EFFECTS OF TARGET-TASK MODEL ON SENIOR SECONDARY SCHOOL STUDENTS' PERFORMANCE IN PHYSICS IN ILORIN, KWARA STATE.

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Abstract

The study investigated the effects of target-task model on senior secondary school students' performance in physics. The research design was a quasi-experimental, pretest-posttest, non-equivalent and non-randomized control group design. The study was conducted in two schools randomly selected schools and involved a total of 120 Senior Secondary School II physics students. The objectives were to find out the difference in the students' performance, and difference in the performance of male and female students when taught using the Target-task model. The physics performance test designed by the researcher was the instrument for data collection. The data collected were analyzed using analysis of covariance (ANCOVA), and the two hypotheses put forward were tested at an alpha level of 0.05. The study revealed that the students that were exposed to the target task model performed better than those that were not exposed to the target-task. Other findings, implications, recommendations and suggestions for further studies were explored.

Introduction

Science has been regarded as the bedrock of modern day technological breakthrough. Nowadays, countries all over the world, especially the developing ones like Nigeria, are striving hard to develop both technologically and scientifically, since the world is turning into a scientific village and has made life easier and comfortable to all living things on earth. Science is basically studied as Biology, Chemistry and Physics.

Physics is the study of matter, energy and their interactions in the environment. It is an enterprise which plays a key role in the progress of mankind. The study of physics generates fundamental knowledge, which is essential for the required technological advancement to propel the economic engine of the world. Physics is sometimes referred to as the science of measurements and its knowledge has contributed greatly to the production of instruments and devices that are of tremendous benefits to the human race (Olaniyan & Omosewo, 2015).

Physics, a subject in the secondary schools has been plagued by one major problem. This is the problem of poor performance of students in the Senior School Certificate Examinations (Omosewo, 2002). Physics is perceived abstract and difficult (Nwankwo & Madu, 2014). Research reports by Adedayo (2008) revealed that the performance of students in physics is very poor, hence, calls for attention. Oderinde (1979) stated that the enrollment figures in physics at the secondary school level in the developing countries are quite low. For example, in Nigeria between 2005 and 2010, an average of less than 30% of the students who registered for West African Senior Secondary Certificate Examination (WASSCE) entered for physics. Out of these, only 40% passed at the Credit level (WAEC, 2010). Some of the reasons for this poor enrollment and performance in physics have been blamed on the way science in general and physics in particular is being taught in secondary schools (Ogunneye & Lasisi, 2008). Survey from schools by Ajayi (2007) revealed that one of the factors that

negatively affects the effective learning of physics in secondary schools is the teacher's method of teaching. Angago (1990) stated that among the causes of students' poor performance in physics globally is lack of students involvement in teaching and learning activities.

Problem-solving involves going through a series of solution to solve the given problem. Mayer (1983) defined problem-solving as a multiple step process where the problem-solver must find the relationship between past experience and the problem at hand and then acts upon a solution. Problem-solving interventions could make use of models adopted or developed for a specific set of learners in order to achieve a desired academic achievement. There were many models available for teaching and learning which include: Polya's model (1957), Newell and Simon (1992) and many more. The choice of a model for an intervention depends on the nature of the problem to be solved (Olaniyan & Omosewo, 2015). Related to physics or education generally, student were seen as; passive learners, dependent on the teacher and books, hence poor performance and absence of skills is the result (Adeniran, 2011).

Problem-solving is a process in which a learner perceives and resolves a gap between a present situation and a desired goal, with the path to the goal blocked by known or unknown obstacles (Huitt, 1992). Huitt, (1992) mentioned four stages of problem-solving, these include:

1. An input phase in which a problem is perceived and an attempt is made to understand the problem
2. A processing phase in which alternatives are generated and evaluated and a solution selected
3. An output phase, which includes planning for and implementing the solution, and
4. A review phase in which the solution is evaluated and modifications are made

According to Olaniyan & Omosewo (2015), the target-task model involves presentation of a major problem, the solution of which requires the application of rules and principles, with which the students may not be familiar. It is expected that the teacher presents some solutions similar to the target-task and guides the students to solve the problem. It is an adaptation of the guided-discovery method. The authors identified six stages of this model, they include:

1. Pre-task: The teacher introduces the topic, explains the topic in detail and ensures the students understand what to do at the task stage
2. Task: The students complete the task in pairs or groups, while the teacher observes and offers encouragement
3. Planning: Students prepare a written report on what they went through during the task in their groups
4. Report: The students make their reports available to the teacher for assessment. After corrections the teacher presents the reports back to the students
5. Analysis: The teacher highlights relevant parts of the learning on the board
6. Practice: The teacher selects area of practice for the students

This model presents the concept first by presenting a problem (called the target-task) which will require the application of a rule, principle or formula which the students may have known. This problem may not be easy for students to solve. Then the physics teacher will guide the students to solve other similar but easier graded examples to the task. When these problems are being solved, the teacher gives hints or clues that can aid the students in participating and conceptualizing the solution to the problems. Obodo (1990) stated that, the target-task approach is the meeting point of Brunner's and Gagne's theory of teaching. The approach is the combination of Brunner's discovery method of teaching and Gagne's hierarchical approach to teaching. It also makes use of inductive method of teaching starting a lesson with a target-task, solving other graded work examples and generalizing is a form of inductive method starting from particular principles to general ones.

