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Effect of Target Task Instructional Model on Secondary School Students Acquisition of Science Process Skill in Biology: Implication for Quality Studentship in Tertiary Education for Sustainable Development

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ABSTRACT: The study investigated the effect of target task instructional model on acquisition of science process skill among secondary school biology students in Ekwusigo Local Government Area of Anambra State, Nigeria: Implication for Quality Studentship in Tertiary Education for Sustainable Development. The study was a quasi-experimental, pre-test, posttest, non randomized, non-equivalent, control group design. The population of the study consisted of all the 538 students of the state-owned Senior Secondary One (SSI) students in Ekwusigo LGA of Anambra State, Nigeria. The samples of 70 SSI students were randomly sampled from two coeducational schools in Ekwusigo Local Government Area. Science Process Skill Acquisition Test (SPSAT) with reliability coefficient of 0.84 was used to collect data. The treatment group comprised the experimental group taught with Target Task Model and the control group taught with the conventional method. The mean and standard deviation were used to answer the research questions while the Analysis of Covariance (ANCOVA) was used to test the hypotheses. The results showed that student's exposed to Target Task Instructional Model achieved significantly higher in the acquisition of science process skills than those taught with Conventional method. Further findings indicated that gender has no significant mean difference in the achievement of male and female student taught Biology with Target Task Instructional Model. The study thus concluded that the use of Target Task Instructional Model produced significant improvement in acquisition of science process skill among senior secondary school biology students. The study thus recommended among others that the education authorities should develop the school curriculum in a format that will encourage the use of Target Task Instructional Model in teaching and learning in Nigeria Education system. Also the implication for quality studentship in higher education for sustainable development was discussed.

KEY WORDS: Target Task Instructional Model, Acquisition, Science Process Skills, Biology, Tertiary Education, Sustainable Development.

I. INTRODUCTION

Science and technology have brought about a lot of changes in the world today. Thus, there is urgent need for a world community of scientifically and technologically literate citizens. This is essential in order to sustain the natural environment of the world, and to enhance the overall quality of life of its populations. Sustainable development according to World Council of Environment and Development (WCED, 1987) is the development that meets present needs without compromising the ability of future generation to meet their own needs. Therefore the goals of development in both developed and developing countries must be defined in terms of sustainability. Sustainable development must be based on principles aiming at not only the quality of life of people but also the entire cosmos. There is need for an infusion of scientific and technological culture into the society (Maharjen & Whittle, 2000).

The main reason for having science education at secondary school are to create awareness on the effect of scientific knowledge in everyday life, to promote technological and socio-economic development in society and to prepare students for tertiary education (Abungu, Okere & Wachanga, 2014).



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In recognition of the importance of Science to mankind and national development, emphasis is now placed on Science Education at all levels of Nigeria Education system. Many instructional strategies have been proposed such as learning by doing, problem solving, inquiries, discovery and demonstration among others. Therefore, for science to be applied to societal and individual problem solving it has to be adequately and effectively taught (Nzewi, 2000). According to Nwosu (2004) the most important aspect of studying science is the development of the learners, the skills needed for conducting scientific activities. These are science process skills. Science process skills are the tools used for acquiring and processing information and to solve day to day problem and it is therefore indispensable in science activities (Nnorom & Obi, 2013).

The Nigeria Education Research Development Council (NERDC), recognized the importance of the fourteen process skills, and then recommended its inclusion into science curriculum in Nigeria schools. These skills the council in 1990 modified to fifteen includes observing, measuring, classifying, communicating, predicting, inferring, using number, using space/time, relationships, controlling variables, questioning, defining operationally, formulating model, hypothesizing, designing experiments and interpreting data. These process skills is normally hierarchically organized. Finely (1983) points out that the ability to use each upper level depends on the ability to use the lower ones. The process skills are specific intellectual skills used by scientist and applicable to understanding any phenomena.

One of the subjects in senior secondary school core curriculum is Biology. The objective of teaching biology is all based in the acquisition of science process skills. Lagoke, Oyebanji and Jegede (2011) observed that biology being a science of life occupies an important position in the secondary school curriculum. It is designed to educate individuals who may or may not pursue biological related carrier but at list acquired the knowledge of how and the basic essential of proper functioning of the body system.

