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## ENHANCING SENIOR SECONDARY STUDENTS' ATTITUDE THROUGH PUZZLE-BASED LEARNING STRATEGY IN BIOLOGY IN WUKARI METROPOLIS

By

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### ABSTRACT

*The study was designed to ascertain the use of instructional PBLs in enhancing student's attitude towards the learning of Biology. Two research questions were asked to guide the study while two hypotheses were formulated and tested at 0.05 level of significance. The design employed for the study was quasi-experimental of non-randomized pre-test post-test control group type. The sample size for the study was 210 out of a population of 2,180 of 2015/2016 academic session. SSI was sampled through purposive and simple random sampling techniques. The sample formed the two intact classes from two co-educational schools in Wukari metropolis. The sample size was assigned to experimental and control group. Data was collected using Students' Attitude towards Ecology Inventory (SAEI). SAEI was subjected to reliability test using Cronbach Alpha and this yield a coefficient of 0.63 Data was analysed using descriptive statistic of mean and standard deviation to answer the research questions while ANCOVA was used to test the formulated hypotheses. Findings from the study revealed that puzzle based-learning strategy had a significant effect on students' attitude ( $P=0.00<0.05$ ). There was no significant difference between the mean attitude rating of male and female students in the experimental group ( $P=.108>0.05$ ). Based on the findings, it was recommended that curriculum planners should incorporate PBLs into Biology curriculum and that Biology teachers should be encouraged to use it in their regular teaching as it enhances students' attitude.*

### INTRODUCTION

Nations are considered developed nations based on their level of scientific and technological development. Bessong and Obo (2005) assert that the rate of scientific and technological advancement of a nation depends on the thoroughness and level of her implementation of policy on Science, Technology and Mathematics. It is in this view that science is recommended at all levels of education. Biology being one of the science subject is a natural science concerned with the study of life including structure, formation, growth, origin, evolution, distribution and taxonomy (Reiss, 2006) In addition, Biology occupies a central position in the Senior Secondary School

curriculum because of it's dealing with living things as a natural science.

Considering the central position of Biology in the Senior Secondary curriculum, its importance to man and the society at large, many variables have been identified by researchers (Salau, 2012, Adesoji, 2008 and Goerge,2000) as responsible for students' negative attitude and poor performance in the subject such variables are lack of mastery of subject language, inadequate scientific background, attitudinal problems and poor instructional delivery approach. Olashinde (2014), identified poor instructional strategy as the root cause of students' negative attitude towards learning of a subject. According to the author, the traditional teaching method used in schools is

wasteful and unproductive, particularly with slow and average learners. In addition, it has also been shown to be ineffective in the conceptual understanding of the subject matter. To strengthen the foregoing assertion on traditional teaching method, Duyilemi (2014) states that the traditional method used by teachers has led to negative attitude of students towards the learning of Biology. The author further maintained that, students' attitude could be enhanced when they are permitted to actively participate in the learning process.

Attitude is a psychological construct, or latent variable inferred from observable responses to stimuli which are assumed to mediate consistency and coherence among those responses (Olatoye & Aderogba, 2012). A positive attitude towards subjects such as attending regularly, copying of notes and doing assignments are commonly considered as a predictor of behaviour, and thus influence achievement (Yilman & Nihal, 2013). In a similar vein, Cheung (2009) mentioned that the development of students' positive attitude in a subject is necessary because attitude is linked with academic achievement and this can only be achieved through teachers' teaching strategies.

The general assumption of the relationship between attitude and achievement is based on the better the attitude a student has towards a subject or task, the higher the achievement level tends to be. In support of this fact, Okebukola, (2011), opines that students attitude is a barrier to under achievement in science. According to the author, this is as a result of science teachers' constant complain about the lazy nature of most Biology students based on their refusal to do assignments promptly and widespread of absconding classes while the few serious ones do their assignments and attend classes regularly. It is on this basis that researchers. (Danjuma, 2005 and Kurumeh, 2006) advocated on activity-based instructional strategies that engages students actively in the learning process. Abakpa and Iguwe (2013) in another study joined the bandwagon to stress that the

teaching approach adopted by teachers can make the learners develop positive or negative attitude of students towards the learning tasks. It is against this background that the researcher is poised to use puzzle-based learning strategy (a learner centred strategy) to ascertain if students' attitude towards Biology could be enhanced.

Puzzle-based learning strategy was designed by John Spilsbury in 1760. It is an activity based approach to learning that allows students to interact with the learning materials, encourages discussion among students and permits investigation of concepts by exploration through questioning. Farlex (2009) defines puzzles as a game that requires ingenuity and persistence in solving or assembling problems. According to David and Zwiefelhofer (2009) the use of puzzle in the classroom could be effective in response to different learning styles of students. Puzzles have inherent potentials of arousing and sustaining students' attitude in learning, excite learners, and generate new ideas in learners to learn difficult concepts (Moore & Dettlaff, 2005). In this same line, Michalewicz and Michalewicz (2008) posit that puzzles are wonderful tool that can grab learners' attention and help them develop a better attitude. The authors highlighted the importance of puzzles as ability to develop students' critical thinking, remove fatigue, and foster social interaction and recalling of information easily. There are several kinds of puzzles as identified by Bowers (2006) they are; Wood Puzzles, Jigsaw Puzzles, Crossword Puzzles, Logic Puzzles, Picture Puzzles amongst others. Specifically, Crossword puzzles was used for this study. The choice of this puzzle is because it is more suitable to teach ecological concepts. It also enables the students to understand the terminologies of a concept, define and spell concepts correctly.

