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EFFECTS OF CONVENTIONAL TEACHINGMETHOD ENRICHED WITH VISUAL INSTRUCTIONAL MATERIALS ON ACADEMIC PERFORMANCE AMONG SECONDARY SCHOOL PHYSICS STUDENTS IN KADUNA-NORTH, KADUNA, NIGERIA

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Abstract

The study investigated the Effects of Conventional Teaching Method Enriched with Visual Instructional Materials on Academic Performance among Secondary School Physics Students in Kaduna-North Local Government Area, Kaduna, Nigeria. The study was guided by two research objectives, two research questions and two null hypotheses. A sample of 225Physics students from two co-educational public secondary schools in Kaduna-north local government area were randomly selected from the total population of 3489Physics students. This study adopted pre-test and post-test quasi- experimental design. Two groups were formed: the Experimental group and the Control group. The students in the Experimental group were taught Physics concepts using Conventional Teaching Method Enriched with Visual Instructional Materials while the students in the control group were taught the same concepts using conventional method. A validated instrument named Physics Performance Test (PPT) with reliability index of .87 was used during the pre-test and post-test for data collection.A measure of internal consistency (Cronbach's alpha)was used to determine the reliability coefficient of PPT. The sets of data collected from the administrations of the instrument were analysed. The two research questions were answered using mean and standard deviation while the null hypotheses were tested at 0.05 level of significance using independent sample t-test statistical tool. The result obtained from data analysis indicated that, students in the Experimental group performed significantly better than those in the Control group academically. The result also showed that, female students in the Experimental group performed significantly better than the male students of the same group. Based on the findings, this study concluded that, using Conventional Teaching Method Enriched with Visual Instructional Materialism teaching and learning of Physics enhances the students' academic performance and is gender-bias in favour of female students. The study recommended

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among others that teachers should be encouraged to use Conventional Teaching Method Enriched with Visual Instructional Materials in teaching and learning of Physics especially in single sex (female) schools.

Keywords: Academic Performance Conventional Teaching Method, Visual Instructional Materials.

Introduction

Education is a crucial element for the development of every individual in particular as well as every nation at large. Without education, no nation or individual can lead a good life (Shabiralyani, Hasan, Hamad & Iqbal, 2015). Particularly, science education has been of great importance world-wide. Science can be described as the universal vehicle for human development and civilization. Science involves the act of explorations and investigations of natural world with the aim of understanding and learning more about the world (Isa, 2025). According to Musa (2021), nations can be classified into developed, developing and underdeveloped by the number of physicists, chemists, pharmacists, doctors, agricultures and science educators the nations could produce. This shows that sustainable socio-economic standard as well as technological advancement of any nation like Nigeria hinges on a reasonable investment in science education. In fact it is visible in the 21stcentuary, science and technology help nations ,particularly in the middle-east of the world to promote self-defence, self-reliance ,economic efficiency and the overall wellbeing of humanity through scientific and technological inventions. Hence, science subjects must be taught in a meaningful manner. The science subjects taught in Nigerian secondary school include Chemistry, Biology and Physics.

Physics is a core science in Nigerian senior secondary schools. Physics deals with the study of laws that, determine the structure of the universe with reference to matter and energy in the universe (Musa, 2021).Atadoga, Mari and Danjuma, (2016) define Physics as the soul of science that, plays a vital role in all human endeavours and serves as a pre-requisite subject for courses such as medicine, geology, computer engineering, forestry, space navigation, agricultural science, pharmacy, among others. In other word, at least a credit pass in SSCE is required to study physical and life science related discipline in Nigerian tertiary institutions. According to Anifalaje, Falalu, Musa and Yusuf, (2022), Physics plays predominant role in the scientific development of nations as it has been identified as the generator and the bedrock of fundamental knowledge of science and technology. This clearly shows that, Physics plays very important roles in the individual and national development. Therefore, academic performance in Physics is a subject of great concern.

