

EFFECTS OF INQUIRY-BASED METHOD AND COMPUTER-ASSISTED-INSTRUCTION ON STUDENTS' PERFORMANCE IN PHYSICS IN NIGERIA FEDERAL GOVERNMENT COLLEGES

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Abstract

The study focused on Effects of Inquiry-Based Method and Computer-Assisted Instruction on Students' Performance in Physics in Southwest Nigeria Federal Government Colleges. The purpose of the study was to compare the effectiveness of Inquiry-Based method and Computer-Assisted-Instruction method on students' achievement in physics. A quasi-experimental design of the three groups pre-test, post-test, control design was employed. The treatment groups include the Computer-Assisted-Instruction group and Inquiry-Based method group. The CAI group was thought using Instructional package while the Inquiry-Based method group was exposed to questioning, searching and examining of books, investigating and probing. The sample for the study consisted of 90 senior secondary school (SSS) class two Physics students who were randomly selected from three Federal Government Colleges in Southwest Nigeria. Two null hypotheses were raised for the study and tested using one way ANOVA and Analysis of Covariance ANCOVA respectively. The study ensured the homogeneity of the three groups. The study showed that Inquiry-Based method is the best among the three and that Computer Assisted Instruction group performed better than the Conventional group.

Key words: Physics, Achievement, Inquiry-Based method; Conventional method, Computer-Assisted-Instruction.

Introduction

The pursuit of science as an imperative effort for achieving prosperity and advancement is conspicuous in many national development plans in both develop and developing countries. This trend has been to produce scientifically literate citizens among a sizeable proportion of the society. For Nigeria to realize accelerated development in the 21st century, she needs qualitative science education in schools, especially Secondary Schools.

Science is an organized body of knowledge in forms of concept, laws, theories and generalization (Urevbu, 2001). One of the objectives of science is to develop students' interest in science and technology. The teachers are expected to devise ways of making their students develop positive attitude toward science and science related disciplines.

Most importantly, teachers need to get used to teaching methods that will help students achieve their learning objectives. Teachers must be aware that many factors contribute to the overall performance of students, notable among these are teachers' personality, learning environment, availability/choice of instructional materials, students' attitude to learning and the teachers' methodology.

In recent years, the issue of how science is taught to individual especially to students, has been more important than it used to be since the idea about the nature of scientific knowledge has radically changed owing to the work of epistemologist. The focus on the nature of science and scientific inquiry in science education in the world is rapidly increasing (Osborne, Smith & Collins, 2003). Science, being a fundamental part of everyday life and essential to our understanding of the world, teaches us a way of finding out about the world.

Physics in particular is central to the field of human endeavours and is a branch of science that is concerned with the properties of matter and energy and the relationship between them. Physics is very critical to technological development and as such, its teaching and learning must be a matter of national concern. Physics is considered a difficult subject by many students and teachers because they face many difficulties in teaching and learning process (Owolabi & Ogini, 2013). Before a teacher can succeed in teaching, he has to improve his/her method of teaching.

The importance attached to Physics by Federal and State Governments in Nigeria has been clearly stated in section five of the revised version of the National Policy on Education (FRN, 2004). The inclusion of Physics as a core subjects for Science bound students within Nigeria Education System calls for studies on how to teach it effectively.

Skillfulness in science and technology could easily be discovered in young learners when investigative or Inquiry-Based method is used in teaching and learning Physics. Inquiry learning involves developing questions, making observations and doing research to find out what information is already recorded. It also involves developing instruments for data collection, collecting, analyzing, interpreting data and outlining possible explanations and creating predictions for future study. (Ashiq, Azra and Muhammad, 2011). Inquiry-Based method is also defined as the method of teaching, where the learner, with minimum guidance from the teacher, seeks to discover and create answers to a recognized problem through procedure of making a diligent search (Adedoyin, 1990). Inquiry equally has a learning goal and teaching approach. The students are engaged in learning through Inquiry-Based Method which is helpful for increasing their learning in scientific concepts, positive reception of how students know what to know in science subjects and their nature. The goal of Inquiry-Based learning contains ability to understand the Science subjects by Inquiry-Based method.

