EFFECT OF 7ES MODEL CONSTRUCTIVIST INSTRUCTIONAL STRATEGY ON INTEREST OF STUDENTS IN SECONDARY SCHOOL BIOLOGY IN KOGI STATE

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Abstract
This study investigated the effects of 7Es model constructivist instructional strategy on interest of students in secondary school biology in Kogi East Education Zone in 2018/2019 academic session. The design used for the study was a quasi-experimental design. Two objectives, two research questions and two hypotheses guided the study. The instruments used for the study was Biology Interest Scale (BIS). The reliability coefficient obtained during the pilot study using Cronbach Alpha formulae for BIS instruments was 0.82 respectively. The population of the study was all the 19,240 senior secondary two students in 147 co-educational schools in both rural and urban areas. Three hundred and thirteen senior secondary two students were selected by stratified random sampling technique for the study. BIS instrument was validated and administered to the students in their intact classes. Mean and Standard Deviation statistical tools were used to answer the research questions while Analysis of co-variance (ANCOVA) was used for testing of the hypotheses at 0.05 level of confidence. The findings revealed that 7Es model constructivist instructional strategy significantly enhanced interest at (F=12.12, P<0.05) more than conventional method among students in biology. There was no significant difference in the interest at F (1,162) = 0.12, P < 0.05 between male and female students taught using 7Es model constructivist instructional strategy in biology. It is recommended, among other things that biology teachers should use more inquiry based strategies like the 7Es model constructivist instructional strategy to enhance interest of students in biology.

Keywords: 7Es model Constructivist Instructional Strategy, Conventional method, Interest, Gender and Biology

Introduction

Defined biology as a branch of science that involves the study of living things. Living things can be classified into two broad groups, namely plants and animals. Some of the branches of biology include: genetics, cytology, anatomy, morphology, entomology and parasitology, among other things (Sarojini, 2005). The subject finds application in other disciplines like agriculture, medicine and so forth. Presently, it is recognized as a standard subject of instruction in schools all over the world. In spite of the popularity of biology among students, the failure rate has remained high and achievement and interest has been poor. This has been attributed to factors like inadequate instructional facilities and teachers' use of inappropriate teaching methods for teaching the subject among other things (Bettina, 2005; Isah, 2007; Anthony, 2010; Alexander, 2012).

Samba, Achor and Ogbeba (2010) have called for the use of innovative teaching strategies like constructivist instructional strategy to science subjects like biology. Constructivism is a philosophy of learning founded on the premise that by reflecting on our experiences we construct our own understanding of the world we live in. It is a broad term used by philosophers, curriculum designers, psychologists and educators to emphasize learners' contribution to learning through both individual and social activity (Woolfolk, 2008).

The guiding principles of constructivism which science educators recommend to be applied in science classrooms include the following: Learning is a search for meaning. Therefore learners must be helped to construct meaning from issues. Learning requires understanding whole as well as parts and not isolated facts (Piaget, 1977). In order to teach well, teachers must understand mental models that students use to perceive the world and the assumptions they make to support these models (Ryder, 2010). By these principles, the purpose of learning is for an individual to construct his or her own meaning and not to just memorize and regurgitate someone else's meaning (Akinloye, 2002; Okebukola, 2002). In other words, learners take responsibility for their own learning, thereby fostering, among other things, learners' acquisition of problem solving skills and ability to express ideas based on the understanding of such concepts.

Also, the principles of constructivism discourage teacher's domination of classroom and encourage teachers' use of open-ended questions among other things. One unique advantage of constructivism principles is that it calls for elimination of grades and standardized testing in science. By this,

assessment becomes a part of the learning process, so that learners play a greater role in determining their own progress in science classroom. There are two constructivist schools of thought namely social constructivism and cognitive constructivism.

Social constructivists emphasize the influence of cultural and social contexts in science learning. They advocate for teachers' use of discovery model of learning in science classrooms (Woolfolk, 2008). The use of the discovery model thus places the teacher in an active role while the students' mental abilities develop naturally through various paths of discovery. One of such discovery models of teaching is the 7Es model of constructivist instructional strategy. The 7Es model involves conducting learners through a cycle of seven stages of learning activities. The stages of activities include: excitement, engagement, exploration, explanation, elaboration, evaluation, and extension. Each stage of learning is aimed at achieving an objective (Eisenkraft, 2003).