Academic performance refers to how well an individual learner is able to accomplish a set of evaluation tasks or demonstrate desired abilities. Academic Performance is seen as the exhibition of knowledge attains or skills developed by students in a subject designed by test scores assigned by teachers(Ruma, 2021). Hence, academic performance can be defined as the scores that, students obtain in the cause of evaluation at the end of a programme or an instruction. According to Musa (2021), the quality of scores on the part of students' academic performance in science is influenced by a number of factors which raise it or improve it to the desired level or standard. Academic performance occupies a very important place in continuing higher education as well as in the selection and placement in any organization and institution. The success of any educational programme depends largely on level of success in students' academic performance recorded (Ezeaghasi, 2017). However, several factors had been attributed to poor academic performance among Nigerian secondary schools' Physics students which include the dominancy

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of conventional teaching method among Nigerian secondary schools' Physics teachers (Sani, 2025).

Conventional teaching method otherwise known as teacher-centred method can be defined as a teaching method by which the teacher presents and explains the new material with no or less active participation of the students. Musa (2024) referred to conventional teaching method as the technique that, involves the teacher in complete verbal instruction or exposition. In this method of teaching, the teacher do most of class-room activities and the students are given less opportunity to participate in the learning process (Musa, 2012). Several studies reported ineffectiveness of conventional teaching method in science related disciplines (Physics inclusive). However, several researchers such as LamiandShaorga(2023) query the absent or inappropriate use of instructional materials.

Instructional materials are essential tools needed for teaching and learning of subjects matter to promote teachers' efficiency and improve students' academic performance. Olayinka (2016) defined Instructional materials as those materials used for practical and demonstration in the class situation by students and teachers. Instructional materials make learning more interesting, practical, realistic ,and appealing; enable both the teachers and the students to participate actively and effectively in lesson sessions; give room for acquisition of skills and knowledge as well as development of self-confidence and self-actualization (Dalali&Mwila, 2022). Instructional materials assist teachers to present lessons to the learners in a logical manner and can be classified into auditory, audio-visual and Visual Instructional Materials.

Visual Instructional Materials are tools that help to make lessons clearer or easier to understand and reduce or eliminate the abstract nature of subject matter. According to Dalali and Mwila (2022), defined Visual Instructional Materials as those devices which are used in classrooms to encourage students learning process and make it easier and interesting; they are those sensory objects or images which initiate or stimulate and support learning. Visual instructional materials can be defined as those instructional materials that can be used through the sense of vision. There are many visual instructional materials available for teaching and learning of science (Physics inclusive). These materials include pictures, models, flannel board, flash cards, bulletin board ,charts, maps, videos, slides, real objects, overhead projectors among others. According to Shabiralyani, Hasan, Hamad and Iqbal(2015)Visual Instructional Materials are the best tools for making teaching effective and the best dissemination of knowledge. This shows that, enriching conventional method with Visual Instructional Materials may improve students' academic performance in Physics .Hence, the present study investigated the Effects of Conventional Method Enriched with Visual Instructional Materials on Academic Performance among Secondary School Physics Students in Kaduna-North Local Government Area, Kaduna, Nigeria.

Gender is another variable in the current study. Gender is the state of being male or female with reference to social or cultural differences. The role of gender in academic performances has led many researchers to carry out studies on it. Gender differences in science can be attributed to the fact that, from birth the girl child is exposed to avoid science. The societal set-up does not give

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equal opportunities for male and female to explore and experience the environment, which is the pre-requisite to learning of science; rather, kept females in-doors to do the housework while males are assigned to out-door labour. According to Musa (2024), females are not only under-represented in science but their levels of achievement in science and technology is low compared to their male counterparts. As such, gender is included in the present study.

