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Effects of Constructivists' Model of Instruction on Students' Perception of their Psychosocial Learning Environment and Achievement in Biology

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Abstract
The study investigated the effects of constructivists' model of instruction on students' perception of their psychosocial learning environment and achievement in biology. Two research questions and two hypotheses guided the study. Pretest-post test quasi experimental design was adopted for the study. 272 (141 males and 131 females) SS2 biology students formed the sample of the study. Two instruments used for data collection were Biology Learning Environment Survey (BLES) and Biology Achievement Test (BAT). These instruments underwent face and content validity, and reliability coefficients established using Cronbach alpha were 0.885 and 0.785. Data collected were analysed using mean, standard deviation and ANCOVA. The findings revealed, among others, that students who were taught biology using constructivists' model of instruction, perceived their psychosocial learning environment better than their counterparts in the control group who were taught using conventional method; the students in the experimental group out-performed their counterparts in the control group. Based on the findings, the researchers recommended that teachers should use innovative strategies that are activity-based and giving opportunities for students to interact with the learning environment in order to create knowledge themselves.
Keywords: constructivist, model, psychosocial, learning, environment

Introduction
The current trend in Science teaching in Nigeria and the world over is geared towards producing 21st century workforce such as scientists, engineers, medical personnel, technologists, teachers, technicians as well as scientifically literate society. Ugo and Akpoghol (2016) opined that any nation which fails to consider Science, Technology, Engineering and Mathematics (STEM) education has planned to be left behind in all

spheres of development. Therefore, a good knowledge of science if properly imparted could prepare students for a useful living in science oriented society.
Biology is one of the core science subjects studied even by none science students (Federal Republic of Nigeria (FRN), 2004). Biology is a subject that focuses on the study of living organisms including their physical structures, chemical processes, physiological mechanism, development and evaluation (Ramalingam, 2013). Biology is a useful science with many applications in the society. The knowledge of Biology concepts has led to the advancement in modern technology; capacity building and admissions into tertiary institutions. A credit in Biology earns a science student admission into the university to read courses like medicine or other para-medical courses, Agriculture, Education and the rest of them. It therefore means that, once biology is properly taught in schools, it is expected that students would understand and be knowledgeable in their field, and at the same time, will be able to pass this knowledge to the society at large.

At the moment, the West African Examination Council's Chief Examiners' yearly reports (2015-2018) have shown a downward trend in the performance of students in science subjects especially biology. Many studies have identified a wide range of factors militating against students' performance in Biology. Among those factors include inappropriate method of teaching adopted by biology teachers (Okoye, 2004) and the students' learning environments (Ekon, 2013). One of such inappropriate method mostly used in teaching science subjects in secondary schools today is the conventional method. This method is said to be ineffective in the sense that it makes learners to be passive listeners (Iloputaife, 2000; Ekon, 2013); it is teacher-centered, not able to provide students with valuable skills and with knowledge that will last beyond the classroom (Udoh, Ado & Udo, 2017). Ekon (2013) also opined that the conventional method does not give students the opportunity to explore their learning environment which is contrary to one of the aims of science education which is stated in the National Policy on Education (NPE) that, the teaching of science subjects is to inculcate in the child, the spirit of inquiry and creativity through the exploration of the child's environment (Federal Republic of Nigeria (FRN), 2004). The ability of the learners to explore their environment using the conventional method is reduced.

From the afore-mentioned facts, conventional method does not create a good inter-personal relationship and better conducive learning environments. It does not help majority of learners to be active participants in the teaching and learning processes. Researchers have made several efforts towards designing methodologies which are interactive, activity-based and child-centred for more effective teaching of science subjects. New innovative instructional methods include cooperative learning and problem solving (Ndirika, 2015), constructivism (Iloputaife, 2000; Eze, 2005; Ekon, 2013) have been advocated. Mayer (2006) found out that these innovative strategies

especially constructivism not only help students learn and retain information but has positive effects on the students' attitudes towards studying science subjects.
Constructivism is a strategy, which holds the view that scientific knowledge is personally constructed and reconstructed based on the learners' prior knowledge or experience. This means that in constructivism, a learner constructs meaning for new information as a result of interaction between the learner's prior conception and his or her current observation. Constructivism is an approach of instruction and learning involving interactive processes in social settings. It is problem solving oriented, allowing students to explore and work in groups.

