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EFFECTS OF TARGET TASK MODEL AND EXPERIENTIAL LEARNING APPROACH ON SENIOR SECONDARY SCHOOL STUDENTS' PERFORMANCE IN PHYSICS

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ABSTRACT:

Purpose: The study investigated the effects of target task and experiential learning approach on senior secondary school students' performances in physics.

The research design was a quasi-experimental, pretest-posttest, non-equivalent and non-randomized control group design. The study was conducted in three schools randomly selected and involved a total of 159 Senior Secondary School II students. The experimental group one (EG1: 57) was exposed to target task model and the experimental group two (EG2: 39) was exposed to the experiential learning approach while the control group (CG: 63) was not. Physics Performance Test (PPT) was the instrument of the study. The data collected were analyzed using analysis of covariance (ANCOVA), and the hypotheses were tested at an alpha level of 0.05. The study revealed that the students that were exposed to the target task model and experiential learning approach performed better than those that were not.

The result of this study may help teachers to adopt target and experiential teaching approaches that will make the teaching and learning of physics to be more stimulating, interesting and understanding.

Keywords: Target-task model, Experiential learning, Performance, Gender

INTRODUCTION

Physics is considered as the root to the applications in science and technology. Physics is the study of matter, energy and their interactions. Physics is sometimes referred to as the science of measurements and its knowledge has contributed greatly to the production of instruments and devices of tremendous benefits to the human race (Olaniyan & Omosewo, 2015). It generates fundamental knowledge, which is essential for the required technological advancement needed to propel the economic engine of the world (Mohammed, 2017). It provides the basic knowledge, exciting intellectual adventures and understanding of principles, whose applications contribute immensely to the quality of life in the society. Physics, a subject in the secondary schools has been plagued by one major problem. This is the problem of poor performance in the Senior School Certificate Examinations (SSCE) level (Omosewo, 2002).

Given that physics is one of the major subjects meant to provide the basic developments needed in technology, its effective teaching and learning are crucial issues for consideration (Jegede & Adedayo, 2013). The teaching of physics in secondary schools is intended to produce young scientists, who would be able to design the technological devices that would make day-to-day activities easier and living more comfortable (Ajayi, 2008, Jegede & Adedayo, 2013). Survey from schools by Ajayi (2007) revealed that one of the factors that affect negatively 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 due to lack of involving the students in teaching and learning activities. The teachers' method of teaching may go a long way in enhancing effective learning by the students. The teacher center method of teaching, only place the learners as passive learners (Jegede and Adedayo, 2013). Teaching methods which encourage students' involvement in the classroom activities include inquiry method, collaborative learning, target-task model, experiential learning approach, discovery method, and so on. Students are guided to discover facts and construct their own ideas and understanding of the concepts of the study. However, Nwagbo (1995) noted that science teachers shy away from activity-oriented instructional methods that are more effective and stick to inadequate methods of teaching.

Problem-solving is a brain tasking exercise of finding an answer to a perceived problem. Mayer (1983) defined problem-solving as a multiple step process, where the problem-solver must find 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, these include; Polya's model (1957), Kolb's (1999), 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 the teaching of physics, some of the academic problems were seen as; development of passivity, dependence on the teacher and books, poor performance, absence of skills (Adeniran, 2011).

Problem-solving is a process in which we perceive and resolve a gap between a present situation and a desired goal, with the path to the goal blocked by known or unknown obstacles (Huitt, 1992). The author mentioned four stages of problem-solving, they 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. Olaniyan & Omosewo (2015) 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

In other words, 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 immediately. 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) asserted that, the target-task approach is the interwoven concepts 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.

Learning could be said to be a measurable and relatively permanent change in behavior through experience, instruction, or study. Simon Fraser University defines experiential learning as the strategic, active engagement of students in opportunities to learn through doing and reflection on those activities, which empowers them to apply their theoretical knowledge to practical endeavors in a multitude of settings inside and outside the classroom.

Experiential learning is a learning environment where learners develop knowledge, skills, values and relating theories with facts from direct life experiences outside a classroom academic setting. The experiential learning theory was made popular by educational theorist David A. Kolb, who along with John Fry, developed the experiential learning theory, which is based on the idea that learning is a process whereby knowledge is created through transformation of experience. The knowledge results from the combination of grasping and transforming experience (Kolb, 1999). The Kolb's experiential learning model portrays a four stage learning cycles; two dialectically related modes of grasping experience and two dialectically related modes of transforming experience:

1. Concrete Experience: At this stage a new experience of situation is encountered or a reinterpretation of existing experience takes place.
2. Abstract Conceptualization: This is the process of making sense of what has been happened and involves interpreting the events and understanding the relationships between them.
3. Reflective Observation: This means taking time-out from doing and stepping back from the task and reviewing what has been done and experienced. Here, lots of questions are being asked and communication channels are opened to members of the class.
4. Active Experimentation: This final stage of the learning cycle considers how the learners are going to put what they have learnt into practice.