On the other hand, cognitive constructivists such as Piaget, (1977) and Von Glasersfeld (1989) posit that a child constructs understanding through many channels in his or her environment. Some principles guiding the cognitive constructivist theory include; learning as an active process, learning in terms of holistic approach and learning as constructing meaning based on learners' experiences. By these principles, leading cognitive constructivist psychologists like Piaget and Bruner (1968) emphasized that there was the need for instructional materials to be relevant to the learner's cognitive development. These cognitive psychologists stressed the need for science curriculum that was organized in a spiral manner so that students could continually build upon what they had already learned. The need for spiral curriculum is necessitated by the adoption of an eccentric pattern for science subjects' curricula; including the biology curriculum in secondary schools in Nigeria.

The choice of a teaching method should be considered in terms of enhancing learners' interest. This is so because the level of interest of a student in a subject whether high or low can either enhance or mar a student's career prospects. Ryder (2010) defined interest as arousing or inducing the attention or curiosity in a person. It also means wanting to know or the feeling that one wants to know or learn more.

The concept of interest in relation to classroom teaching and learning has been one of the concerns of educators and psychologists in recent years. Cognitive theorist such as Piaget (1977) outlined stages of cognitive development of a child into four namely sensory, pre-operational, operational and concrete stages. A child's response to stimuli in his environment differs in each of these stages. Cognitive psychologists such as Piaget and Brunner (1968) have called for the use of instructional materials that are relevant to learners' cognitive level. This implies that teachers should use learning materials and methods that appeal to learners' interest based on their cognitive level. By this theory, there is need to employ the 7Es model constructivist instructional strategy whether it will foster students' interest in biology lessons.

An issue of concern in education is the possible influence of gender on learning outcomes like students' interest. In a report by the West African Examination Council's Senior School Certificate Examination (2017-2018), statistics of results in Nigeria by subject, grade and sex revealed low enrolment due to low interest among girls for science subjects. Thus, it is against this backdrop, that arouse the need to determine the effect of 7Es model constructivist instructional strategy on interest among students in biology with respect to gender in senior secondary schools in Kogi East Education Zone in Nigeria.

Statement of the Problem

Biology is taught as a compulsory subject in secondary schools because of its importance to several disciplines including medicine and agriculture in Nigeria. The subject content consists of concepts that require both theoretical and practical applications. Both theoretical and practical aspects of the course content demand that biology be taught with methods that require minds-on and hands-on activity. That is, methods that are inquiry based.

The need for more efficient approaches in teaching science subjects like biology has been the concern of educators like Samba and Eriba (2012) in recent years. This concern is as a result of inability of biology teachers to use inquiry based methods in teaching biology. This leads to poor interest among students in biology in Nigeria.This is evident in studies by Mbajiorgu (2003), Isah (2007) and in the Chief Examiner's report of West African Senior School Certificate report between 2001- 2011. Thus, the problem of this study stated as a question is: what are the effects of 7Es model constructivist strategy on interest of students in secondary school biology in Kogi East Education Zone?

Purpose of the Study

The study investigated the effects of 7Es model constructivist instructional strategy on students' interest in biology in senior secondary schools. Specifically, the study investigated the following objectives.

1. Effect of 7Es model constructivist instructional strategy and conventional method on students' interest in biology.
2. Effect of gender on students interest when using 7Es model constructivist instructional strategy.

Research Questions

The following research questions guided the study.

1. What is the effect of 7Es model constructivist instructional strategy and conventional method on interest of students in biology?
2. What is the effect of 7Es model constructivist instructional strategy on interest of students in biology based on gender?

Hypotheses

The study was guided by the following hypotheses.

$Ho_{:1}$ There is no significant difference between the mean interest scores of the students' taught biology using 7Es model constructivist instructional method and conventional method.

$Ho_{2:}$ There is no significant difference between mean interest scores of male and female students taught biology using 7Es model constructivist instructional strategy.

Methodology

Quasi-experimental design was used for the study. Specifically, non-equivalent control group design was used. The population of the study was all the 19,240(10,524 male and 8,716 female) senior secondary two students from the 147 co-educational schools in Kogi East Education Zone for 2018/2019 academic session (Kogi State Ministry of Education, Lokoja, 2019).

Simple random sampling techniques were used to select 313 students (152 males and 161 females) from eight schools in the area of study. The instrument used for the study was a Biology Interest Scale (BIS), a Likert type scale was designed by the researcher to obtain students' feelings or views about topics in biology that were used in the study and students' views on biology as a subject. The first fifteen BIS items focus on students' views on biology as a subject. The second fifteen items of the BIS inventory were drawn from the four selected topics in SSII biology syllabus. The topic includes balanced diet, excretion, pollution and erosion. The topics were used because they are topics in biology SS II syllabus. The BIS items were thirty in all.