Constructivism is a theory of learning which agrees that knowledge is not a thing that can be simply given by the teacher in front of the classroom to learners seated on their desks. Rather, knowledge should be constructed by the learners through an active mental developmental process because learners are expected to be builders and creators of meaning of concepts and knowledge acquisition. Constructivists' models of instruction may be effective tools that enable teachers provide learners with the opportunity to interact with them and even among themselves, in the classroom, in order to do away with prior conceptions before the learning of new concepts. Obiekwe (2010) in a study on effect of constructivist learning approach on the academic performance and interest of SS3 students in Ecology in Ogidi Education Zone of Anambra state, observed that constructivist learning approach was more effective in facilitating students' performance and interest in ecological concepts than when using the conventional method.

Another variable considered in this study is the learning environment. The classroom in this context is the learning environment. It is where the students and teachers interact with learning materials for the purpose of teaching and learning processes. Zandeliet and Buker (2003) identified two main components of the classroom learning environment as physical and psychosocial. These two components, according to them, interact to either facilitate or constrain students' participation, achievement and satisfaction with their learning. As the name implies, the physical components of the classroom are the physical facilities which may include the following: the seating arrangement, the colour of the environment – walls, roofs, desk etc., lighting system (arrangement), and furniture. The school structure determines what and how the students learn.

Apart from the physical components of the classroom, there is also the psychosocial components which is operationally defined in this study as the relationships existing between students and students; students and instructional materials; students and teachers as well as teachers' management style in the classroom learning environment. This relationship forms the psychological climate of the classroom (Zandeliet &

Buker, 2003). Conducive psychosocial classroom learning environment enhances the emotional development of learners by giving them opportunities for experimentation, exploration and self-knowledge. A learner is motivated mostly through classroom activities which ginger the learner's curiosity to know more by searching deep through reading more books and recalling what was learnt previously. This eventually leads to self-actualization, independence and better achievement. It therefore means that for maximum and effective learning to occur, classroom learning environment should be well planned and stimulating, so as to enable students develop interest towards learning which in due course would enhance better performance in the subject studied especially in Biology.

Effiong (2002) identified fifteen (15) psycho-social components of the learning environment; but this study examined eleven which are Students' cohesiveness, Satisfaction, Personal goal attainment, cooperation, democracy, Organization, Innovation, Personal relevance, teacher support, Students' involvement, and task orientation. Students are affected by psychological climate through the perception of their learning environment and other significant persons involved in education such as teachers, parents and administrators. Perception here is seen as a cognitive process which leads to awareness, organization and association of stimuli received from environment through the sensory organs. Ukpong (2000) asserted that the mechanism of students' perception is known to involve information analysis, synthesis and integration within the classroom environment. Therefore, perception involves sensory experience organized into meaningful concepts or ideas in the classroom. In a science classroom environment, a teacher is a "psychological weather maker" in that he/she plays an important role in determining the kind of social climate that will prevail in the classroom. Therefore, teachers' characteristics can affect the classroom climate generally. In other words, the classroom learning atmosphere depends on how the teacher controls the class in terms of the type of management styles and the use of interpersonal relationship within the classroom.

A good classroom management style is that which enhances a sense of belonging, builds up interest which leads to a positive attitude towards the subject taught and a higher productivity in terms of achievement. Teachers' obligation to their students is that of motivating them in order to promote learning. Teachers ought to prevent negative attitudes like the use of punishment, abusive words, ridicule and other attitudes that discourage the students. These negative attitudes destroy or diminish the students' enthusiasm towards better performance especially in science subjects. Effiong (2002) conducted a study on Science classroom environment factors, cognitive preferences and achievement in Physics among senior secondary school students in Cross River State. The sample was 400 SS2 Physics students. The result of the analyses indicated that there was significant relationship between students' perception of

Physics learning environment and their achievement in Physics. Further analysis indicated that teacher support was the best perceived scale while students' cohesiveness was the least.

Purpose of the Study

The main purpose of this study is to determine the effect of Constructivists' model of instruction on students' perception of their psychosocial learning environment and achievement in Biology. Specifically, the study sought to:

1) Determine the effect of constructivists' model of instruction on biology students' Perception of their psychosocial learning environment;

2) Determine the effect of constructivists' model of instruction on Biology students' academic performance;

when taught concepts in biology using constructivists' model of instruction as compared with conventional method of instruction.

