EFFECTS OF CONCRETE INSTRUCTIONAL METHOD ON JUNIOR SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN BASIC SCIENCE IN EKITI STATE

BY

Ogunloye Oluwafunmike Yinka
Department of Science Education,
Ekiti State University, Ado Ekiti, Ekiti State
ayoolaoluwafunmikeyinka@gmail.com

Abstract

This study examined the effects of Concrete Instructional Method on Junior Secondary School Students' academic performance in Basic Science in Ekiti State. The study adopted the pre-test, post-test, control group quasi-experimental research design. One research question was raised and three hypotheses were formulated. The population of the study comprised 16,256 Public Junior Secondary School II (JSSII) students in Ekiti State, Nigeria. The sample size for the study was eighty (80) JSS II students. Multistage sampling procedure was used to select the sample. The Instrument for data collection was: Basic Science Performance Test (BSPT). The face and content validity of the instrument was ensured by the experts. Kudar Richardson-21 (K_{r-21}) method was used to establish the reliability coefficient value of 0.82. The data collected were analyzed using mean, standard deviation and t-test. The findings showed that there was no significant difference in the pre-test performance scores of students in experimental and control groups in Basic Science. Also, there is significant difference in the post test performance of students in experimental and control groups when taught Basic Science in favour of experimental group. Based on these findings, the study concludes that concrete instructional method offers potent capabilities that can enhance the teaching and learning process in basic science in Ekiti State. It was recommended that the use of concrete instructional method should be encouraged in Basic Science classes in order to have concrete experience and understanding of Basic Science concepts so as to enhance better academic performance of students.

Keywords: *Concrete Instructional Method, Conventional teaching strategy, Performance*

Introduction

The importance of science and technology in contemporary time is demonstrated by its conscious and unconscious use in our daily lives. Indeed, transportation, electrical devices, medicine and food are benefits of science and technology. Also, modern societies are literally built on science and technology. Ewesor (2015) expressed that the countries of the world are currently driven by science and technology as the instrument par excellence for nation building. This is why greater emphasis is being placed on industrial and technological development not only in Nigeria but the world over. Science and technology plays a dominant role in the development of nations in which is an instrument to create in younger ones on how to make inquiry into a problem and how to proffer permanent solution to it (Elvis, 2013). According to Rulp, (2014) that Science and Technology is the bedrock of civilization and

development and no nation can afford to ignore its impact on the modern world. Science is valued by societies because the application of scientific knowledge helps to satisfy many basic human needs and improve their living standard.

Basic science is a core subject at the Junior Secondary School (JSS) level of Education. Basic Science presents science as a unified whole in order for learners to have a holistic view of the science subjects (Seweje and Jegede, 2012). It is a subject that teachers approach with wider application in terms of its concept and objectives as an academic discipline. The knowledge of Basic science is necessary for individual to be scientifically trained in different areas of endeavor. It also helps in the development of the nation science and technology advancement. Basic Science was introduced into the Nigerian secondary schools as a panacea to some of the problems bedeviling science education especially at the Junior Secondary School level.

Basic science formerly known as Integrated Science is the first form of science taught at the Junior secondary school levels. Basic Science is considered the bedrock of all science subjects at the Senior Secondary School (SSS) level. According to Oyeniyi (2019), Basic Science is a revolutionary new introductory science curriculum developed at Princeton intended for students considering a career in science. Basic Science emphasizes scientific literacy and research oriented learning (Gunseli and Guzin, 2017). The subject encourages exploration of student's immediate environment. As a result, Basic Science teachers continue to learn along with their students. Basic Science involves the study of elementary Biology, Anatomy, earth/solar system, Ecology, Genetics, Chemistry and Physics as a single science subject in the Junior Secondary School. It offers the basic training in scientific skills required for human survival, sustainable development and societal transformation. Basic Science studies also involve bringing together traditionally separated science subjects so that students grasp a more authentic understanding of science. Thus, the subject prepares students at the upper basic level for the study of core science subjects such as Biology, Chemistry and Physics at the Senior Secondary School (SSS) level (Oludipe, 2012).