The BIS was expected to elicit responses based on the views of the students on assigned points of 5, 4, 3, 2, and 1 on five-category theme; strongly agree (SA), agree (A), undecided (U), disagree (D) and strongly disagree (SD). Thus, a maximum of 150 score and minimum of 30 scores could be obtained on responses to interest inventory. Three experts in science education validated the instrument. A pilot test was conducted in two schools outside the area of studyand areliability index of 0.82was obtained using Cronbach Alpha formular.

Method of Data Collection

First, the researcher under-took a training workshop using a training instructional guide for the eight research assistants who were graduate biology teachers in each selected school for two days. On the first day of the workshop, the researcherinstructed the four research assistants for control schools to conduct rehearsal on the use of lesson plans on conventional method in teaching selected topics in biology. While the second day of the workshop was used to train the other four research assistants for experimental schools on the use of lesson plans on 7Es model constructivist strategy in teaching selected topics in biology.

Secondly, all students that were involved in the study were pre-tested using BIS instrument. There was no prior lesson taught to treatment and control groups before the pre-testing. The results of the pre-BIS scores were collated before the actual treatment began.

The third phase involved teaching selected topics in biology with 7Es model constructivist instructional strategy to the treatment groups. The same topics were taught with conventional approach to the control groups. Both treatment and control groups were taught with different modes of lesson plans for four weeks. Both treatment and control groups were post-tested using BIS instrument after four

weeks of teaching. The post-BIS ratings were collated like those of pre- BIS. These were then subjected to statistical analysis.

Results

The research questions were answered using means and standard deviation while the hypotheses were tested at 0.05 level of significance using analysis of co-variance. The data are presented and analyzed according to the research questions and hypotheses.

Research Question 1**:** What is the effect of 7Es model constructivist instructional strategy and conventional method on interest of students in biology?

Data answering research question two is presented in Table 1

Table 1**: Mean and Standard Deviation of Pre-test and Post-test Interest scores for Conventional and 7Es groups**

Group		Pretest	Posttest	Mean difference
Conventional group	N	148	148	
	$\overline{X}$	2.95	2.97	0.02
	SD	0.37	0.34	
7Es group	N	165	165	
	$\overline{X}$	3.21	3.54	0.33
	SD	0.42	0.41	
Mean difference				0.31

Table 1 shows that the students in the 7Es group had a mean interest score gain of 0.33 while those in the conventional group had a mean interest score gain of 0.02. This shows that the students in the 7Es group scored higher than conventional group with a difference of 0.31. Thus, interest was enhanced for students taught biology with 7Es model constructivist instructional strategy than those taught biology with conventional method.

Research Question 2: What is the effect of 7Es model constructivist instructional strategy on interest of students in biology based on gender?

Data answering research question four is presented in Table 2

Table 2: Mean and Standard Deviation of Pre-test and Post-test Interest scores of Male and Female Students in the 7Es group

Sex		Pretest	Posttest	Mean difference
Male	N	80	80	
	$\overline{X}$	3.20	3.53	0.32
	SD	.441	.400	
Female	N	85	85	
	$\overline{X}$	3.23	3.55	0.33
	SD	.443	.442	
Mean difference				0.01

Table 2 shows that the male students had a mean interest score gain of 0.32 while the females had a mean gain of 0.33. This shows that the female students scored higher than their male counterparts with a difference 0.01. Hence, the use of 7Es constructivist instructional strategy fosters interest of females than males in biology.

Test of Hypotheses

Analysis of Covariance (ANCOVA) was used to test the significance of the differences between the mean scores in hypotheses 1-2. Also, the F-values were tested at 0.05 level of significance.

Hypothesis 1**:** There is no significant difference between the mean interest scores of the students taught biology using 7Es model constructivist instructional method and those taught using conventional method.

The test of hypothesis two is presented in Table 3

Table 3: ANCOVA of Mean Interest Scores of Students Exposed to 7Es and Conventional methods

Source	Type III Sum of Square	df	Mean Square	F-ratio	Sig.	Decision
Corrected Model	32.73[a]2	8.18	68.80	.00	(S)	
Intercept 20.391	20.39	1	20.39	171.37	.00	
Pre-test	8.18	1	8.1868.80	.00		
Method	14.41	1	14.41	12.12	.00	
Gender	0.03	1	0.03	0.28	.87	
Method * Gender	0.01 1	0.01	0.12	.73		
Error	36.64308	0.12				
Total	3428.36	313				
Corrected Total	69.4	312				

a. R Squared= .472 (Adjusted R Squared=.465)

Table 3 shows that the calculated F-ratio is significant. F(1,308) = 12.12, P<0.05. Therefore, the null hypothesis is rejected. There is a significant difference between the mean interest scores of students taught biology using 7Es constructivist instructional strategy and conventional method. As such, interest was enhanced in students taught biology using 7Es constructivist instructional strategy than conventional method..