Computer-Assisted-Instruction (CAI) is one of the teaching methods that can be used in teaching Physics. The concept of CAI originated from the

presentation of program instruction through computer. The development of Computer-Assisted-Instruction transforms the application of Computer in education from the simple administration of record keeping and student scheduling procedures into a widely implemented method of instruction (teaching). Chen (2006) was of the opinion that CAI is becoming a more and more widespread used method and it has been very relevant at teaching difficult subjects in Science, most especially Physics and Mathematics. Computer-Assisted-Instruction has been defined by Collete & Collete, (2001) as a method, which uses Computer in learning media, strengthening students motivation and educational process. It gives the students and teachers the opportunities to learn at their own speed and combine active learning with Computer technology. Steinberg (2000) opined that CAI has many methods incorporated into it. These include direct and exploratory lessons, drills, games and simulations. The learning takes place through the students' interaction with Computer and appropriate feedback.

The specific objective of this study is to compare the effect of Inquiry- Based method and Computer-Assisted-Instruction method on students' achievement in Physics in Federal Government Colleges.

Hypotheses:- Two Null hypotheses were formulated for this study

HO₁: There is no significant difference in the Pre-test achievement mean scores of Physics students in the three groups

HO₂: There is no significant difference on the Post-test achievement mean scores of Physics students in the three groups.

Materials and Methods

The study adopted the quasi- experimental design using Pre-test, Post- test three groups design. The three groups were:

- Inquiry-Based Method (IBM) group which was exposed to learning Physics through posing questioning, searching of books and investigative approach.

- Computer-Assisted-Instruction group which was exposed to Computer instruction Packages
- Conventional group, the third group was exposed to classroom teaching.

The design of the study is as follows;

Inquiry Based Method group

$G_1 \quad O_1 \quad X \quad O_2$

Computer-Assisted Instruction group

$G_2 \quad O_3 \quad Y \quad O_4$

Conventional group

$G_3 \quad O_5 \quad - \quad O_6$

The third group is used as the Control group.

The subjects for the study comprised 90 senior secondary school two (SS2) Physics students randomly selected from the fourteen (14) Federal Government Colleges in Southwest Nigeria. The multistage sampling technique was used to select the sample. The first stage involved the selection of the three States within the 6 Geo-political states in South-west which include Oyo, Osun and Ekiti State. The second stage involved the selection of three Federal Government Colleges from each selected State, using purposive random sampling. The third stage was the selection of 30 students from each school using stratified random techniques. Two of the schools were assigned to the experimental groups while the remaining one was assigned to the Control group.

The instrument used to gather data for the study was a Physics Achievement Test (PAT). The

Instrument consisted of 40 Objective test items which was constructed by the researcher based on the topics in the package. These include Projectile, Linear Momentum, Production and Propagation of Light waves (Reflection and Refraction). The instrument was subjected to screening by experts in Physics to ensure face and content validity procedures.

The reliability of the instrument was ascertained using test-retest method, the reliability coefficient of 0.85 was obtained at 95% level of significant which was adjudged high enough for the study of this type

The research was carried out in three stages, administration of Pre-test, the treatment and Post-test administration. The students in the groups were exposed to different treatments. Group G_1 was exposed to investigative method, searching books and asking questions on the topics given, i.e Inquiry Based Method. Group G_2 , the Computer-Assisted-Instruction were taught using the specifically designed package; and the third Group G_3 was exposed to Conventional method for a period of six weeks. All the students in the three groups attempted the Pre-test, Post-test before and after the treatment respectively. The performances of the students were analyzed using Inferential Statistics. One-way Analysis of Variance was used to test the Hypothesis 1. While Analysis of Covariance was used to test for Hypothesis 2 raised for the study.

Results

Hypothesis 1 was tested using one-way ANOVA (F-statistics) at 0.05 level of significance (Table 1).

Table 1: ANOVA showing achievement mean scores of students in three groups before treatment.

Source of Variation	SS	df	MS	F_{cal}	p	Results
Between group	32.822	2	16.411	2.660	0.076	Not significant
Within group	536.733	87	6.169			
Total	569.556	89				

$P > 0.05$

The F-calculated value (2.660) was less than F-table (3.070), $P = 0.076 > 0.05$. This means that the null hypothesis was not rejected. This implies that there was no significant difference in the achievement means scores of students in three groups before treatment. Hence, the equality of the baseline knowledge of the sample prior to the treatments is hereby established for the three

groups involved in the study. It was then concluded that the students selected for the study were homogenous

Hypothesis 2 was tested using Analysis of Covariance (ANCOVA). F-Statistics at 0.05 level of significance. (Table 2).