Ecology being the focus of this study is a topic in Biology that deals with definition of concepts, covers 40% of the entire syllabus and perceived as a difficult topic in Biology. West Africa Examination Council (WAEC) Chief Examiners' report (2012) notes

that students possess low content coverage and poor understanding of ecological concepts. Literature by researchers (Akinsele, 2007, Anaekwe, 2006 & Lawan, 2006) emphasized on the use of effective instructional strategy in order to sustain students' attitude towards the learning of science (Biology inclusive).

There has been a continuous call towards gender response to learning of science (Biology inclusive) by stakeholders. This is because it appears that there is still a considerable bias against female students which impedes their participation and achievement. Olowe (2010) emphasized on the importance of examining instructional strategy in relation to gender is based primarily on the socio-economic differences between boys and girls. Traditionally, according to the author girls in our society are encouraged to conform to the norms of the societies whereas boys are expected to be active and dominant risk takers. Similarly, Longe and Adedeji (2003) are of the opinion that science and technology is a male-dominated subject and that females tend to shy away from scientific and technological fields. Hence boys seem to have a natural positive attitude to science subjects while girls show negative attitude

The influence of gender in learning of science has been of great concern to science educators for a long time, yet no consistent result has emerged. Some researchers are of the opinion that male students develop positive attitude towards science subjects than their female counterparts. For instance, Olyemi (2013) and Wiwat (2013) stated that both male and female students develop positive attitude towards learning of concepts. On the contrary, Dago (2016) found significant difference in the mean attitude rating of male and female students. However, with the contradictions and lack of a clear trend in the attitude of gender towards science, more investigation is imperative. Hence, the study.

### ***Purpose of the Study***

The purpose of the study was to determine the effectiveness of puzzle-based strategy on attitude of senior secondary (I) students in Biology. Specifically, the study sought to;

1. Determine whether the use of puzzle-based learning strategy would improve students attitude towards ecology
2. Ascertain which gender will improve on their attitude ratings towards ecology when taught using puzzles.

### ***Research Questions***

The following questions were asked to guide the study;

1. What are the mean attitude ratings of students taught ecology using puzzles and those taught using traditional method?
2. What are the mean attitude ratings of male and female students taught ecology using puzzles?

### ***Hypotheses***

The following hypotheses were formulated and tested at 0.05 level of significance

H<sub>01</sub> There is no significant difference between the mean attitude ratings of students taught ecology using puzzle-based strategy and those taught using traditional.

H<sub>02</sub> There is no significant difference between the mean attitude ratings of male and female students taught ecology using puzzle-based learning strategy.

### **METHODOLOGY**

The study adopted a quasi-experimental design of non-equivalent pre-test post-test control group type. Intact classes were used to avoid disruption of programmes. A sample of 210 out of 2,180 students from four out of 20 Senior Secondary co-educational schools in Wukari metropolis in Taraba State were used for the study. Multistage sampling precisely purposive and simple random sampling

technique was used in drawing out the sample size. Two schools were assigned to experimental and the other two were assigned to control group.

The instrument used for data collection is Students' Attitude towards Ecology Inventory (SAEI). SAEI is a 30-item instrument adapted from Fennma and Sherman (1976) by the researcher. It is a four-point rating scale to find out students' disposition and feeling about ecology. The items were coded as strongly agree (SA), agree (A) disagree (D) and strongly agree (SD) The items weighted 4, 3, 2, and 1 for positive items while those of negative statements were scored in reverse order of 1,2,3, and 4 respectively. Lesson plans were prepared as an instructional tool for the study. The lesson plan and

instrument were validated by experts in the field. The instrument was trial-tested on 30 Students in a different school outside that of the ones for the main study. The reliability of SAEI was calculated using Cronbach alpha since the items were in continuum which yielded a reliability co-efficient value of 0.63.

**RESULTS**

Results of this study are presented according to the research questions asked and hypotheses formulated.

**Research Question 1**

**What are the mean attitude ratings of students taught ecology using puzzle-based strategy and those taught using traditional method?**

**Table 1:** Mean and Standard Deviations of Attitude Ratings of Students in the Experimental and Control Group

Group	N	Pre-SAEI		Post-SAEI		Mean Gain
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Experimental	118	69.42	7.286	71.64	8.922	2.22
Control	92	66.66	6.138	66.66	6.138	00.00
Mean diff.		2.76		4.98		
Total	210					

From Table 1, the mean attitude ratings of students in the pre-SAEI of the experimental and control groups are 69.42 and 66.66 respectively with their corresponding standard deviations as 7.286 and 6.138. The difference between the mean attitude ratings of students of the experimental and control groups is 2.76. On the other hand, the mean attitude rating scores of students in the post- SAEI of the experimental and control groups are 71.64 and 66.66 respectively with their standard deviations as 8.922 and 6.138. The difference between the mean attitude ratings of the experimental and control groups from

the post- SAEI is 4.98. This implies that students taught with puzzle-based learning strategy developed positive attitude towards learning of ecology than those taught without.

