna and Federal College of Education Kontagora to ascertain its validity. For the purpose of reliability of the research instrument, a pilot test was conducted to test the reliability of the test instrument. The trial test was conducted in College of Education, Zuba. A total number of forty 40 (20 Male and 20 Female) NCE II Physics Education Students composed a class, where the marks obtained was use to get the reliability coefficient of the Optics Achievement Test (OAT). The results of the first and the second test were marked and subjected to Pearson's Product Moment Correlation Coefficient (PPMC) for a reliability coefficient of the research instrument and a reliability index of 0.96 was obtained which indicated a strong correlation coefficient for the Optics Achievement Test (OAT) instrument.

Three different methods were used in the collection of data for the study. Pretest was used in the collection of data that determined the entry behavior of the students before the administration of the treatment. After the pretesting, a posttest was used in the collecting data which was used to answer the research questions stated above and also same data collected was used to test the stated hypotheses above at 0.05 alpha level of significance. The data was analyzed using mean, standard deviation to answer the research questions One and Two. Analysis of variance (ANOVA) was used for the testing of hypothesis One and Two at 0.05 significant level using the data obtained from pretest and posttest. A computer software statistical package for social science (SPSS) version 23.0 was used for the analysis.

RESULTS

1. What is the impact of special intervention course on the achievement scores of preservice teachers II taught Physics?

Table 1. Means and Standard Deviation of the Experimental and Control groups in Achievement Test

Groups	N	Pre-test		Post-test		Mean Difference
		\bar{x}	SD	\bar{x}	SD	
Experimental	43	11.95	3.02	22.14	3.32	10.19
Control	38	11.48	3.13	12.82	3.27	1.34

The data presented in Table 1 shows that the experimental group had a mean score of 11.95 and standard deviation of 3.02 in the pre-test and a mean score of 22.14 and standard deviation of 3.32 in the post-test making a pre-test post-test difference in the experimental group to be 10.19. The control group had

a mean score of 11.48 and a standard deviation of 3.13 in the pre-test and a post-test mean of 12.82 and a standard deviation of 3.27 with a pre-test posttest difference of 1.34. With this result, the students in the experimental group performed better in the achievement test than the students in the control group.

2. What is the impact of special intervention course on the achievement scores of Male and Female preservice teachers II taught Physics?

Table 2. Means and Standard Deviation of Achievement Mean Score Male and Female Groups of Students Taught Physics in Special Intervention Course

Groups	N	Pre-test		Post-test		Mean Difference
		\bar{x}	SD	\bar{x}	SD	
Male	26	10.23	2.01	22.96	3.24	12.73
Female	17	14.59	2.32	20.88	3.12	6.29

Results in Table 2 shows that male group had a mean score of 10.23 and standard deviation of 2.01 in the pre-test and a mean score of 22.96 and standard deviation of 3.24 in the post-test making a pre-test post-test score difference in male group to be 12.73. On the other hand, the female group had a mean score of 14.59 and standard deviation of 2.32 in the pre-test and a mean score of 20.88 and standard deviation of 3.12 in the post-test making a pre-test post-test difference of 6.29. The results show that there is a difference between

the mean achievement scores of male and female students when exposed to experimental condition in favour of the male students.

Research Hypotheses

HO₁: There is no significant difference in the mean achievement scores of preservice teachers II taught Physics with special intervention course and those taught without special intervention course.

Table 3. Summary of Analysis of Variance (ANOVA) for Posttest between Experimental and Control Groups

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1753.670	1	1753.670	161.304	0.000
Within Groups	858.873	79	10.872		
Total	2612.543	80			

*Significant at $P < 0.05$

Table 3 The result reveals that there was a significant difference in the mean scores of Experimental and Control Groups with $F(1, 80) = 161.304, p < 0.05$. Hence the null hypothesis stated was rejected.

HO₂: There is no significant difference in the mean achievement scores of Male and Female preservice teachers II taught Physics with special intervention course.

Table 4. Summary of Analysis of Variance (ANOVA) for Posttest between Male and Female Students.

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	44.437	1	44.437	4.351	0.043
Within Groups	418.726	41	10.213		
Total	463.163	42			

*Significant at $P < 0.05$

Table 4 The result reveals that there was significant difference in the mean scores of male and female students that were taught Physics in Special Intervention Course $F(1, 42) = 4.351, p < 0.05$. Hence the null hypothesis stated above was rejected.

DISCUSSION OF FINDINGS

Hypothesis One, the summary analysis of the Posttest means scores of Experimental and Control Groups using one-way ANOVA statistics in SPSS. A p-value of 0.00 was reported indicating a difference between experimental and control groups. This reveals that there was a significant impact on the mean achievement scores of Experimental and Control Groups. Hence the null hypothesis stated above was rejected. The differences might be as a result of Optics I course content that was embedded in the special intervention course taught during the study which make these findings in line with the work of Sara, (2013); Alma, (2013); Lambert and Spinath, (2014); Isaac, *et al.*, (2014); Reeves, *et al.*, (2015) and Thomas, *et al.*, (2016) that indicates a higher gain in achievement as result of intervention strategies use.

Hypothesis Two, the analysis of the mean scores of Male and Female preservice teachers that were taught Physics in the special intervention course using one-way ANOVA statistics in SPSS. A p-value of 0.04 was reported indicating a difference between Male and Female preservice teachers. This reveals that there was a significant impact on the mean achievement scores of Male and Female preservice teachers II taught Physics with special intervention course in favour of Male preservice teachers, hence the null hypothesis stated above was rejected. The outcome might be as a result of Male preservice teachers being more actively involved in learning Physics because the Female counterpart have high tendency of shying away from Mathematical aspects of Physics. This confirm with the study of Aina and Joseph, (2017); Chibabi, *et al.*, (2018) and in disagreement with the findings of Ukoh, (2013); Josiah, (2012); Aina, (2017) their findings show that both Male and Female preservice teachers have no differences in Physics achievement.

CONCLUSION

This study revealed that, special intervention course improved the achievement of preservice teachers in Physics and it also revealed that special intervention course improved the achievement of both Male and Female preservice teachers in Physics. Since the use of special intervention course improve achievement of preservice teachers in such a limited period of time, it can then be concluded that under normal classroom setting the use of this additional instructional process have proven to be efficient and effective.

RECOMMENDATIONS

In line with the findings of the study, the following recommendations were made:

1. NCCE should adopted the use of Special Intervention Course pending the reintroduction of Optics I into NCE Minimum Standard of Physics and other subjects.
2. Preservice teachers and other teachers should endeavour to use special intervention course in their places of primary assignment since it improves both the academic achievement of regardless of the gender of the students.
3. Government and Non-Governmental organisations should create avenue for teachers to be enlightened on the importance of special intervention course as instructional strategy to improve learning in schools.

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