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. The poor performance in physics is no gender exception as it cut across both male and female but it is very important to find out the level of failure between male and female so as to proffer adequate solution to gender influence in learning (Aina & Akintunde, 2013).

Literature Review

Harbor-Peters (1989) carried out a study to determine the effect of target task approach on students' retention of some geometric concepts. 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 240 SSIII students' achievement in conditional probability in Udi Local Government Area of Enugu Education zone, Nigeria. Results showed that there was no significant difference between the achievement of experimental and control groups in conditional probability, there was significant difference between the methods and gender. In a similar study conducted by Ezeh (2002) on the secondary school students showed that the target task approach enhanced students' achievement and interest in physical chemistry than the expository method. Some researchers argued that students learn based on their experiences with phenomena in their immediate environment.

Baker and Robinson (2016) investigated the effects of experiential learning approach to instruction on the successful intelligence of secondary school agricultural science students. The purpose of the study was to examine the effects of the experiential learning approach on the successful intelligence of the secondary school agricultural students, measured across three domains- practical intelligence, analytical intelligence and creative intelligence. It was concluded that students who received the experiential learning produced higher creativity scores that were domain specific. Also, they scored higher in their practical use of knowledge when compared to their direct instruction counterpart. Cheriyan (2010) tested the effectiveness of Kolb's Experiential Learning Model on the Achievement of 332 secondary school Mathematics students in Kerala. The study found out a significant difference in favour of students taught using Kolb's Experiential Learning Model than those taught using activity oriented methods.

Purpose of the Study

The study also sought to investigate:

1. The performance of students in Physics using target task model, experiential learning approach and those taught without any specific method.
2. The difference in the performance of male and female students who were taught physics using the target-task model.
3. The difference in the performance of male and female students who were taught physics using the experiential learning approach
4. The difference in the performance of students who were taught physics using the target-task model and those taught physics using the experiential learning approach.

Research Questions

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

What is the performance of students when taught Physics using target task model, experiential learning approach and those taught without either of the two?

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

Research Hypotheses

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

Ho_1: There is no significant difference in the performance of male and female students when taught physics using the target-task model.

Ho_2: There is no significant difference in the performance of male and female students when taught physics using the experiential learning approach.

$H0_3$: There is no significant difference in the performance of students who were taught physics using the target-task model and those who were taught physics using the experiential learning approach.

METHODOLOGY

The population for this study was all senior secondary school students offering physics in Ilorin South. The target population was all senior secondary two (SS2) students offering physics in Ilorin South Local Government Area. This was because the students would have some prior knowledge on the concept of electric fields as they would have been exposed to the basics of the concepts of electric field in their SS1. The sample for this study was three intact classes from three schools randomly selected by the researcher and each was assigned one instructional package; EG1=Target Task Model, EG2= Experiential Learning Approach and CG=Normal teacher's Method.

The instruments for this study were in two categories;

Physics Performance Tests (PPT); The items of this were constructed by the researcher based on the WAEC standardized question format. The Pre-PPT included 20 questions and the Post-PPT included 25 questions in total. The content of the Pre-PPT were 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, and 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 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 also enabled the researcher to identify, reconstruct and rule out some items that seemed to be too difficult and too easy in Physics Performance Test (PPT). The reliability of the instrument was carried out using split half method of reliability. Then their scores in the two halves were subjected to reliability using Cronbach Alpha and the reliability coefficient of 0.71 was therefore obtained.

Physics Instructional Package (PIP); This 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(Target-Task Model) and ELA (Experiential Learning Approach) were explored and implemented. The package consisted of lesson plans for four weeks.

Procedure for Data Collection

The researchers designed instructional packages well-grounded in the TTM and ELA. These packages were administered to the students of the sampled schools during the second to fifth week of the experiment. The experimental group one was taught using the TTM and the experimental group two was taught using the ELA while the control group was taught without any treatment. During the TTM instruction, the teacher first introduced the topic to the students, explained it in detail while the students took down relevant notes, the teacher used relevant illustrations and materials 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 right, 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 students in the groups were given posttest.

During the ELA, the teacher first started by reinterpreting existing experience/encounters the students should have. The teacher then related the experience with the concept to be learned. The teacher asked the students to discuss their experiences and asks them to make conclusions from the analogies after which the teacher explained the topic in detail. The teacher treated worked examples afterwards and gave the students exercises to practice. During the sixth week, the students in the two schools were given posttest.

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 hypothesized and tested with the use of Analysis of Covariance (ANCOVA).