**Research Hypothesis 1**

**There is no significant difference between the mean attitude rating scores of students taught ecology using puzzle-based learning strategy and those taught without puzzle-based learning strategy**

**Table 2:** Summary of Two-Way ANCOVA Table for Effect of PBLs on Students' Attitude in Ecology.

Source	Type III sum of squares	df	Mean square	F	sig	Partial Eta Squared
Corrected Model	2290.239a	4	572.560	9.883	.000	.162
Intercept	5059.246	1	5059.246	87.332	.000	.229
Pre	692.602	1	692.602	11.956	.001	.055
Group	819.008	1	819.008	14.138	.000	.065
Gender	151.070	1	151.070	2.608	.108	.013
Grp* gender	6.138	1	6.318	.109	.742	.001
Error	11875.875	205	57.931			
Total	1027268.000	210				
Corrected Total	14166.114	209				

A R-squared =.162 (adjusted R-squared =.145)

Table 2 presents the effect of puzzle-based learning strategy on students' attitude in ecology. The Table reveals (F, 205) = 14.138, since  $p = 0.00 < 0.05$ , where 0.05 is the level of significance for the study. The null hypothesis that there is no significant difference in the attitude ratings attained by students exposed to puzzle-based learning strategy and the traditional teaching group was therefore rejected. This implies that students in the experimental group

significantly developed positive attitude towards the learning of ecology more than their control group counterparts.

**Research Question 2**

**What are the mean attitude ratings of male and female students taught ecology using puzzle-based learning strategy**

**Table 7:** Mean and Standard Deviations of male and female Students' Attitude

Gender	N	Pre-SAEI		Post- SAEI		Mean Gain
		X	S.D	X	S.D	
Male	59	68.12	7.006	70.69	9.570	2.57
Female	59	70.67	7.389	72.65	8.293	1.98
Mean diff.		7.45			8.04	
Total	118					

**Key:** X=Mean S.D=Standard Deviation

From Table 3, the mean attitude ratings of male and female students in the pre- SAEI of the experimental group are 68.12 and 70.67 respectively with their Standard Deviations as 7.006 and 7.389. The mean difference in the attitude ratings of male and female students in the pre-SAEI is 7.45. On the other hand, the mean attitude ratings of male and female students in the post -SAEI of the experimental group are 70.69 and 72.65 respectively with their standard deviation as 9.570 and 8.293. The mean difference in

the attitude ratings of male and female students in the post-SAEI is 8.04.

**Research Hypothesis 2**

**There is no significant difference in the mean attitude rating scores of male and female students taught ecology using puzzle-based learning strategy.**

From Table 2, F (1,205= 2.608) at degrees of freedom and  $p = .108$  since  $p > 0.05$ , the study reveals

that the null hypothesis of no significant difference between male and female students' attitude is not rejected. Thus, the result indicates that the difference between male and female students' attitude taught ecology using puzzle-based learning strategy is not statistically significant.

## DISCUSSION

The result of this study revealed that students exposed to puzzle-based learning strategy developed positive attitude towards the learning of ecology than their control group counterparts. This finding is consistent with the findings of Michalewicz and Michalewicz (2008) and Duyilemi (2013) who found out that puzzles are wonderful tool that can enhanced students' attention and help them develop positive attitude towards learning. This implies that puzzle-based learning strategy enhanced students' attitude than the traditional teaching method which is deficient in meeting the learners need.

Furthermore, the result revealed that PBLs improved both attitude ratings of male and female students in post-SAEI. The non-significant difference in the attitude ratings of both male and female students is an indication that PBLs is not gender biased. This result agrees with Oluymi (2013) and Wiwat (2013) who reported that there is no significant difference between male and female students' attitude towards learning of concepts using puzzle-based learning strategy. On the other hand, the result disagrees with the reports of Longe and Adedeji (2003) and Dogo (2016) who found significant differences in students' attitude towards learning of concepts.

## CONCLUSION

Based on the findings, the study concluded that teaching strategy has the potentials of improving students' attitude. This is because of the high mean attitude rating score of students exposed to PBLs than their counterparts exposed to traditional teaching method. The possible reason for this could be that

students were allowed to argue, discuss and share ideas in the learning process, thereby making the shy ones to become bold in the process.

## RECOMMENDATIONS

Based on the findings from the study, it was recommended that:

- 1 Biology teachers should be encouraged to use PBLs during lesson to enable students to learn from one another.
- 2 Teachers should be trained at seminars and workshops to adopt puzzle-based strategy so as to keep them abreast with the principles and implementation process thereby making lessons interesting for the learner.

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