Various researchers observed that the present conventional method used in teaching science in some secondary schools do not encourage the acquisition of science process skills by students (Obioha, 2003; Obiekwe, 2008 & Nnorom, 2016). The conventional teaching approach is described as teacher centered and didactic with learners simply listening and copying notes. Also, WAEC Chief Examiner's report (2011, 2013, 2014, 2015) recorded poor performance of students in Biology examinations. This poor teaching methods have contributed a great deal to the extreme difficulty in achieving the aim and objectives of science Education especially biology. These in turn constitutes a problem in the enhancement of science.

For acquisition of science process skill to be achieved, students should be allowed to actively take part in science lessons. Teachers should be encouraged or motivated to adopt better strategies that will bring about the expected objectives and learning outcome to students (Ali, 2009). Science process skill improves significantly as a result of science material and equipment rather than through rote learning. Some scholars are of the view that developing and adopting some of existing innovative instructional methods for the attainment of science process skill is the way to go (Abakpa & Iji, 2011; Ogbu, 2011; Nnorom, 2014). One of such innovative strategies to science teaching according to Nzewi (2000) is the Target Task Model (TTM).

According to Harbour-Peter (2002) a target task model is an adaptation of the guided discovery method of science teaching. This model uses inductive method of teaching starting from a particular principle to general ones. As a teaching strategy, the TTM involves the presentation of a major problem "the target task", the solution of which requires the application of some rules and principles which the students may not be familiar with. Expectedly, the problem may not be easy for the students to solve immediately. The teacher then presents some graded problems similar to the target task and guides the students to solve them by providing some hints or clues. According to Olaniyan & Omosewo (2015) the teacher initially provides more hints for the solution of the first two or more examples. As the students progress in the solution of such related problems, the provision of hints is minimized. The knowledge and experience gained from the solution of the graded questions transfer positively to the target task. Eventually, the students are able to solve the target task.



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The Target Task Instructional Model (TTIM) has been found effective in Mathematics instructions (Harbor-Peters, 1989) but there is paucity of research evidence on the use of the same teaching strategy in Biology which differs remarkably from Mathematics in terms of content.

Eze (2002) suggests that target task method is a constructive based teaching model because it is learner centered. The learner restructures or reconstructs its conception view through the process of solving related problems. The clues provided by the teacher helps the student in participating actively and comprehensively to the solution of the problem.

The issues of gender and gender stereotyping permeate every aspect of human endeavour. Okeke (2007) observed that the consequences of gender stereotyping cut across social, economic, political and educational development, especially in the areas of science and technology. However, there have been conflicting reports in respect to gender and achievement in science (Abonyi, 1998, Ezeliora, 1999; Okigbo & Okeke, 2011; Nnorom, 2016). This study is therefore expected to contribute to the debate.

Science learning is expected to produce individuals that are capable of solving their problems as well as those of the society. Such individuals are expected to be autonomous, confident and self-reliant. Science and technology constitute the basis of advancement in nearly all fields of human endeavour. Nwagbo & Chikelu (2011) reported that all is not well with science instruction in Nigerian secondary schools, and noted that science teaching lays extreme emphasis on content and the use of conventional method neglecting the innovative method which enhances teaching and learning. This negligence and 'shy away' attitude from activity oriented method of teaching has led to abstraction which makes the students less active and more prone to rote memorization. Based on this, the Federal Government of Nigeria is emphasizing "the teaching and learning of science process and principles which will lead to fundamental and applied research in the sciences at all levels of education" (NPE, 2008).

A lot has been done to improve science teaching in secondary schools in Nigeria. In spite of that, students continue to perform poorly in science subjects, of which biology is one. This situation has created the need for more effective teaching method. It then becomes necessary to explore the efficacy of alternative method of redressing this situation.

Therefore, the problem of this study posed as a question is: which of the two teaching methods chosen target-task instructional model and conventional method better elicits the acquisition of science process skills among senior secondary school I (SSI) Biology students in Ekwusigo Local Government Area of Anambra State.

II. PURPOSE OF THE STUDY

The purpose of the study is to determine the effect of target task instructional model (TTIM) on acquisition of science process skills among senior secondary school biology students. The study specifically sought to ascertain

1. the effect of target task instructional model and conventional method on SSI biology student's acquisition of science process skills.
2. the effect of target task instructional model on student's acquisition of science process skills among male and female Biology students.

III. RESEARCH QUESTIONS

The following research questions are posed to guide the study:

1. What are the effects of target task instructional model and conventional method on mean acquisition of science process skills of SSI biology students?
2. What is the effect of TTIM on the mean acquisition of science process skills among male and female SSI biology students?