Table 2: ANCOVA showing Post-test achievement mean scores of students in the three groups after treatment.

Source of variation	SS	df	MS	F _{cal}	P	Result
Corrected Model	2354.044	3	784.681	47.642	0.000	Significant
Covariate (pretest)	7.977	1	7.977	0.484	0.488	Not Significant
Group	2295.031	2	1147.515	69.671*	0.000	Significant
Error	1416.456	86	16.470			
Corrected total	3770.500	89				
Total	36833.000	90				

* $P < 0.05$

In Table (2), the calculated value of F-cal = (69.671), $P = 0.000 < 0.05$. This means that the null hypothesis was rejected, implying that there was significant difference in the Post-test mean scores of students in the three groups after treatment.

A post-hoc analysis on pairs of the group significant differences was carried out using Scheffe's analysis. The result is presented in Scheffe's summary as shown in table 3.

Table 3: Scheffé Post-hoc analysis of students' achievement in Physics in three groups

Groups	Control	Computer-Assisted Instruction	Inquiry	N	Mean
Conventional method		*	*	30	12.30
Computer-Assisted Instruction			*	30	20.67
Inquiry-based method				30	24.53
Total				90	19.17

* $P < 0.05$

Table 3 revealed that there was significant difference between the achievement mean scores of students in the Computer-Assisted- Instruction and Control group at 0.05 level of significance. Similarly, the mean difference between the achievement of students in the Inquiry and Control, Computer-Assisted Instruction and Control groups were statistically significant at 0.05 significant level in each case. The results above revealed that the Inquiry-Based Method was the most effective method. This implies that

Inquiry-Based Method had the greatest effect on Students' achievement in Physics.

Discussion

The findings of this study revealed that students' achievement in Physics both experimental and control groups in Pre-test were low and did not differ statistically. This implies that there was no significance difference in the Pre-test mean score of the students in the experimental groups (Computer- Assisted- Instruction and Inquiry-Based method group) and Control group

(Conventional group). This established the homogeneity of the three groups involved in the study prior the treatment. In other word, it could be said that the knowledge baseline for the groups involved in the study were equal.

The findings of the study also showed that there was significant difference in the achievement mean scores of the groups after the treatment. This implies that there was improvement in the performance of the students resulting from their exposure to the treatment. The implication is that the use of Inquiry-Based method and Computer-Assisted-Instruction are teaching strategies for enhancing students' achievement in Physics. The study further found out that there was significant difference in the performance of students exposed to Computer-Assisted-Instruction and Inquiry-Based method whereby the students exposed to Inquiry-Based method performed better than those exposed to Computer-Assisted Instruction. This is in agreement with Ashiq (2011) that students assimilated and accommodated information better when they are left alone to make observation, pose questions, examine books and other source of information which include experimental evidences, use tool to gather, analyze and interpret data, propose answer, explain predictions and communicate the results. Alexander(2001) also reported that students' achievement and motivation for the study of Physics improves tremendously if the students are active participants in constructing their own knowledge through self -learning strategies using CAI and applying such knowledge to analyze Scientific processes. Azar and Sengulec (2011) asserted that CAI materials are more effective in developing favourable attitude and in capturing students' interest toward learning Physics.

The result of this research work therefore revealed that Computer-Assisted-Instruction is better than Conventional method but among the three tested groups Inquiry-Based method of instruction is the best.

Conclusion and Recommendation

The study concluded that there is significant difference in students' achievement mean scores in the three groups. The use of Inquiry-Based method was most effective for the teaching and learning of Physics. The idea of active teacher, passive students that characterized Convectional method was relegated as students were allowed to develop methods for experiments, develop instruments for data collection, analyzing, interpreting data and outlining possible explanations and to create predictions for study on their own.

Also, the Computer-Assisted-Instruction with characteristics of individualization, self-pacing and feedback had enhanced the teaching and learning of Physics. The result of analyses showed that the Inquiry-Based method was the best among the three groups.

Physics teacher should be made to recognized the potentials of Inquiry-Based method of teaching and Computer-Assisted Instruction and utilize them for better performance of students in Physics.

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