Eryilmaz (2004) observed that gender contributes to poor achievements of students in physics. Gender according to Yang (2010) refers to the social attributes and opportunities associated with being male and female and the relationships between women and men, girls and boys, as well as the relationship between women and those between men. Habor-Peter (2000) reported a

significant increase in students' performance in problem-solving technique using polya's model strategy with the male students performing better than females. Also, in a research carried out by Olaniyan, Omosewo, and Nwankwo (2015), results show that there is no significant difference in the performance of male and female students taught physics using polya problem-solving model. There is a need to inculcate innovative methods to physics teaching in Nigeria. These include inquiry method, collaborative learning, target-task model, discovery method, and so on. These methods encourage child-centered approaches to learning of physics. The students are guided by the teacher to discover facts and construct their own ideas and understanding the concepts of the study.

The impact of teachers in the performance of students is important because teachers are the facilitators who are to impact on the students the concepts to be learned (Achufusi, 2015). Nwagbo (2001) is of the opinion that ignorance of teachers and neglect of activity oriented methods by teachers grossly contributes to students' low performance in physics. One thing is to be grounded in conceptual understanding of a subject and another is to be well acquitted with the best method to pass the concepts across to learners for proper comprehension. It is obvious that the study of physics cannot be effectively carried out without an empirical analysis of some of the factors that impede the study of the subject and some of the factors that may improve students' performances in the subject, some of which have been listed above. Therefore, this present study sought to determine the effects of target-task model on senior secondary school students' performance in physics in Ilorin, Kwara State.

Literature Review

Harbor-Peters (1989) carried out a study to determine the effect of target-task model approach on students' retention of some geometric concepts. The study was conducted using two schools (1 male and 1 female) in Nsukka urban as sample. The study lasted for three weeks and four geometric theories were taught. The findings indicated that both the experimental (target task) and control (formal approach) groups performed alike in the pretest. However, the experimental group performed better than the control group in the posttest. Ozofor (1993) also investigated the effects of the target task approach on SS3 students' achievement in conditional probability. The subjects of the study consisted of 240 SS3 students drawn from two senior secondary schools in Udi Local Government Area of Enugu Education Zone. Results of the data analysis showed that there was no significant difference between the experimental and control groups in their achievement in conditional probability, there was a significant difference between the methods and gender. Ezeh (2002) researched on the effects of target-task approach on students' achievement and interest in senior secondary school physical chemistry. A sample of 160 SS2 chemistry students were drawn by simple random sampling technique from four senior secondary schools in Nsukka Local Government Area were used for the study. The result of data analysis showed that the target task was superior to the expository method in enhancing students' achievement and interest in the units of physical chemistry. Therefore, this present study investigated the effects of target task model on students' performances in physics in Ilorin South Local Government Area, Kwara, drawing samples from three secondary schools.

Purpose of the Study

The main purpose of this study was to investigate the effects of Target-Task Model on senior secondary school students' performance in physics in Kwara State, with specific emphasis on Ilorin South Local Government Area. The study also sought to investigate:

1. The difference in performance of students in physics before and after being exposed to target-task model.
2. The difference in performance of students who were taught physics using the target-task model and those taught physics without target-task model.
3. The difference in the performance of male and female students who were taught physics using the target-task model.

Research Questions

The following research questions were raised and answered to guide this study:

1. What is the difference in performance of students in physics before and after being exposed to target-task model?

2. Is there any difference in the performance of students who were taught physics using the target-task model and those taught physics without target-task model?

3. Is there any difference in the performance of male and female students who were taught physics using the target-task model?

Research Hypotheses

The following research hypotheses were stated based on the research questions raised in this study and were tested in the course of the study:

Ho_1: There is no significant difference in the performance of students when taught physics using the target-task model and those taught physics without target-task model.

Ho_2: There is no significant difference in the performance of male and female students when taught physics using the target-task model.