IV. HYPOTHESES

The following null hypotheses were tested at 0.5 level of significance:

1. Ho1: There is no significant difference in the mean science process skill acquisition score of students taught biology with Target Task Model and those taught with Conventional method.
2. Ho2: There is no significant difference in the mean science process skill scores of male and female SSI students taught biology using Target-Task Instructional Model.

V. METHOD

The study was a quasi-experimental involving pre-test, post test, non-equivalent control group design. This design was adopted because intact classes were used as it was not possible to have complete randomization of the subject. The study was carried out in Ekwusigo local government area of Anambra State, Nigeria. The population of the study comprised all the 538 SSI biology students in all the senior secondary schools in 8 (eight) co-educational senior secondary schools in Ekwusigo LGA of Anambra State. The sample consists of 70 SSI biology students randomly sampled from two co-educational schools in the area of study. Only two schools were randomly sampled due to the experimental nature of the study. One school sampled was assigned to the experimental group while the remaining one school was the control group. An instrument known as Science Process Skill Acquisition Test (SPSAT) was developed by the researcher based on the biology topic taught:- Test for the production of photosynthesis which was from SSI biology core curriculum. The SPSAT is a 20 items designed to measure the level of acquisition of each science process skills. The items were distributed among the process skills of measuring, experimenting, classifying, observing, and communicating. SPSAT was used for both pre test and post test. The validation of SPSAT was done by two specialist in science Education department of Chukwuemeka Odumegwu Ojukwu University, Anambra State. A reliability index of 0.84 was obtained for the SPSAT using Kuder-Richardson formula (K-R 20).

The regular biology class teacher were used for the study in both experimental and control groups. Training was given to the biology teacher who took the experimental group on the application of the instructional approach: Target Task Instructional Model (TTIM), while the biology teacher who took the control group used the conventional method. Since intact class was used. The experimental stream teacher was given notes of lesson prepared by the researcher, while the researcher vetted the lesson plan prepared by the biology teacher in the control group to ensure that the teacher did not deviate from the procedures of instructions commonly used by biology teachers.

The treatment consist of teaching a selected biology topic: Test for the product of photosynthesis using Target-Task Instructional Model. However, the control group was taught the same biology concept using conventional method. Lesson plans for both the treatment and control group were the same in terms of contents, basic instructional objectives, length of time for teaching and mode of evaluation. At the end of six weeks, the teacher administered the post test (after reshuffling of the items) to the subjects in the two groups using SPSAT. The scores from both pretest and post test of the two groups were marked and scored using the marking guide.

The data collected from the pretest and post test of SPSAT were analysed using mean and standard deviation for answering the research questions and analysis of covariance (ANCOVA) was used for testing the hypotheses at 0.05 level of significance.

VI. RESULTS**A. Research Question One**

What are the effects of Target Task instructional model and conventional method on mean acquisition of science process skills of SSI biology students?

Table 1: Mean and standard deviation for the experimental and control group

Teaching Method	N	Pre Test		Post Test		Gain Score Mean
		Mean	SD	Mean	SD	
Experiment	35	47.03	8.05	71.83	9.66	24.80
Control	35	44.63	7.12	62.09	7.86	17.46

Source: Authors computation with SPSS 20

From the result on Table 1 above, the experimental pretest mean = 47.03, posttest mean = 71.83 and Gain score = 24.80. However, the control pretest mean = 44.63; posttest mean = 62.09 and Gain score = 17.46. The difference between the pre test and post test mean gain score is higher in experimental group 24.80 than the control group 17.46 indicating the superiority of treatment group over the control in fostering students process skill acquisition.

B. Research Question Two

What is the effect of TTIM on the mean acquisition of science process skills among male and female SSI biology students?

Table 2: pre test and post test mean scores of male and female students exposed to Target Task Instructional Model

Gender	N	Pre Test		Post Test		Gain Score Mean
		Mean	SD	Mean	SD	
Male	16	46.69	9.10	72.75	11.07	28.50
Female	19	47.31	7.30	71.05	8.53	27.46

Source: Authors computation with SPSS 20

Table 2 result shows that the pre test mean scores for the experimental male and female are 46.69 and 47.31 respectively. Similarly, the post test mean scores for the experimental male and female are 72.75 and 71.05 respectively. The mean gain score for male and female in the treatment group are 28.50 and 27.46.

C. Hypothesis One

There is no significant difference in the mean science process skill acquisition score of students taught biology with Target Task Model and those taught with Conventional method.