Despite the utilitarian value of Basic Science in science and technological advancement and teachers' position in the teaching and learning in order to realize the subject's objectives; the subject is still characterized with lack of concrete activities which has resulted in poor manipulation and observation skills (Adepoju, 2012). Presently, the current statistics on students' academic performance in public Junior Secondary School Certificate Examination (JSSCE) in Ekiti State showed that the teaching and learning process of Basic Science as a subject at the Junior Secondary School level is still inadequate.

Concrete learning occurs when students have ample opportunities to manipulate concrete objects to solve problem. For students who have difficult in learning science, an explicit teacher who knows how to model a specific concrete objects to solve specific Science problems is needed. Additional activities with concrete materials are essential for the transfer of acquired knowledge to procedural knowledge because concrete materials help students to construct procedural knowledge. Prior learning through concrete materials makes new learning easier and more meaningful. Teachers provide declarative knowledge which enable the students use concrete materials to transfer declarative knowledge into procedural knowledge. However, guidance is needed in order for students reach the desired outcome. The procedural analogy theory instructs how to use concrete materials to

achieve a particular goal. Aniaku (2012) opined that, the persistent low academic performance in Science was attributed to the teachers instructional strategy among others, this view corroborate with that of Popoola and Olojo (2012) that, conventional teaching techniques often make students passive, leading to under performance in Science subjects.

In spite of the possible effect of different instructional strategies of teaching Basic Science, learner characteristics could also affect the learning outcome of student in Basic Science as supported by researchers such as Ochu and Haruna, (2014) and Oyeniyi, (2019). The present study is also interested in investigating how a learner could be empowered to improve on his performance in Basic Science, it is most likely that variables such as students' attitude and gender can be another factor that can affect learning outcomes in the subject.

Statement of the Problem

Despite the central role of Basic Science in building solid foundation to science education and technological advancement and various efforts by the stakeholders to improve the teaching and learning of Basic Science subject in Junior Secondary Schools, little success has been achieved. The researcher observed that the science education system in Nigeria seems to have been plagued with a lot of problems and one of the most serious problems is continuous performance of students in Basic Science that is not encouraging which is evident over the years.

Furthermore, the researcher observed that Basic Science teachers seem not to be mindful of their learning method and practice of teaching the subjects during the classroom interaction such that many of them still stick to the traditional chalk and talk method, may be due to their familiarity with it, while few occasionally use demonstration method which makes the subject looks complex and students seem to view Basic Science concepts as very difficult to understand through these methods, thereby resulting to low enrollment of students in Basic Science subject and loss of interest in offering science subjects at the Senior Secondary School level.

It has also been observed by the researcher that most teachers find it difficult to use concrete object to teach practically oriented topics in Basic Science which makes the subject to be on abstract to the students. This might be why some students lost their interest in the subject which could also affect their attitude towards the subject.

Purpose of the Study

The purpose of this study was to investigate the effect of Concrete Instructional Method on Junior Secondary School Students' academic performance in basic science in Ekiti State: This study specifically examined:

i. the effects of Concrete Instructional Method on Junior Secondary School Students' Performance in Basic Science in Ekiti State;
ii. the significant difference in the pre-test Performance scores of the experimental and control groups.
iii. the significant difference between the post-test Performance scores of students in experimental and control groups.

Research Questions

A research question was raised to direct this study.

1. What is the performance of students in Basic Science before and after the treatment?

Research Hypotheses

The following null hypotheses were postulated for this study:

1. There is no significant difference in the pre-test performance scores of the experimental and control groups.
2. There is no significant difference between the post-test performance

scores of students in experimental and control groups.

Methodology

The study adopted pre-test and post-test control group quasi-experimental research design. The design provided an opportunity to determine how the independent variables was influenced the dependent variables in the study to determine the effectiveness of the treatment. The schematized diagram for the crossing of the independent variables with the moderator variables is also expressed as follow.