Significance of the Study

The findings of this study may form part of the efforts that are being made to have greater achievement of students in physics. The findings may contribute empirical information that would be of immense benefit to teachers, students, researchers. The findings of this study may help teachers to adopt different teaching approaches that will make the teaching and learning of physics to be more stimulating, interesting and activity-based. Teachers may also find the study helpful in developing and strategized their lessons with appropriate steps involving the target-task. The findings of this study may help physics students to gain better understanding of concepts in physics, which will enhance their performances in internal and external examinations. It may also make students to be proficient in solving different problems associated with inquiry based activities in the classroom. The findings of this study may serve as a reference point for future researchers on related research works in science education.

Methodology

The population for this study was all senior secondary school students offering physics in Ilorin. The target population was all senior secondary school two (SSSII) students offering physics in Ilorin South Local Government Area Kwara State, Nigeria. The choice of SSII was necessary because the concept of electric field is expected to be taught in SSII as scheduled in scheme of work. Two schools were randomly selected and 120 physics students in two intact classes of the sampled schools were involved in the study. The experimental group contained 57 students, while the 63 students formed the control group.

The instruments for this study were in two categories; Physics Performance Tests.

Physics Instructional Package.

The Physics Performance Tests; were designed by the researcher. It involved questions adapted from the WASSCE past questions. The Pre-PPT included 20 questions and the Post-PPT included 25 questions in total respectively. The content area of the Pre-PPT was topics from the SS1 physics syllabus while the POST-PPT content involved questions on electric fields. The PRE-PPT tested for knowledge levels while the POST-PPT tested for understanding, comprehension, application, an achievement levels. The tests were given to three experts to scrutinize and determine the suitability. All corrections made by these experts enabled the researcher to eliminate the ambiguous and reconstruct some items in the instrument. This instrument was administered to a set of 20 students that were not part of the participating schools which enabled the researcher to subject the test items to item analysis and discrimination. Based on that, the researcher reconstructs and ruled out some items that seemed to be too difficult and too easy in the Physics Performance Test (PPT). The reliability of the instrument was carried out using split half method. Then their scores in the two halves were subjected to reliability using Cronbach Alpha Method and the reliability coefficient of 0.71 was therefore obtained at 0.05 alpha level.

Physics Instructional Package, was designed by the researcher based on the content of electric fields (electrostatics, coulomb's law and electric force, electric field lines of force, electric current

and ohm's law, resistors and resistance, capacitors and capacitance), process and steps involved in the TTM was explored and implemented. The package consisted of lesson plans for four weeks.

The package was administered on students in the intact class of the selected schools during the second to fifth weeks of the experiment. The experimental group was taught using the TTM while the control group was taught without TTM. During the TTM instruction, the teacher first introduced the topic to the students, explained it in details while the students took down relevant notes. Relevant illustrations and materials were used to teach the students. After the students must have understood the topic, the teacher presented the target-task, explained what is expected in the task stage and instructed the students to carry on with the task in groups after which the teacher went round to crosscheck while rendering relevant corrections. After the students finished with the task, the teacher went through their answers and for those who didn't get it, the teacher solved easier related examples and asked them to re-solve the target task, after which the students present their results to the rest of the class. During the sixth week, the experimental and control groups were given posttest.

Data Analysis and Results

The data gathered from both the experimental and the control groups were analyzed using frequency and percentage to present the demographic data of the participants. Mean and standard deviation were used to answer the research question one while the other research questions were formulated into hypotheses and tested with Analysis of Covariance (ANCOVA) at 0.05 alpha level.

Results

Research Question: What is the difference in performance of students in physics before and after being exposed to target-task model?

Table 1: Descriptive Statistics of Students' Performance in Physics before and after the Treatment

Groups		Mean	S.D.	Min	Max	Remark
Experimental	Pre-test	9.29	2.50	4.00	15.00	Low
(Target Task Model)	Post-test	18.12	2.50	13.00	23.00	High
Control	Pre-test	6.96	1.90	2.00	11.00	Low
	Post-test	12.14	3.45	3.00	20.00	Fair

As revealed in Table 1, the performance of students (both the experimental and control groups) in the post-test was higher than their performance in the pre-test. This implies that the performance of students (both the experimental and control groups) before the treatment was low, however after the treatment, the performance of students taught target task approach (18.12) was higher than the performance of students taught without (12.14).