Table 3: Summary of ANCOVA table on method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1677.228 ^a	2	838.614	10.691	.000
Intercept	8040.311	1	8040.311	102.500	.000
Pre-test	16.071	1	16.071	.205	.652
Method	1568.978	1	1568.978	20.002	.000
Error	5255.643	67	78.442		
Total	320761.000	70			
Corrected Total	6932.871	69			

a. R Square = .242 (Adjusted R Squared = .219)

Table 3 revealed that an $F(1:70) = 20.002$, ($p = 0.000$) for the Method (treatment) was significant at 0.05 alpha level. The figures revealed that the method of instruction produced a significant effect on the post-test achievement scores of students when the covariance effect (pre-test) was statistically controlled. Thus, the null hypothesis of no significance difference was rejected. That is there is significance difference between the science process skills acquisition test-scores of students taught biology using TTIM and those taught using conventional method.

D. Hypothesis Two

There is no significant difference in the mean science process skill scores of male and female SSI students taught biology using Target-Task Instructional Model.

Table 4: Summary of ANCOVA table on gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	25.132 ^a	2	12.566	.128	.880
Intercept	4339.134	1	4339.134	44.138	.000
Gender	25.115	1	25.115	.255	.617
Pre TTM	.108	1	.108	.001	.974
Error	3145.839	32	98.307		
Total	183748.000	35			
Corrected Total	3170.971	34			

a. R Square = .008 (Adjusted R Squared = -.054)



Table 4 shows that $F(1:35) = 25.115$, ($p=0.017$) for the gender effect (male and female) was not significant at 0.05 alpha level. Hence, the hypothesis is accepted. The study thus concludes that there is no significant difference between the male and female students mean score on a science process skill acquisition test.

VII. DISCUSSION OF FINDINGS

The study has shown that students exposed to Target Task Instructional Model achieved significantly higher in Biology in the acquisition of science process skills than those taught with conventional method. The findings support the cognitive theory and the theory of transfer which agree that the use of target task model in science teaching and learning is in its ability to solve the main task based on the fact of finding solutions (Obodo, 2010, Eze, 2002) this implies that as target task model aims to achieve the very task as defined, it will arouse student's interest as well as give focus to the teacher, thereby enhancing student participation and increased learning outcome. This finding conform to the works of Eze (2002), Harbor-Peter (2002), Obodo and Abuggu (1998), Nwagbo and Chukelu (2011), and Abungu, Okere and Wachanga (2014).

In the case of Gender it was revealed that gender has no significant mean difference in the acquisition of science process skills among male and female student taught Biology with Target Task Model. This indicates that Target Task Model is effective on bridging gender gaps in students' achievement in Biology. The findings agrees with existing empirical studies such as Harbor-Peter (2002); & Olaniyan and Omosewo (2015) who also found that gender has no significant mean difference in the achievement of male and female students in science subjects.

VIII. CONCLUSION

The study have shown that Target Task model is very effective as a teaching and learning technique for enhancing the acquisition of science process skill in Biology more than conventional method. Also, TTIM foster acquisition of process skills in both male and female students.

A. Educational Implication for quality Studentship in Tertiary Education for Sustainable Development

The findings of this study have some educational implications for students, teachers and curriculum planners. Active participation of the students in the class aids retention and makes the lesson more meaningful. This is because as the students participate actively, they apply their five senses and other skills to their lessons more than when they would have learned in abstraction or remained less active in the class.

The findings of this study have implications on the teachers who should adopt TTIM method of teaching which is the student centered method. Students learn better when they are deeply involved. TTIM methods enhance understanding of biological concepts and increase the ability to acquire science process skills by the learner.

The findings of this study also have implication on the curriculum planners who are expected to plan for conceptual change over period of years. This is because learning involves the restructuring of prior knowledge to gain new ones for effective learning to take place. Therefore, since the use of TTIM enhances students acquisition of science process skills, it follows that curriculum planners can create the awareness of this method in teachers by including it in the biology curricula. Also, they should include within the existing subjects contents of the biology curriculum, some corresponding indigenous knowledge. They can do this by re-examining the existing units of the subject matter taught in schools and identifying their corresponding indigenous knowledge and instructional material. This will make the teaching of biology interesting and more meaningful for quality studentship in tertiary education for sustainable development.

IX. RECOMMENDATIONS

The following recommendations were made:

1. The education authorities should develop the school curriculum in a format that will encourage the use of Target Task Instructional Model in teaching and learning in Nigerian Education System.
2. Teachers should be sent on seminars and workshops that will expose them to the skills needed for the use of target task instructional model in teaching and learning.



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