

LOCATION AS A FACTOR IN TEACHING PHYSICS USING CONSTRUCTIVIST INSTRUCTIONAL METHOD

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Abstract

In this study, the researchers examined the effect location has on academic achievement of secondary school physics students. The study adopted pretest-posttest non-equivalent control group design. The study was conducted in Enugu North and East Local government Areas of Enugu state. The population of the study was 5104 senior secondary one (SS1) Physics students made up of twenty five (25) Schools. The sample size was 118 (60 males and 58 females). Stratified random sampling was used to draw two co-educational schools, one from Urban Schools and the other from rural schools. Intact classes were used for this study. In the urban School, two intact classes were randomly drawn from the three classes of SS1 Physics students while in the rural school, the two classes of the SS1 Physics students were used. In each of the two schools sampled, one out of the two intact classes was assigned to constructivist teaching method while control group was assigned to lecture method. Two research questions and two null hypotheses guided the study. The duration of the experiment lasted for four weeks. Data generated were analyzed using mean with standard deviation. Analysis of Covariance (ANCOVA) was used in testing the hypothesis at $P < 0.05$. The result of the study indicated that the students' achievement in Physics was better when they were taught basic concept of electricity using constructivist teaching method than when they were taught using lecture method. It was also shown that location had a significant influence on academic achievement of Physics students with those in urban schools achieving higher than the students in rural schools.

Keywords: Constructivist Instruction, Location, Physics and Achievement.

Introduction

It is an accepted fact globally that qualitative education promotes the development of every individual and offers him/her an opportunity for capacity building and for contribution of one's quota to the society to enhance national, economic and social growth of that nation. In view of this, the National policy makers of education in Nigeria, stipulated as one of goals of education, the development of appropriate skills, mental, physical and social abilities and competencies to empower the individual to live in and contribute positively to the society (National Policy of Education, 2013).

Physics is one of the core science subjects as contained in the National curriculum for Senior Secondary Education. It plays an important role in national development. This is as a result of the fact that Physics concepts are applied in almost every aspect of human life on daily basis. The technological and scientific development of any nation depends strongly on the application of Physics knowledge. Instances of remarkable areas where physics concepts are applied are in the communication industries, Agriculture, global positioning system. The study of Physics provides proper foundations for engineers, medical doctors, among others. (Anamezie, 2015). Consequently Physics educators, the government and the society at large focus their attention on the achievement of students in this subject area at the Senior Secondary School Examination level (SSCE), since the performance at this level is a determinant for higher education programmes at the tertiary institutions.

The importance of Physics for national growth notwithstanding, the achievement in the subject and in other science subjects has been found to be poor (Bello, 2012, Sintayehu, 2014; Anamezie, 2015; Anamezie & Eze, 2015)

Considering the fact that physics is viewed as the bedrock of science and technology, because it possesses the tools on which technological advancement depends, it is therefore imperative that much effort is made towards finding out the "whats and whys" of the ugly situation of academic outcomes in this subject area in particular and in other science subjects at large and proffer solutions to them by improving the teaching-learning process for a better achievement.

In an attempt to find the hindrances to better teaching-learning process, some researchers have implicated poor teaching method and location as variables that are likely to affect academic

achievement of students in secondary school Physics. For instance, Odeh, Oguche, Angelina, Ivagher and Ezikiel, (2015) and Ella and Ita (2017), in their respective studies investigated the influence of school location on the academic achievement of students in secondary schools. The result of their findings indicated that school location has significant influence on academic achievement of students in secondary school in favor of urban schools, while on the contrary, Musibau and Johnson (2010), Thomas and Ikuero, (2013) in their independent studies the influence of school location on academic achievement of students in secondary schools observed that school location had no significant influence on students' academic achievement. It is based on this premise of contradicting results therefore, that the researchers intend to investigate location as regards its effect on the achievement of students in secondary schools.

School location refers to the area where a school is sited. A school may be sited in the urban, semi-urban or in the rural areas. If a school is located in the rural area, it is referred as rural school while those located in the urban areas are referred to as urban schools or semi-urban schools as the case may be.