Group	Pretest	Treatment	Posttest
E	O_1	X_1	O_2
C	O_3	---	O_4

Where:
E = Experimental group
C = Control group
O_1 and O_3 = Pre-test Observations
O_2 and O_4 = Post-test Observations
X_1=Treatment for Experimental group (Concrete Instructional Method)
--- = No treatment for control group (Conventional Method of Teaching)

Population

The population of the study comprised all 16,256 Public Junior Secondary School ll (JSSll) students in Ekiti State, Nigeria (Source: Ekiti State Teaching Service Commission, 2019). Junior Secondary School II (JSSll) students were considered relevant because they were not involved in Junior Secondary School Certificate Examination (JSSCE) and therefore were readily available for the study. Besides, they had been exposed to the rudiment of Basic Science concepts which facilitated their content knowledge of practical skills in Basic Science.

Sample and Sampling Technique

The sample for this study consisted of 80 students from two intact classes of Junior Secondary School II (JSS II) in Ekiti State. Multistage sampling procedure was used to select the sample. Stage one involved the selection of one out of the three senatorial districts in Ekiti State using simple random sampling technique. Stage two involved the selection of two Local Government Areas from the senatorial district earlier selected using simple random sampling technique. The third stage involved the use of simple random sampling technique to select one Junior Secondary School each from the Local Government Areas previously selected from the State. Stage Four involved the selection of students from each of the two schools earlier selected using intact classes.

Research Instrument

The study made use of one instrument, namely: Basic Science Performance (BSPT) The BSPT consisted of 24 items with four options labeled A- D that covered two major topics taught in the class i.e; Types of Energy and Thermal Energy. The correct option taken from A – D.

Validity of the Instrument

The face and content validity of the instrument was ensured by giving them to experts in Basic Science Education, Test and Measurement in the Faculty of Education, Ekiti State University, Ado-Ekiti. Their suggestions, criticism, corrections and opinions were built into the final draft of the instrument to ensure the suitability.

The final Draft of the instrument was used for data collection.

Reliability of the Instruments

To establish the reliability of BSPT, it was administered on 20 students outside the sampled area. The Data collected were analyzed using Kudar Richardson-21 (K_{r-21}) method to establish the reliability coefficient value of 0.82.The coefficient was high enough to declare the instrument reliable.

Experimental Procedure

The experimental procedure was carried out in eight weeks as follows, which include the pre treatment stage, treatment stage and post treatment stage.

Pre-treatment Stage (One Week)

At the pre-treatment stage, the researcher visited the selected schools with a letter of introduction to obtain permission from the principals and the Basic Science teachers to use their schools and students. This was followed by discussion with Basic Science teachers to intimate them with the purpose and the objectives of the research. The researcher thereafter took time during the week to train the research assistants for the experimental group on the proper use of the instrument and the teachers guide. The Basic Science Performance Test (BSPT) was administered on the two groups to obtain the pre-test scores.

Treatment stage (Six Weeks)

At this stage, the researcher handed over the instructional materials and teaching manual she developed to the research assistants which they used as guide to teach the selected topics for the study. The students in experimental group were exposed to the use of concrete instructional method of teaching while the students in the control group were taught using the conventional method in the same period at their respective schools.

Post-treatment Stage: One week

At the post-treatment stage, the BSPT was administered to the students, so as to determine their level of performance after the whole exercise. The scores obtained constituted the post-test scores for the study. Thus the experimental procedure lasted for eight weeks.

Data Analysis

The data obtained were analyzed using appropriate descriptive and inferential statistics. Specifically, the mean, standard deviation, and bar-charts were used to answer the research question while t-test was used to analyze all the hypotheses generated. All the hypotheses were tested at 0.05 level of significance.

Results

Question 1: What is the performance of students in Basic Science before and after the treatments?

In answering the question, performance of students exposed to concrete instructional and conventional methods of teaching Basic Science before and after treatment were computed and compared.

Table 1: Mean and Standard Deviation of Students in Experimental and Control groups before and after treatment.