Statement of the Problem

There is an urgent need to improve the quality of students' academic performance in Physics among Nigerian secondary schools to bridge the gap between developed, developing and underdeveloped nations. Physics as a core science in senior secondary schools plays important roles asit generates the fundamental knowledge needed for the future scientific and technological advancement that will continue to drive the economics engine of world (Anifalaje, Falalu, Musa & Yusuf, 2022). Despite the importance of Physics to national development, the academic performance and patronage in the subject are not encouraging over the years. According Musa (2021), Physics has been suffering from low patronage and poor academic performance in both internal and external examination within and outside the country over the years. Based on the stated reports, poor academic performance in Physics has been identified over years and may be attributed to the abstract nature of Physics concepts. Researchers such as Shabiralyani, Hasan, Hamad and Iqbal(2015), Dalali and Mwila (2022) ;Lami and Shaorga (2023) disclosed that, Visual instructional materials are the best tool for making teaching effective and the best dissemination of knowledge. Gender is another factor of great concern among educators and researchers. According to Musa (2024),females are not only under-represented in science but their levels of achievement in science and technology is low compared to their male counterparts. Hence, issue of gender is address in this study. Based on this background, the study ascertained the Effects of Conventional Method Enriched with Visual Instructional Materials on Academic Performance among Secondary School Physics Students in Kaduna-North Local Government Area, Kaduna, Nigeria

Objectives of the study

The study broadly aimed at determining the Effects of Conventional Method Enriched with Visual Instructional Materials on Academic Performance among Secondary School Physics Students in Kaduna-North Local Government Area, Kaduna, Nigeria. The specific objectives of the study were to:

1. ascertain the Effects of Conventional Method Enriched with Visual Instructional Materials on Academic Performance among Secondary School Physics Students in Kaduna-North, Kaduna, Nigeria and
2. determine the Effects of Conventional Method Enriched with Visual Instructional Materials on Academic Performance of male and female Secondary School Physics Students in Kaduna-North, Kaduna, Nigeria

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Research Question

The following research questions were addressed by the present study:

1. What is the difference between the mean academic performance scores of students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials and those taught the same concepts using conventional methods?
2. What is the difference between the mean academic performance scores of male and female students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials?

Null Hypotheses

The following null hypotheses are formulated based on the research questions for testing at $P \leq 0.05$ levels of significance.

$H0_1$: There is no significant difference between the mean academic performance scores of students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials and those taught the same concepts using the conventional method.

$H0_2$: There is no significant difference between the mean performance scores of male and female students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials.

Methodology

This study adopted pre-test and post-test quasi-experimental research design. The design involves the use of two groups, one as experimental group and the other as control group. Both groups were pretested before giving the treatment. The experimental group (EG) was taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials while the control group was exposed to the same concepts using conventional method for the same period. A post-test was administered to both groups in other to determine if there would be any significant difference in students' academic performance between the groups in the concepts taught.

The population of the current study comprised all public co-educational Senior Secondary Schools two (SSII) Physics students in Kaduna-north local government. Senior Secondary two (SSII) students were used for the purpose of the present study. Co-educational Senior Secondary Schools were used for the purpose of the study as the schools comprised both male and female students which helped in tapping information for addressing gender related issues. There were 14 public co-educational Senior Secondary Schools offering Physics in Kaduna-Nouth local government area with total population of 3,489 students out of which 1,428were males and 2,061 were females.

The sample of the present study was selected using simple random sampling technique. The name of each of the 14 public co-educational Senior Secondary Schools were written in a piece of paper, squeezed, put in a container and shuffled. One piece of paper was picked at a time and reshuffled in each case until four papers were selected. The names that appeared on those papers

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were pretested to ascertain the academic equivalent or parity among the schools. The scores were analysed using analysis of variance (ANOVA) by which two academically equivalent schools in the Physics concepts A and B were randomly tagged as experimental and control group respectively using tossing of coin. The students in the experimental group and the control group were 118 and 107 respectively. Therefore, this study consisted of 225 students which are viable for a quasi-experimental research based on the recommendation of Tuckman (1975).

In each of the two schools selected, intact class was used for both instrument and treatment administrations. The experimental group was taught the Physics concepts by the researcher and two research assistants (for effectiveness and efficiency of the treatment) using Visual Instructional Materials while the control group was exposed to the same concepts using conventional method for the same period.