Urban areas are developed cities with social amenities, good technology and infrastructural development including education facilities which attract all calibers of people to live and work in cities. On the other hand, rural areas are areas that lack most of these if not all the social amenities. As a result, it is a general belief that the urban or rural location of school is likely to influence the teaching and learning outcome. In this study therefore, the researchers intend to investigate the influence of school location on the students' academic achievement in Physics.

Another area of great concern in teaching- learning process is the method of teaching. This is important because the method a teacher adopts counts a lot and will go a long way in improving and producing a fruitful and meaningful learning outcome. Many researchers had in their respective studies shared the same view. For instance, Bello, (2011) noted that using small cooperative teaching method facilitated students learning in Physics. In the same vein, Bello (2012) established from his study that the effective utilization of appropriate teaching method is likely to have an influence on the academic achievement of Physics students. Furthermore, Amadalo, Alphaya and Thomas (2016) in their study, showed that traditional lecture method in Kenya produces little or no effect on most students' understanding of how the physical world

works and that the method of teaching of a teacher was a factor that might affect Physics achievement.

Therefore, there is an urgent need to address and reverse this ugly situation by adopting an innovative teaching method that will enhance Physics achievement in secondary schools. It is based on this backdrop that the researchers were motivated to consider the Constructivist Instructional Method in teaching Physics.

Constructivist philosophers propose that individuals structure their own life philosophy and knowledge by themselves. The central idea in constructivist learning environment is such that the learners participate actively to structure, restructure knowledge as well as apply the knowledge in problem solving. (Nilgun & Evrim, 2011). This implies that the learners should be guided by the teacher to discover things themselves by participating in the activities that encourage constructivism such as experimentation, class discussions among others thus, projecting learner as the central focus and the teacher as a guide, (Anamezie, 2015).

According to Yagar, (1991), constructivist teaching method helps the learners to direct their own exploration and discover solutions of problems by themselves, drawing conclusions that will help them to develop new insights and connecting them to the already existing knowledge. In this way the learners will have the opportunity of interpreting what is learnt, and learning thus becomes effective and meaningful.

In the same vein, Akanwa and Ovute (2014) stated that constructivists are of the opinion that learners are guided to interpret new experiences in the light of the existing experiences. The constructivist model therefore, is viewed as a teaching method that foster learners active participation during the teaching-learning experiences. This is in contrast with the usual traditional method of instruction where the learning environment is often (dominated by the teacher activities and learners “sit, look and wait to be spoon fed” by experts. Consequently, the learners thinking is discredited. (Anamezie, 2015).

From the foregoing, a good question would be, does constructivist instructional method actually effect positively on the academic achievement of physics students? In this study, the researchers intend to include constructivist learning method as one of the variables in this study.

Purpose of the Study

The main purpose of the study is to determine the effect of constructivist instructional method and location on Physics students' achievement.

Research Questions

The following research questions guided the study:

- (1) What are the mean achievement scores of physics students in the experimental group and those in the control group in Physics achievement test
- (2) What are the mean achievement scores of Physics students in urban and rural schools in Enugu education.

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of probability.

H₀₁ There is no significant difference between the mean achievement scores of students taught Physics using constructivist teaching method and those taught the same topic using lecture method

H₀₂ There is no significant difference between mean achievement scores of Physics students in the urban schools and those in rural schools in Physics achievement test (PAT).

Research Method

In this study the researchers adopted pretest posttest non equivalent control group. There was no randomization of the research subjects into equivalent ability groups. Instead, intact classes were used. The population for this study comprised all senior secondary school one (SS1) Physics students in Enugu education zone of Enugu state. The population of SS1 students in this Education zone is 5104.

There are three local government areas in Enugu educational zone. They are Enugu North, Enugu East and Isi-uzo local government areas. The study was conducted in Enugu North and Enugu East local government areas of Enugu state. The choice of the two local government areas was based on the fact that location was a factor in the study and there is need for the areas of the

study to be of different features (Urban and rural). In these local government areas, Enugu North is purely urban and for Enugu East, some parts are semi-urban while some parts are rural and the school used for the study in this area fall within the rural area of Enugu East.

The sample size used for the study was 118, of which 58 were females and 60 were males. The sample was obtained by multi-stage sampling techniques.