Group	*N*	*Pretest*		*Posttest*		*Mean Difference*
		$\bar{x}$	*Sd*	$\bar{x}$	*Sd*	
Control	40	13.270	1.275	15.170	1.408	1.90
Concrete Instructional Method	40	14.700	5.491	18.070	8.137	3.37

Table 1 showed that, students in the control and experimental groups had mean scores of 13.27 and 14.70 respectively prior to treatment, which appeared to be closer prior treatment. On exposure to treatment, students taught with concrete instructional method had the higher mean score of 18.07 while the students in the control group had the least mean score of 15.17. This implied that, the use of concrete instructional method was more effective than conventional method in enhancing the performance of students in Basic Science.

Testing of Hypotheses

Hypothesis 1: There is no significant difference in the pre-test scores of students in experimental and control groups in Basic Science.

The pre-test scores of students in experimental group and those in the control group were computed and compared for statistical significance using t-test at 0.05 level. The result is as presented in Table 2.

Table 2: t-test of pre-test scores of students in experimental and control groups

Group	*N*	x	*Sd*	*df*	*t*	*P*
Control	40	13.27	1.28	78	0.26	0.76
Experimental	40	14.70	5.49			

p>0.05 (Not Significant)

The result in Table 2 showed that t= 0.26, p = 0.76> 0.05. Since the p-*value* is greater than 0.05, hence, the null hypothesis was not rejected. This implied that there was no significant difference in the pre-test scores of students in experimental and control groups. This showed that the two groups were homogeneous at the commencement of the experiment.

Hypothesis 2: There is no significant difference in the post test science of students in experimental and control groups when taught Basic Science.

The post-test scores of students in experimental group and those in the control group were computed and compared for statistical significance using t-test at 0.05 level. The result is presented in Table 3.

Table 3: t-test of post-test of students in experimental and control groups

Group	*N*	$\bar{x}$	*Sd*	*df*	*t*	*p*
Control	40	15.17	1.41	78	7.76	0.00*
Experimental	40	18.07	8.14			

$p<0.05$ (Significant result)

The result in Table 3 showed that t= 7.76, p = 0.00 < 0.05. Since the p-v*alue* is less than 0.05, the hypothesis was rejected. This implied that, there was a significant difference in the post-test scores of students in experimental and control groups. The performance the students in the experimental group performed better than those in the control group. Hence, the concrete instructional method was effective than the conventional method.

Discussion

The study's result indicated that both the experimental and control groups had a similar low performance levels before the intervention of the treatment. This suggested that both groups had an equivalent knowledge base before the experiment was applied. This indicated that, the two groups were homogenius initially. Therefore any notable difference observed later could be attributed to the specific interventions applied. It was recorded that, both groups mean scores were low, the researcher believes that, this might be linked to the use of traditional method of teaching in Basic Science which might not be effective enough and might not sufficiently address the students learning challenges in Basic Science. This aligned with the view of Aniaku (2012) that, the persistent low academic performance in Science was attributed to the teachers instructional strategy among others, this view corroborate with that of Popoola and Olojo (2012) that, conventional teaching techniques often make students passive, leading to under performance in Science subjects.

The findings of the study also revealed that, there was a significant difference in the performance score between the experimental and control groups after the treatment was applied. This suggested that, concrete instructional method was more effective in improving students performance in Basic Science than the conventional method of teaching, This aligns with Oyeniyi (2019) that, concrete instruction accelerates learning and grant students more agency in their educational experience. Awodun (2016) indicated that, concrete instructions enhances teaching effectiveness and subsequently improve students' learning outcomes.

Another observation from the study was that, there was no difference in the pre-test mean scores of students in the experimental and control groups before the implementation of the treatment. The result indicated that, both the experimental and control groups had low pre-test means scores, which indicated that, both groups were comparable in terms of their attitude towards Basic Science before the treatment.