Research Questions

The following research questions guided the study:

1. What is the effect of constructivists' model of instruction on biology students' perception of their psychosocial learning environment when taught biology concept using constructivists' model of instruction?
2. What is the effect of constructivists' model of instruction on biology students' academic performance when taught biology concept using constructivists' model of instruction?

Hypotheses

The following null hypotheses were formulated to guide the study:

Ho1: There is no significant difference in the mean scores of students' perception of their psychosocial learning environment when taught biology concept using constructivists' model of instruction and when taught using the conventional method.

Ho2: There is no significant difference in the mean score of Biology students' academic performance when taught Biology concept using constructivists' model of instruction and when taught using the conventional method.

Methodology

The pre-test, post-test, non-equivalent control group design was adopted for this study. Two research questions and two hypotheses guided the study. The population of the study comprised all the Senior Secondary Two (SS II) Biology students in the twenty-two state-owned secondary schools in both Calabar municipality and Calabar south Local Government areas in the 2017/2018 academic session. A total of two hundred and seventy-two (272) SS2 biology students formed the study sample. Two instruments developed by the researchers were used for data collection. These are,

Biology Learning Environment Survey (BLES) and Biology Achievement Test (BAT). BLES questionnaire was made up of 65 statements. These statements were grouped into eleven (11) sections covering the psycho-social components of the learning environment. A 4 point Likert type scale was used for scoring. Biology Achievement Test (BAT) consisted of thirty multiple test questions on the learnt concept. The test items were scored using pre-determined marking scheme. These two instruments underwent face and content validity and reliability coefficient established using Cronbach alpha as 0.885 and 0.785 respectively.

Simple random sampling technique was used to select four schools out of the twenty two (22). This implied that two schools were assigned as experimental groups while the other two were assigned control groups. The Biology teachers from the two (2) experimental schools were trained on how to use the constructivist's model of instruction. The training exercise lasted for two weeks. These teachers eventually taught the students in the experimental classes while the control group students were taught conventionally by their teachers who were not given any form of training. Prior to treatment, a pre-test was administered to all the students in the two groups. This was done to determine the students' knowledge on the biology concept - cell and its environment. After six weeks, a post-test was administered on the students. The data obtained from the tests administered were analysed using Mean score, standard deviation and analysis of Co-variance.

Presentation of results

Research Question One: What is the effect of constructivists' model of instruction on biology students' perception of their psychosocial learning environment when taught biology concept using constructivists' model of instruction?

Table 1: Mean score and standard deviation of students' perception of their psychosocial learning environment in Biology

		Pre-test		**Post-test**		**Mean**
Groups	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	**Difference**
Experimental	132	38.91	3.24	84.06	14.58	45.15
Control	140	42.78	7.72	54.65	9.62	11.86
Total	272	40.90	6.28	68.92	19.16	

From table 1, the mean score of students in the experimental group, taught using constructivists' instructional model was 84.50 while those students in the control group taught using conventional method had a mean score of 54.65. This shows that the students in the experimental group had a better perception of their psychosocial

learning environment and this had a positive effect on their mean score as compared to their counterparts in the control group.

Research question Two: What is the effect of constructivists' model of instruction on biology students' academic performance when taught biology concept using constructivists' model of instruction and when taught using conventional method?

Table2: Mean scores and standard deviation of students' academic performance in Biology

		Pre-test		**Post-test**		**Mean**
Groups	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	**Difference**
Experimental	130	6.70	3.70	63.67	11.76	56.97
Control	138	7.31	4.06	30.67	9.19	23.36
Total	268	7.01	3.89	46.68	19.58	

There was mortality here as four respondents did not summit their assessment scripts on post-test. From table 2, the mean post-test score of students taught using constructivists' model of instruction in the experimental group was 63.67 while their counterparts in the control group had 30.67. This shows that students in the experimental group had a higher mean score than those in the control group.

Ho1: There is no significant difference in the mean scores of students' perception of their psychosocial learning environment when taught biology concept using constructivists' model of instruction and those taught using the conventional method.

Table 3 presents summary of statistics of testing hypotheses 1.

