Effects of Exposure to Constructivist Instruction on Interest of Male and Female Science Students.

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Abstract

The study investigated the effect of exposure to constructivist instruction on interest of male and female science students. Quasi-experiment of the pretest- posttest non equivalent control group research design was used. Three research questions answered using Mean and Standard Deviation (SD), and three hypotheses tested at .05 level of significance using ANCOVA guided the study. The subjects were 162 Upper Basic secondary two students from four intact classes, selected by purposive sampling of four schools, out of 23 coeducational JS schools in Ohafia Local Government Area of Abia state, Nigeria. Four schools were randomly assigned two each, to constructivist instruction and traditional (lecture method) groups. Instrument for data collection was Basic Science Interest Inventory (BSII), a four point rating scale response options. BSII had 30-items validated by four science educators in the University of Nigeria. The reliability was established using Cronbach Alpha and an internal consistency of 0.98 was found. Students' regular teachers exposed to training handled the teaching. The major findings were that students exposed to constructivist instruction developed higher interest in science than those exposed to lecture method. There was no significant difference between the compared mean interest scores of male and female students. Constructivist instruction was superior to lecture method irrespective of student's sexes. Recommendations were made based on the findings.

Keywords: Constructivist instruction; Interest; Exposure; Science students

1 Introduction

Interest is an important factor needed for a brilliant output of any task. According to Okoro (2006) interest is the likes or dislikes of activities or things by a person. In education, it is a state of wanting to learn an academic content or subject. Interest is a major learner characteristic that play a key role in student's achievement in a subject. A learner who is interested in a subject would likely enjoy and feel satisfied in what he or she is expected to do. When lessons do not accommodate students' interest as a tool with which to achieve, learners lose interest and feel disengaged (Weber, 2007).

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Research studies have observed that there is a positive relationship between interest and high achievement (Murphey and Beggs, 2003; Eccles, Dinesen and Zarret, 2007). The pattern of student's interaction in the classroom has significant effect on their interest and achievement in science. For students to become really interested in the learning process, Opara (2008) suggested that they must be encouraged to play active role in the learning process. Strong objection to the use of less investigative method arose as a result of research findings that students' interest in science is high in their early years of schooling but drops after ten years of age (Murphey and Beggs, 2003). This means that as students' progress in their educational levels, their interest in science diminish due to a number of factors which include:

- Poor teaching methods in the form of excessive talking, copying of notes and rote learning of textbooks' materials adopted by science teachers in Nigeria;
- Expository rather than inquiry methods of instruction which does not predispose students to hands-on-minds-on activity (Ibe, 2006), for arousal of the learners' enthusiasm in the teaching learning process (Opara, 2008) and attitude in science (Nwagbo, 2006). In the light of the above, Iyobebhe (2002) pointed out the need for upgrading current instructional practices in primary, secondary and tertiary levels of science education.

In response to the need of upgrading instructional practices, the federal government of Nigeria launched the Universal Basic Education (UBE) in Zamfara state on 30th September 1999 and was legalized by the compulsory free UBE Act of 2004. The UBE covers 6 years of primary education and the first 3 years of secondary education known as the Junior Secondary school. The curricula for UBE restructured in 2006 such that after 9 years of education, the learner must have acquired appropriate levels of literacy, numeracy, manipulative, communicative and life skills as well as moral and ethical values needed for laying a solid foundation for life-long learning as a basis for scientific and reflective thinking (Duada and Udofia, 2010). This were put in place because unless a proper foundation is led at the middle years of schooling, much of what occur at the higher levels (senior secondary and tertiary) may not be sound, appreciative and appropriate (Ibe, 2013).

The quality of teaching may appear to be central in enhancing students' interest irrespective of gender.

However, studies carried out in Nigeria by (Adaji, 2006, Njoku, 2006, Azikiwe 2011) found out that females under-achieve in science in relation to males. On the other hand, UNESCO as cited in (Okeke, 2001) had stated that women perform two third (2/3) of the world's work and occupy a unique role in maintaining the socio-economic growth in most countries of the world. These reasons underscore the need of carrying out research that determines the effect of exposure to constructivist mode of instruction on interest of male and female science students at the highly sensitive period of their schooling.