Purposive random sampling technique was used to draw two co-educational schools from Enugu Education Zone. Stratified random sampling was used to draw two schools, one from the urban and one from the rural areas.

The instrument used for data collection was Physics Achievement Test(PAT). PAT was a forty (40) multiple choice response items developed from Electricity concept. It had four options A-D for the research subjects to make a choice of right or wrong answer to a particular question.

The Instrument used for this study was face validated by three experts. One expert in the measurement and evaluation was selected and the other two were selected from Physics Education, all from Science and Computer Education of the faculty of Education, in Enugu State University of Science and Technology, Enugu. Table of specification was used to establish the content validity. The reliability of the Physics Achievement Test (PAT) was determined using the Kuder-Richardson Formula (K-R 20) and the internal consistency index obtained was 0.76.

A pre-test was administered to all the SS1 Physics research subjects before the actual experiment. After the pre-test, the actual experiment which lasted for four weeks commenced following the normal school time table. The research subjects in both constructivist instructional method and lecture method were both given the PAT. In each school chosen, both the treatment and the control groups were taught using constructivist instructional method and lecture method respectively. Data collected were analyzed using mean with standard deviation. Analysis of covariance (ANCOVA) was used in testing the hypotheses set for the study at 0.05 level of probability.

Results

The results are thus presented below according to research questions and hypotheses

Research Question one

What are the mean achievement scores of Physics students in the experimental group and those in the control group in Physics achievement test?

Table 1: Mean achievement scores of students in Physics achievement test by method. n=118

	Experimental group(n=56)		Control group n=62	
	Mean	S.D	Mean	S.D
Posttest	21.96	4.15	18.39	5.52
Pretest	17.27	4.99	17.08	7.39

The result in Table1above showed that the students in experimental group obtained the mean score (x) of 21.96 with standard deviation of 4.15 and 17.27 with standard deviation of 4.99 in the posttest and pretest respectively. On the other hand, those in control group had the mean score (x) of 18.39 with standard deviation of 5.52 and 17.08 with the standard deviation of 7.37in the posttest and pretest respectively. This shows that students in the experimental group that were taught with the constructivist instructional method achieved higher than those taught with lecture method in the control group. In terms of variability of the mean scores, the posttest scores in either groups were more stable in the posttest than in the pretest. However, higher stability in mean variability was achieved by the experimental relative to the control group sub-sample.

Research Question two

How do the mean achievement scores of SS1 physics student in urban school compare with of their counterparts in the rural school in Physics Achievement Test?

Table 2: Mean achievement scores of students in Urban and rural schools.

	Urban n=59		Rural n=59	
	Mean	S.D	Mean	S.D
Posttest	23.92	3.55	16.25	6.19
Pretest	18.43	3.68	15.85	6.77

From Table 2 above, the result shows that the students in the urban school obtained a mean (\bar{x}) score of 23.92 with standard deviation of 3.55 and 18.49 with standard deviation of 3.68 in the posttest and pretest respectively. Their counterparts in the rural school obtained a mean (\bar{x}) score of 16.25 with standard deviation of 6.19 and 15.85 with standard deviation of 6.77 in posttest and pretest respectively. This indicates that the student in the urban school achieved higher than their counterparts in the rural school with a mean score difference of 7.67. In terms of variability of the mean scores, the posttest scores in either groups were more stable in posttest than in the pretest. Higher stability in mean was achieved by the urban relative to the rural sub-sample.

Null Hypothesis one

Analysis of covariance (ANCOVA) was used to test the significance difference between mean scores in hypotheses at 0.05 probability level.

H₀₁: There is no significant difference in the mean physics achievement scores of SSI Physics students taught Basic concept of electricity through the use of constructivist instructional method and lecture method.

Table 3: ANCOVA Results for Students Mean Achievement Scores in Physics Achievement Test.