Hypothesis 2 There is no significant difference between mean interest scores of male and female students taught biology using 7Es model constructivist instructional strategy.

The test of hypothesis four is presented in Table

Table 4: ANCOVA of Mean Interest Scores of Male and Female Students Exposed to 7Es

Source	Type III Sum of Square	df	Mean Square	F-ratio	Sig.	Decision
Corrected Model	3.44[a]2	1.72	11.48	.00	(S)	
Intercept	16.82	1	16.82	112.26	.00	
Pre-test	3.41	1	3.41	22.75	.00	
Gender	0.19	1	0.19	0.12	73	
Error	24.27162	0.15				
Total	2096.41	165				
Corrected Total	27.71	164				

a. R Squared= .124 (Adjusted R Squared=.113

Table4 shows that the calculated F-ratio is not significant, F (1,162) = 0.12, P<0.05. Therefore, the null hypothesis is not rejected. There is no significant difference between the mean interest scores of male and female students taught biology using 7Es constructivist instructional strategy. Hence, interest was enhanced in both male and female students taught biology using 7Es constructivist instructional strategy.

Discussion of Findings

The study is about the effect of 7Es model constructivist instructional strategy on interest of students in biology in senior secondary schools. The discussion is based on the analysis and findings of the research questions and hypotheses.

Effect of 7Es constructivist instructional strategy and conventional method on students' interest in biology

Table 1 shows that the observeddifference between the mean interest score of students in the 7Es group and those in the conventional group is 0.31. This shows that the students in the 7Es group scored higher than conventional group. Table 2 shows that at F (1,308)=12.12, P<0.05, there is a significant difference between the mean interest scores of students taught biology using 7Es model constructivist instructional strategy and conventional method.

Previous study by (Mbajiorgu, 2003) reveals that students do not show interest in biology because of teachers' poor approach in teaching the subjects. This makes biology lesson boring and uninteresting. More often, students complain that the subject is too wide and involves a lot of note taking. This study has confirmed findings with previous study by Kim (2005) that the use of constructivist instructional strategy fosters interest of learners than conventional method in biology. Students

showed greater interest when taught with 7Es model constructivist instructional strategy than conventional method because they were allowed to observe real problems like erosion, malnutrition and pollution, investigate and proffer solution to these problems.

Effect of 7Es constructivist instructional strategy on male and female students' interest in biology

Table 2 reveals that the female students had a higher mean interest gain thanmale students. The observed mean difference in interest between female and male is 0.01. Table 4 shows that at F (1,162) = 0.12, P<0.05, there is no significant difference between the mean interest scores of female and male students taught biology using 7Es model constructivist instructional strategy.

Biology is one of the science subjects made compulsory in secondary schools in Nigeria. Like other science subjects, students' interest in biology has not been encouraging over the years. This has been blamed on several factors including teachers' use of in-appropriate teaching methods (Nwagbo, 2001; Isah, 2007). The high mean interest scores of male and female students in this study shows that use of 7Es model of constructivist teaching strategy which is inquiry-based fosters interest among male and female in biology. This finding is in agreement with findings in previous studies by Mbajiorgu (2003) and Kim (2005) that the use of inquiry teaching strategies could fosters students' interest in female thanmale students in science subjects.Interest of female students were enhanced because they were exposed to diverse activities like visiting sites of problems related to the topics in biology lessons, investigate the causes of the problems and proffer solutions to the problems observed.

Conclusion

Based on the findings in this study, the following conclusions are made.

i. 7Es model constructivist instructional strategy significantly fosters students' interest more than conventional method in biology.
ii. 7Es model of constructivist instructional strategy fosters interest of both male and female students in biology..

Recommendations

On the basis of the findings of this study, the following recommendations are made.

1. Science teachers should intensify the use 7Es model constructivist instructional strategy in teaching science subject like biology to stimulate and sustain students' interest.
2. There is need biology teachers to teach biology without being gender bias.And this can be achieved through the use of all gender friendly activity-based strategies such as the 7Es model constructivist instructional strategythat can stimulate students' interest in biology.
3. There is need for biology teachers to help students develop interest in biology and other science subjects. This is because the use of inquiry-based teaching strategies like 7Es model constructivist instructional strategy requires the use of activities like discussion and small group work that can stimulate students' interest in biology.

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