Constructivist instruction has various models which include the 6 steps Teaching with Analogy (TWA), 5 steps conceptual model (PEDDA), 4 phase constructivist model and 5 phase ES model of Biological Science Curriculum Studies (BSCS, 1993) which this research study utilized. According to BSCS (1993) teaching and learning framework based on constructivism consist of five phases namely Engagement, Exploration, Explanation, Elaboration and Evaluation. In this model students redefine, reorganize, elaborate and change their initial concepts through interaction with their senses, environment and other individuals. Generally, the study investigated the effects of constructivist instruction on interest of male and female science students in Nigeria. Specifically the study investigated the:

- Relative efficacy of constructivist instruction and the traditional (lecture) method on students' interests in basic science.
- Influence of gender on the mean interest of students when exposed to the two methods of teaching.
- Interaction effect of approach and gender on students' interest in science.

These three research questions and three hypotheses guided the study:

1. What are the mean interest scores of students exposed to constructivist instruction and the traditional (lecture) method?
2. What is the influence of gender on mean interest scores of students when exposed to the two teaching methods?
3. What is the interaction effect of approach and gender on the mean interest scores of students?

Hypotheses:

1. There is no significant difference in the mean interest scores of students exposed to constructivist instruction and those exposed to traditional (lecture) method.
2. There is no significant difference in the mean interest scores of male and female exposed to the two teaching methods.
3. Interaction effect of teaching approach and gender on mean interest scores of students is not significant.

1.2 Significance of study

The findings of the study will be of benefit to science teachers and their students, curriculum planners and education policy makers. Since teachers determine classroom activity task structures and interaction patterns, the result of this study will provide a guide for their choice of constructivist model. The significance of interest development in the learners will enhance the awareness of curriculum planners and education policy makers on essential instructional materials/elements that need inclusion in the curriculum and education policy statements respectively.

Theory: The study was based on Piaget's constructivist theory of learning which emphasizes the teachers ability to present instruction in such a way that students are actively involved to ensure that their learning needs are taken care of even in the affective domain of educational objectives.

2 Design and Procedure

The research design was quasi-experimental of the pretest-post-test non equivalent control group. Intact classes were used. The sample was made up of one hundred and sixty two (162) students from four intact classes. The intact classes were selected through purposive sampling of four schools out of 23 coeducational junior secondary schools in Ohafia Local Government Area of Abia state, Nigeria. The four schools were randomly assigned two to experimental group and the other two to control group. Instrument for data collection was Basic Science Interest Inventory, a four point scale that had 30 items validated by four science educators from the department of Science Education, University of Nigeria, Nsukka. Trial testing was done using 40 JS2 students in Enugu state, Nigeria. The reliability was established using Cronbach Alpha. Internal consistency reliability of 0.98 was found. The normal class teachers who were trained by the researcher were given lesson notes and advised to adhere strictly to the lesson notes. The instructional packages for the two methods were the same except in method. The 3 research questions were answered using Mean and Standard Deviation (SD) while the hypotheses were tested at .05 level of significance using Analysis of Covariance (ANCOVA).

3 Findings

The findings are presented in tables based on the research questions and the hypotheses that guided the study. Data for answering research questions one, two and three are presented on table 1, 2 and 3 respectively.

Table 1: Mean interest scores and Standard Deviations of students exposed to constructivist instruction and those exposed to traditional (lecture) method.

Treatment Group		Pre Interest
Experimental Group (Constructivist Model)	Mean	1.81
	N	85
	SD	.698
Control Group (Lecture Method)	Mean	1.79
	N	77
	SD	.694

Findings in table 1 reveal that students exposed to constructivist instruction had post-test mean interest score of 3.37 and an SD of .706 while those exposed to lecture method had a post-test mean interest score of 1.90 and an SD of .710.

Table 2: Mean interest and SD scores of male and female students exposed to constructivist instruction and traditional (lecture) method

	Students Gender	Pre Interest	SD
Experimental Group (Constructivist Model)	Males	1.81	.691
	Females	1.80	.714
	Total	1.81	.698
Control (Lecture)	Males	1.86	.701
	Females	1.69	.683
	Total	1.79	.694

Male students exposed to constructivist instruction had a post-interest mean score of 3.36 with an SD of .718 while the females in the same group had a mean of 3.39. Males in the control group had a post-interest mean of 1.95 and an SD of. 745 while females had 1.84 and an SD of .667. It appears that females developed slightly higher interest than males in the constructivist group and reverses in the control group, that difference was not statistically substantial.

Table 3: Mean interest scores and Standard deviation scores of students on interaction effect of approach and gender.