The research revealed in the data collected that, students who were taught using concrete instructional method achieved a higher mean scores in their post-test after being exposed to treatment compared to those educated using conventional method, this means that, the notable difference between the two groups was as a result of the treatment. This suggested that, implementing concrete instructional method in teaching the students influenced the students' attitude towards Basic Science. The researcher believed that, concrete instructional method help students to grasp Basic Science concepts more effectively leading to a significant shift in the students attitude

towards the subject compared to conventional method of teaching. This observation aligned with that of Gunseli and Guzin (2017) assertion that, a positive attitude toward Science significantly correlates with students' performance in the field. The use of concrete instructional method can transform students attitude, shifting them from passive to achieve learners, Jegede (2016) revealed that, effective teaching method can foster positive behavioral changes in learners.

Conclusion

Based on the findings of this study, it was concluded that, concrete instructional method offers a potent capabilities that can enhance the teaching and learning process, which can benefit both the students and educators in Nigeria.

Recommendations

Based on the finding of this study, the following recommendations were made:

1. The use of concrete instructional method should be encouraged in Basic Science classes in order to have concrete experience and understanding of Basic Science concepts so as to enhance better academic performance of students.
2. The conventional method of teaching which is only teacher's centered should be enhanced.
3. Seminars, Workshops, In service trainings and symposiums should be organized from time to time for Basic Science teachers in order to update and broaden their knowledge and scope in the use of concrete instructional method of teaching.

References

Adepoju, A. O. (2012). Effect of Practical Activities on Students' Achievement in Integrated Science. *Journal of Science Teachers Association of Nigeria, 28 (1and2) 102-103*

Aniaku, O. L. (2012). Effects of guided and unguided inquiry teaching methods on secondary school students" achievement and interest in Biology in Enugu State. An unpublished Ph.D Thesis at University of Nigeria Virtual Library.

Awodun, A. O. (2015). Effects of outdoor activities on students academic performance in Physics in secondary school in Ekiti State, Nigeria. In the book of proceedings of Ireland International Conference on Education. Dublin, Irelan. 193-198.

Elvis, M. G. (2013). Teaching methods and students" academic performance. *International Journal of Humanities and Social Science Invention*, 2 (9), 28-35.

Ewesor, D. (2015) Innovations and Transformation in Teaching and Learning of Basic Science in Nigeria. *Journal of Teacher Perspective*9(2) 471 - 478.

Gunseli, Y. and Guzin O. A. (2017). The effect of outdoor learning activities and the development of preschool children. *South African Journal of Education*, 37(2), 1-10.

Jegede, C. K. (2016). *Non-cognitive ability, test scores, and teacher quality: Evidence from ninth grade teachers in North Carolina.* NBER Working Paper No. 18624.

Jegede, S. A. (2009). Towards improving skill acquisition during students' industrial work experience scheme programme. *National Association of Women in Academics*, 1(1), 46- 54.

Ochu O. and Haruna, P. (2014). A comparative study of ausibulean

and traditional method of teaching Physics at secondary level in Pakistan. Retrieved from prr.hec.gwc.Pk/thesis518pdf.

Oludipe, D. I. (2012). Gender difference in Nigerian Junior Secondary Students. Academic Achievement in Basic Science. *Journal of Educational and Social Research*, 2 (1), 93-99.

Oyeniyi, A. D. (2019). Effects of outdoor activities and Advance Organizer teaching strategies on students learning outcome in secondary school Basic Science in Ekiti State. An Unpublished Ph.D Thesis. Ekiti State University, Ado-Ekiti, Ekiti State.

Popoola O. J. and Olojo E. O.(2012). The impact of Social Networks on Science Students' Academic Performance in Ondo State Senior Secondary Schools, Nigeria" *Addaiyan Journal of Arts, Humanities and Social Sciences*. 3, 50 – 63.

Rulp, U. (2014). A comparative study of the impacts and students" perceptions of indoor and outdoor learning in the science classroom. *Asian-Pacific forum on Science Learning and Teaching*, 14 (2), article 2, 1-23.

Seweje, R. O., & Jegede, S. A. (2005). Science Education and Science Teaching Methods. Lagos: Atlantic Association.