Hypothesis One: *There is no significant difference in the performance of students when taught Physics using the target-task model and those taught without target-task model.*

Table 2: Analysis of Covariance Showing the Difference in the Performance of Students when Taught Physics Using the Target-Task Model and Those Taught Physics without

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1200.219[a]	2	600.110	73.005	.000
Intercept	1034.743	1	1034.743	125.880	.000
Pre-test	130.107	1	130.107	15.828	.000
Treatment	554.978	1	554.978	67.515	.000
Error	961.747	117	8.220		
Total	29102.000	120			
Corrected Total	2161.967	119			

a. R Squared = .555 (Adjusted R Squared = .548)

**Significant at p<0.05*

Result in Table 2 showed that the *F*-value of 67.515 was obtained with a *p*-value of 0.000 computed at 0.05 alpha level. Since *p*-value 0.00 was less than alpha level 0.05, the null hypothesis was not retained and thus, there was a statistically significant difference in the performance of students when taught Physics using the target-task model and those taught without ($F_{(1, 117)} = 67.515$, $p<0.05$).

Table 3: Pairwise Comparisons Analysis Showing the Effect of the Treatment on Students' Performance in Physics

Treatment	Mean	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Experimental(I)	18.12[a]	5.98*	0.59	0.00	3.70	6.05
Control (J)	12.14[a]	-5.98*	0.59	0.00	-6.05	-3.70

Grand Mean = 15.13

* the mean difference is significant at 0.05 level

b. Adjustment for Multiple Comparisons: Bonferroni

To ascertain the direction of the significance, the Multiple Comparison Analysis was depicted in Table 3 to show where the difference lies. Table 3 showed that students who were taught Physics using target task model had higher mean score of 18.12 and those taught Physics without the target task model had a mean score of 12.14. This implied that students taught with the use of target task approach performed better than those taught without in Physics Performance Test (PPT).

Hypothesis Two: *There is no significant difference in the performance of male and female students when taught Physics using the target task approach.*

Table 4: Analysis of Covariance Showing the Difference in the Performance of Male and Female Students That Were Taught Physics Using the Target Task Approach

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	89.332[a]	2	44.666	9.178	.000
Intercept	663.689	1	663.689	136.370	.000
Pre-test	80.601	1	80.601	16.561	.000
Gender	.400	1	.400	.082	.775
Error	262.808	54	4.867		
Total	19073.000	57			
Corrected Total	352.140	56			

a. R Squared = .254 (Adjusted R Squared = .226)

**Insignificant at p>0.05*

Table 4 revealed that the *F*-value of 0.082 was obtained with a *p*-value of 0.775 computed at 0.05 alpha level. Since *p*-value (0.775) was greater than alpha level (0.05), the null hypothesis was retained and thus, there was no statistically significant difference in the performance of male and female students that were taught Physics using the target task approach ($F_{(1,54)} = 0.082$, $p>0.05$).

Discussion of Findings

Findings from this study revealed that the performance of students (both the experimental and control groups) before the treatment was low, however after the treatment, the academic performance of students taught target task model was higher than the performance of students taught without. This may due to the fact that target task model exposed students beyond the traditional and regular method thereby resulting in students' higher performance in Physics. This outcome corroborates Wambugu, Changeiywo and Ndiritu (2014) whose findings indicated that the integration of modern teaching approaches in instructional delivery resulted in high students' understanding of the subjects and academic performance when compared with the use of traditional teaching method alone.

Results obtained from this study showed that there was a statistically significant difference in the performance of students when taught Physics using the target-task model and those taught physics without. Students taught with the use of target task model were found to academically perform better than those taught without. This finding is in line with Omosewo and Olaniyan (2015) who found that students taught with the target task model performed better than those taught using lecture methods when exposed to the performance test on current electricity. In correlation with this, Ezeh (2002) discovered that

the target task was superior to the expository method in enhancing students' achievement and interest in the units of physical chemistry.

In addition, this study showed that the performance of male and female students exposed to target task teaching approach do not differ as insignificant statistical difference was found in the performance of male and female students that were taught Physics using the target task approach. This result is in support of Harbor-Peters (1989) and Ozofor (1993) whose findings revealed no significant difference in the mean performance of male and female students taught Mathematics using target task model. However, this outcome disagrees with Shaibu and Mari (1997) who observed a gender difference in achievement in science process skills in favour of the female students.

Conclusion

The Target Task Model enhanced better performance of students in physics. It could also be concluded that the use of target task model did not reveal any bias in the results towards gender as both male and female students that were exposed to target-task model performed well in Physics.

Recommendations

With respect to the findings of this study, the following recommendations are proffered;

1. Physics teachers should expose students to target task model while delivering classroom instruction so as to improve students' problem solving skills in physics and hence their academic performance.
2. Physics teachers should take into consideration that both male and female students while teaching using the target task model since performance is not influenced by gender.
3. There should be seminars, conferences and workshops where in-service teachers should be trained in the knowledge and skills of effective implementation of target task model in schools since the approach was found to improve students' academic performance.
4. School authorities and educational administrators should encourage teachers to employ target task model into implementation of the secondary school science curriculum in all the subjects

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