Source	Sum of squares	Df	Mean square	F	Sig
Gender	3.092	1	3.092	.303	.583
Location	1157.026	1	1157.026	113.473	.000
Method	491.826	1	491.826	48.235	.000
Gender * Location	3.055	1	3.055	.300	.585
Gender * Method	9.714	1	9.714	.953	.331
Location *Method	565.721	1	565.721	55.482	.000
Gender *Location* Method	3.409	1	3.409	.334	.564
Error	1111.413	109	10.794		
Total	52774.000	118			
Corrected total	5173.153	117			

From the result presented in table 3 above, it is observed that the calculated F-value due to method (f-cal) of 48.235 is significant at 0.000. Since the significant level of .000 is less than 0.05 probability set for this study, the researcher therefore, rejected null hypothesis one and concluded that there is a significant difference between the mean achievement scores of students taught physics with constructivist instructional method and those taught with lecture method in favour of the experimental group.

H₀₂: There is no significant difference in the mean physics achievement scores of SS1 physics students in the urban school and those in rural school taught basic concept of electricity.

The results of ANCOVA in table 3 revealed that calculated F value (f- Cal) of 113.473 for location is significant at .000. Since the significant level of 0.000 is less than 0.05 probability set for this study, the researcher therefore, rejected the null hypothesis two and concluded that there is a significant difference in the mean achievement scores of students taught basic concept of electricity in urban school and those taught the same topic in the rural school in favour of the rural students.

Discussion of Findings

The finding indicated that the students in the experimental group that were taught using constructivist instructional method had a mean score of 4.69 while student in the control group that were taught with lecture method obtained a mean difference score of 1.31, suggesting that the students that were taught using constructivist instructional method achieved higher than those that were taught using lecture method.

Further investigation on ANCOVA, confirms that there is a significant difference in the mean achievement scores of physics students based on method of instruction.. The finding of this study is in agreement with the views of Akanwa and Ovute (2014) who studied the effectiveness constructivist instructional on Physics achievement and the results indicated that the teaching model was effective in facilitating student achievement in Physics.

The study also is in line with the studies of Jong, (2005) whose findings revealed that constructivist instructional model enhanced higher achievement in mathematics in elementary education. From the result, the researcher confirms that using constructivist instructional method has a positive effect on the physics achievement of students.

Considering the Physics achievement among physics students in the urban and rural schools in Enugu education zone, the findings revealed that the Physics students in the urban school taught concept of electricity achieved higher than their counterparts in the rural school taught the same topic. The students in the urban obtained a mean score of 23.92 while their counterparts in rural school obtained a mean score of 16.25, thus showing a difference mean scores of 7.67 is very significant. The results of further investigations on ANCOVA in table 3 above revealed that calculated F-value of 113.473 for location is significant at .000 which is less than 0.05 probability set for this study, thus confirming that there is a significant difference in the achievement mean scores of students taught physics in the urban school and their counterparts taught the same topic in the rural school. From the result, the researcher concluded that location has a positive effect on the physics achievement of students' and this is in favor of urban school.

The findings of this, study is in agreement with studies of Ode et al (2015) and Ella and Ita (2017) whose respective findings indicated that school location has significant influence on academic achievement, with the students in the urban schools achieving higher than those in the

rural schools. Therefore, the assertion of Musibau and Johnson (2010), Thomas and Ikuero (2013) whose findings on their independent studies observed that school location had no significant influence on students academic achievement does not hold with respect to the findings of this study. The result of this study is also in line with Agboghroma (2005) whose study to ascertain the knowledge acquisition of urban and rural students in basic science, indicated that there was a significant difference in terms of improvement in the knowledge acquisition of the exposed urban students than the rural students. The researchers concluded from the results of this study that the urban schools are in favour of academic achievement than rural schools.

Conclusion

From the results obtained from this study, the researchers made the following observations: The constructivist instructional method has enhanced students' achievement in senior secondary school physics. Students who were taught physics using constructivist instructional method achieved higher than those who were taught using lecture method. Location had a significant influence on academic achievement in favour of the urban school. Hence the researchers concluded that both method of instruction and school location had a positive influence on academic achievement of student.

Recommendations

1. Based on the results obtained from the study, it is recommended that constructivist instructional method should be employed by Physics teachers and indeed by all science teachers to improve teaching –learning process.
2. Government and/or school authorities should provide equal infrastructures as well as adequate and equal facilities to rural schools to facilitate effective teaching and learning outcomes.

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