Table 3: ANCOVA table for testing difference in the mean score of students' perception of their psychosocial learning environment

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	67898.372s0	4	16974.59	143.38	.000
Intercept	5196.568	1	5196.57	43.89	.000
Per Perception	8867.655	1	8867.66	74.90	.000
Group	67681.037	1	67681.04	571.68	.000
Error	31610.158	267	118.39		
Total	1391742.000	272			
Corrected Total	99508.529	271			

In Table 3, the computed F ratio of the group is 571.68 with p-value of .000. Since the F ratio is significant at 0.05 level of significance, the hypothesis is therefore not accepted. Hence, there is significant difference in the mean scores of students' perception of their psychosocial learning environment when taught Biology using constructivists' model of instruction and when taught using conventional method.

Ho2: There is no significant difference in the mean scores of students' academic performance when taught Biology using constructivists' model of instruction and when taught using the conventional method.

Table 4: ANCOVA table for testing difference in the mean performance score of students taught Biology

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	73089.4500	4	18272.36	164.33	.000
Intercept	134614.885	1	134614.89	1210.66	.000
Per achievement	39.272	1	39.27	.353	.553
Group	72323.646	1	72323.65	650.44	.000
Error	29243.307	263	111.19		
Total	686195.000	268			
Corrected Total	102332.757	267			

Table 4 shows results from the data analyses that are used for testing hypothesis 2. In Table 4, the computed F ratio of group is 650.44 with p-value of .000. Since the F ratio is significant at 0.5 level of significance, the null hypothesis is rejected. Hence, there is significant difference in the mean scores of students' academic performance when taught Biology using constructivists' model of instruction compared to those taught Biology using the conventional method.

Discussion of the findings

The findings in Table 1 revealed that those students taught Biology using constructivists' model of instruction in the experimental group had a better perception of their psychosocial learning environment with the mean score of 84.06 while those taught with the conventional method in the control group had a low perception mean score of 54.65. This difference is tested further using a null hypothesis. The result from the hypothesis revealed that there is significant difference in the mean score of the students' perception of their psychosocial learning environment when exposed to constructivists' model of instruction.

It is seen from the result that the constructivists' model of instruction encouraged students to participate fully in the classroom. The active involvement of the students caused them to interact with themselves, instructional materials used when performing the different activities, as well as their teachers. It enabled them to work in groups and reconstruct knowledge by themselves easily. This finding is in line with the study of Effiong (2002) who reported that there was significant relationship between students' perception of Physics learning environment and their academic performance in Physics.

Further analysis of these data revealed that among the eleven psychosocial learning environment variables considered in this study, statements in Personal relevance had the highest mean perception score of 19.51. This was followed by items in cooperation ($\bar{x}$ = 19.00); and items in students' involvement ($\bar{x}$=18.89). The least perceived items were those in teacher support ($\bar{x}$ 15.80). This finding is contrary to Effiong's (2002) study in which students rated teacher's support high. It is pertinent to note that perception of this particular variable may depend on the type of instructional method, subject and even the class involved in the experiment.

The result obtained in Table 2 revealed that those taught using constructivists' model of instruction in the experimental groups had a mean achievement score of 63.67 while those taught with the conventional method in the control groups had a mean achievement score of 30.67. This difference was further tested using a null hypothesis tested in Table 4. The result revealed that there is significant difference in the mean

performance scores of students taught Biology using constructivists' model of instruction as compared to those taught using the conventional method. This is a clear indication that the method of teaching helped the students in the experimental groups to perform significantly better than their counterparts in the control group.

The significant enhancement of achievement of biology students due to the constructivists' model of instruction may be as a result of its nature which is activity-oriented, student-centered and interactive. The students were able to construct or gained knowledge through exploring and manipulating the different activities they were engaged in. This study is in line with Obiekwe (2010) that revealed that Constructivist learning approach was more effective in facilitating students' academic performance.

Conclusion

On the basis of this finding, it was concluded that teachers should adopt activity-based, student-centred and interactive strategies for the teaching of science subjects including Biology. These innovative strategies help student to explore their learning environment as well as construct knowledge themselves rather than depending on the teacher's note.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Teachers should make available instructional activities that will challenge the students to be actively involved in the classroom.
2. Teachers should give students opportunities to express themselves in variety of ways.
3. Teachers should adopt any of the constructivist models of instruction while teaching science subjects.
4. Since the classroom is an important unit of the educational system, it must be managed properly to achieve the stated objectives of education.

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