Treatments Groups	Students Gender	Pre Interest	SD	Post Interest	SD	N
Experimental Group (Constructivist Model)	Males	1.81	.691	3.36	.718	44
	Females	1.80	.714	3.39	.702	41
	Total	1.81	.698	3.37	.706	85
Control (Lecture)	Males	1.86	.701	1.95	.745	44
	Females	1.69	.683	1.84	.667	33
	Total	1.79	.694	1.90	.710	77
Total	Males	1.84	.692	2.26	1.01	88
	Females	1.75	.698	2.70	1.03	74
	Total	1.80	.694	2.67	1.01	162

Table 3 above reveal that for the experimental group, males had pretest and post-test mean interest scores of 1.81 and 3.36 while females had a pretest and post-test mean interest scores of 1.80 and 3.39. With respect to interaction effect of teaching approach and gender on students' interest, the development of higher interest by females and males in the constructivist group was as a result of treatment and not as a result of gender.

Table 4: Analysis of Covariance (ANCOVA) of Students Post-interest Mean Scores by Treatment and by Gender.

Source	Type III Sum of Squares	Df	Mean Squares	F	Sig.
Correct model	87.513a	4	21.878	43.046	.000
Intercept	157.312	1	157.312	309.513	.005
Pre interest	.293	1	.293	.577	.449
Treatment	87.130	1	87.130	171.429	.000
Gender	.082	1	.082	.160	.689
Treatment by Gender	.201	1	.201	.396	.530
Error	79.796	157	.508		
Total	1330.000	162			
Corrected Total	167.309	161			

As regards hypothesis one, data on table 4 above show that students exposed to treatment differ significantly in their interest in science than those in the control group. That was shown by their calculated f value of 171.429 which was significant at .000. The hypothesis one of no significant difference is therefore rejected.

For hypothesis two, the ANCOVA of students post – interest scores by gender, table 4 showed no significant difference between the compared mean interest scores of male and female students. This was shown by calculated f value of .160 that was not significant at .689 at 1 degree of freedom.

The test of hypothesis 3 presented on table 4 showed that the interaction effect of teaching approach on gender on mean interest scores of students is not significant. This was revealed by the calculated f value of .396 which is not significant at .530. This showed that constructivist instruction consistently showed superiority over the lecture method irrespective of student's sexes.

4 Discussion of findings and Educational Implications

With respect to research question one and corresponding hypothesis one data presented in table I and 4 reveal that student exposed to constructivist instruction developed higher interest (3.37) than those exposed to traditional method (1.90). Data in table 4 also indicate that students exposed to constructivist instruction and those exposed to traditional (lecture) method differed significantly (f-calculated 171.429 which is significant at 0.05 level of probability). The results agree with the findings of Revilla (1998) and Njoku (2003) that attributed loss of interest in science at higher levels of education to less investigative science practices in the middle years of schooling. Role dominance by the teacher in traditional method hardly increases student's interest and enthusiasm in the learning process. Opportunities should therefore be given to students to experience what they are to learn in a direct way. Meaningful learning activities built on prior knowledge motivate students and foster their interest in their efforts to exclusively control their own cognitive processes. Teachers need to provide learning experiences that excite learners (e.g use of local resources from students' immediate environment). This makes learning meaningful and provides broad knowledge and intellectual skills.

As regards research question two and hypothesis two, data in table two reveal that females had slightly higher post interest mean (3.39) than their male counterparts (3.36) for the treatment group which was higher than their scores in the control group. However the ANCOVA of students post interest scores by gender reveal that there is no significant difference between the compared mean interest scores of male and female students exposed to basic science using the two methods of instruction. This was shown by the calculated f value of .160 which is not significant at .689 at 1 degree of freedom.

The result agree with Ugwuadu (2011) who found no significant difference in the compared mean interest scores of male and female students taught biology concepts using the dialogue discuss pattern.

With respect to interaction effect of teaching approach and gender on interest in science, treatment had a positive effect on interest development of students irrespective of gender. This finding agrees with Ugwu (2013) that the use of gender inclusive kits and teaching strategy enabled the females improve on their interest and achievement in science. This implies that gender biases in favor of males should be removed from the conventional science and technology curriculum so that both sexes would learn and perform well in science and technology to their greater benefit and that of the society in which they live.

5 Conclusion

It is much easier to learn when something makes sense and is related to one's life, interest and aspirations. Science becomes fun, easy and interesting if taught and learnt by doing, and should be handled that way for interest development. Frantic effort must be made by all education stakeholders to ensure that necessary services be put in place for effective science teaching.

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