Table 1:

Demographic Information of the groups

Groups	Gender	Frequency (%)	Sub-Total (%)
Experimental I	Male	33 (20.7%)	57(36%)
(Target Task Approach)	Female	24 (15.7%)	
Experimental II	Male	20 (12.5%)	39(24%)
(Exp. Learning Approach)	Female	19 (11.9%)	
Control	Male	19 (11.9%)	63(39%)
	Female	44 (27.5%)	
Total			**159(100%)**

. Table 1 showed the demographic information of the groups (experimental I, II and control group). Out of 159 (100%) students that were sampled for this study, 57(36%) of the participants were in the experimental group I (Target Task Approach) out of which 33(20.7%)

were male and 24(15.7%) were female while 39(24%) of the respondents were in the experimental group II (Experiential learning Approach) from which 20(12.5%) were male and 19(11.9%) were female; whereas, 63(39%) of the participants constituted the control group out of which 19(11.9%) were male and 44(27.5) were female

Research Question: *What is the performance of students in Physics before and after the treatment?*

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

Groups		Mean	S.D.	Min	Max	Remark
Experimental I (Target Task Approach)	Pre-test	9.29	2.50	4.00	15.00	Low
	Post-test	18.12	2.50	13.00	23.00	High
Experimental II (Exp. Learning Method)	Pre-test	8.38	2.08	4.00	12.00	Low
	Post-test	16.66	4.25	7.00	24.00	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 2, 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 academic performance of students taught target task approach (18.12) and those taught with Experiential learning method (16.66) were higher than the performance of students taught without (12.14).

Hypotheses Testing

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

Table 3:

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 3 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 three is 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).

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

Table 4:

Analysis of Covariance Showing the Difference in the Performance of Male and Female Students That Were Taught Physics Using the Experiential learning Approach

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	132.664[a]	2	66.332	4.310	.021
Intercept	213.962	1	213.962	13.904	.001
Pretest	76.787	1	76.787	4.990	.032
Gender	14.042	1	14.042	.912	.346
Error	554.003	36	15.389		
Total	11520.000	39			
Corrected Total	686.667	38			

a. R Squared = .193 (Adjusted R Squared = .148)

**Insignificant at p>0.05*

The result in Table 4 showed that the F-value of 0.912 was obtained with a p-value of 0.346 computed at 0.05 alpha level. Since p-value (0.346) was greater than alpha level (0.05), the null hypothesis four was retained and thus, there was no statistically significant difference in the performance of male and female students that were taught Physics using the experiential learning approach ($F_{(1,36)} = 0.912$, p>0.05).

Hypothesis Three: *There is no significant difference in the performance of students who were taught physics using the target-task model and those who were taught physics using the experiential learning approach.*

Table 5:

Analysis of Covariance Showing the Difference in the Performance of Students That Were Taught Physics Using the Target Task and Experiential learning Approaches

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	243.301[a]	2	121.650	13.395	.000
Intercept	885.723	1	885.723	97.527	.000
Pre-test	194.202	1	194.202	21.384	.000
Treatment	17.931	1	17.931	1.974	.163

Error	844.605	93	9.082
Total	30593.000	96	
Corrected Total	1087.906	95	

**Insignificant at p>0.05*

Table 5 showed that the F-value of 1.974 was obtained with a p-value of 0.163 computed at 0.05 alpha level. Since p-value (0.163) was greater than alpha level (0.05), the null hypothesis four was retained and thus, there was no statistically significant difference in the performance of male and female students that were taught Physics using the experiential learning approach ($F_{(1, 93)} = 1.974$, $p>0.05$).

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 and experiential learning approaches were higher than the performance of students taught without. This may be due to the fact that target task and experiential learning teaching approaches 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.

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 favor of the female students while Studies by Adeosun (2008) revealed that in science and mathematics, male students performed significantly better than the female students.

Furthermore, the results obtained from this study revealed that the performance of male and female students taught Physics using experiential learning approach do not differ as no statistical discrepancy was found in the performance of male and female students that were taught using the experiential learning approach. This outcome supports the findings of Weinberge, Basile and Albright (2011) which showed that the performance of male and female students exposed to experiential learning in Mathematics were statistically the same.

Lastly, findings obtained from this study revealed that there was no statistically significant difference in the performance of students that were taught Physics using target task and experiential learning approach. This signifies that both the target task and experiential learning approaches were very effective as the students that were taught with the two approaches performed better in Physics than students those students taught with the conventional method. This result substantiates Obodo (1990) whose study specified that target task and delayed formalization methods are effective in Mathematics instructional delivery.

CONCLUSION

The use of target task model and experiential learning approach enhanced better understanding of concepts of the topics selected and hence improved performance of students

was obtained. It could also be concluded that the use of target task model and experiential learning approach did not reveal any bias in the results towards gender as both male and female students that were exposed to the performed well in Physics.

Recommendations

Based on the findings of this study, the following recommendations were proffered;

1. Teachers should expose students to target task model while delivering classroom instruction so as to improve students' problem solving skills and hence their academic performance.
2. Teachers should also expose students to experiential learning approach while delivering classroom instruction so as to enhance better understanding of the subject matter.
3. Teachers should take into consideration both male and female students while teaching using the target task model and experiential learning approach.
4. There should be seminars, conferences and workshops where in-service teachers should be trained to acquire the knowledge and skills of effective implementation of target task model and experiential learning approach in schools since these methods were found to improve students' academic performance.

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