The pre-test result of both the experimental and the control groups were stored as pre-test data. After the treatment, a post-test was administered to both groups. The results collected from the post-test administration were stored as post-test data. A validated instrument named Physics Performance Test (PPT) with reliability index of .87 was used during the pre-test and post-test for data collection.

The two sets of data were used for data analysis. The sets of data collected from the administrations of the instrument were analyzed using appropriate statistical tools. In order to answer the research questions, mean and standard deviation were used while the null hypotheses were tested using t-test statistical tool at 0.05 level of significance.

Result

The research questions were answered using mean and standard deviation while the null hypotheses were tested using independent samples t-testat 0.05 level of significance.

Research Question One: What is the difference between the mean scores of students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materialsand those taught the same concepts using conventional methods?

To answer this research question, the post-test academic performance scores of experimental and control groups were subjected to descriptive statistics. Mean and standard deviation were calculated and used to draw Table 1.

Table 1: Mean and Standard Deviation of the Post-test Scores of the Experimentaland Control Groups:

Groups	n	Mean	Std. Deviation	Mean Difference
Experimental	118	14.43	3.81	
				2.39
Control	107	12.05	5.28	

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The results from Table 1 show that, the mean academic performance scores of the experimental and control groups were 14.43and 12.05respectively. The standard deviation of the experimental and control groups were 3.81 and 5.28 respectively. The mean difference was 2.39. This means the experimental group performed higher than the control group, and this could be attributed to the different treatments received by the groups.

$H0_1$: There is no significant difference between the mean academic performance scores of students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials and those taught the same concepts using the conventional method.

To test the hypothesis, the mean academic Performance scores of students in the experimental and control groups were subjected to independent sample t-test and the summary of analysis is shown in Table 2.

Table 2: Summary of the t-test Analysis of the Mean Academic Performance Scores of Experimental and Control Groups:

Groups	N	Mean	S.D	Df	P-value	Decision
Experimental	118	14.43	3.81			
				223	0.00	Significant
Control	107	12.05	5.28			

Significant at P≤0.05

The experimental group has higher mean scores of 14.43 as compared to that of control group with mean scores of 12.05. The p-value 0.00 which is less than 0.05 level of significance at 223 degree of freedom. Hence, the null hypothesis is rejected. This means that, there is significant difference between the mean academic performance scores of students taught Physics concepts using Visual Instructional Materials and those taught the same concepts using the conventional method (P=0.00 at α≤0.05).

Research Question Two: What is the difference between the mean academic performance scores of male and female students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials?

To answer this research question, post-test scores of the experimental group were sorted according to gender and subjected to descriptive statistics. Mean and standard deviation were computed and used to draw Table 3.

Table 3: Mean and Standard Deviation of the Post-test Scores of Male and Female Students Taught Physics Concepts Using Visual Instructional Materials.

Groups	N	Mean	Std. Deviation	Mean Difference
Male	28	12.46	3.31	

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					2.58
Female	90	15.04	3.76		

Results from Table 3 show that, the mean academic performance scores of the male and female students were 12.46 and 15.04 respectively. The mean Difference is 2.58.This means that female students performed higher than the male students and this may be attributed to the gender differences between male and female students in the experimental group.

$H0_2$: There is no significant difference between the mean academic performance scores of male and female students taught Physics using Conventional Method Enriched with Visual Instructional Materials.

To test this hypothesis, the mean academic performance scores of the students in the experimental group were subjected to independent sample t-test and the summary ofthe analysis is shown in the Table 4.

Table 4: Summary of the t-test Analysis of Post-test Means Scores of Male and Female Students in the Experimental Group.

Groups	n	Mean	S.D	Df	P-value	Decision
Male	28	12.46	3.31			
				116	0.00	Significant
Female	90	15.04	3.76			

Significant at P≤ 0.05

The male group has higher mean scores of 12.46 as compared to that of female group with mean scores of 15.04. The p-value 0.00 which is less than 0.05 level of significance at 116 degree of freedom. Hence, the null hypothesis is rejected. This means that, there is significant difference between the mean academic performance scores of male and female students taught Physics using Visual Instructional Materials.

Major Findings of the Study:

Based on the results obtained from the analysis, the followings were the major findings of the present study:

i There is a significant difference between the mean academic performance scores of students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials and those taught the same concepts using the conventional method in favour of the experimental group.

ii There is a significant difference between the mean academic performance scores of male and female students taught Physics concepts using Conventional Method Enriched with Visual Instructional Materials.

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Discussion of Results

The study ascertained the effects of Conventional Method Enriched with Visual Instructional Materials on academic Performance among Secondary School Physics Students in Kaduna-north, Kaduna, Nigeria. To achieve this aim, students in the experimental group were taught Physics concepts using visual instructional materials while students in control group were taught the same concepts using conventional method. Therefore, the observed differences in the result were due to the different treatments. Hence, the results obtained from the data analysis were hereby discussed.

The result of the analysis presented in Tables 1 and 2 showed that the students taught Physics concepts using Visual Instructional Materials performed significantly higher than the students taught the same concepts using conventional method. The present result is in agreement with the findings of Olayinka (2016) who investigated the effects of Instructional Materials on secondary schools students' academic achievement in social studies in Ekiti state, Nigeria. The study concluded that, students who were taught with instructional materials performed better than those taught without Instructional Materials. This result is also in line with that of Dalali and Mwila (2022) who investigated the effects of Visual aids in enhancing teaching and learning process in public secondary schools in Ilemela Municipality, Tanzania. Specifically, the study described Visual Instructional Materials used by teachers during the teaching and learning process and found out the views of teachers and students about the effects of using Visual Instructional Materials in the teaching and learning process. The current study concluded that, the use of visual instructional materials in the teaching and learning process is very important because it simplifies the concepts taught. The result is also in line with that of Lami and Shaorga (2023)who determined the effects of Instructional Materials on Physics students' attitude and their academic achievement. The findings of the research revealed that instructional materials had a very great influence on the teaching and learning of Physics in senior secondary school.

The analysis of the mean performance scores in Tables 3 and 4 showed that, there is a significant difference between mean academic performance scores of male and female students taught Physics concepts using Visual Instructional Materials. The finding indicated that, gender had effect on teaching and learning Physics concepts using Visual Instructional Materials. The finding disagreed with that of Olayinka (2016) who investigated the effects of instructional materials on secondary schools students' academic achievement in social studies in Ekiti state, Nigeria. The study found that gender effect was not statistically significant in social studies. The disagreement may lays on the fact that, the study was based on concepts of social studies while the present study was based on Physics concepts which encourages group interactions or activities. However this finding agreed with that of Lami and Shaorga (2023)who determined the effect of instructional materials on Physics students' attitude and their academic achievement. The findings of the research revealed that, there is a significant difference between the mean academic performance scores of male and female students taught Physics concepts using instructional materials.

Conclusions

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Based on the findings of this study, it was concluded that, using Conventional Method Enriched with Visual Instructional Materialism teaching and learning of Physics enhances the students' academic performance. The study also concluded that, using Conventional Method Enriched with Visual Instructional Materialism teaching and learning of Physics promotes the academic performance of female students better than that of male students as it is found to be gender-bias in favour of female students.

Recommendations

Based on the findings of this study, the study recommended that, the use of Conventional Method Enriched with Visual Instructional Materials should be encouraged among secondary school Physics teachers because from this study, Conventional Method Enriched with Visual Instructional Materials was found to be very effective in enhancing meaningful learning of Physics concepts. The study also recommended that, professional bodies such as Science Teachers Association of Nigeria (STAN) and Mathematics Association of Nigeria (MAN) should emphasize the use of Conventional Method Enriched with Visual Instructional Materialism teaching and learning of science. Finally, the study recommended that state government should embark on training and retaining of Physics teachers on the use of Conventional Method Enriched with Visual Instructional Materials through seminars, workshops.

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