



## Assessment of Psycho-Social Interest of Students With and Without Disabilities in Organic Chemistry Using Constructivist Approaches

### KEYWORDS

Inclusive education, Special education, Psycho-social interest, constructivism, PEDDA instructional approaches, IEPT instructional approaches, organic chemistry, gender, students, assessment.

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**ABSTRACT** *The study assessed the psycho-social interest of students' with and without disabilities in organic chemistry using constructivist approaches. The study adopted a quasi experimental design specifically pretest-posttest non-equivalent control group design. Three research questions were posed and three null hypotheses were formulated to guide the study. The hypotheses were tested at 0.05 level of significance. The study was carried out in Nsukka Education Zone of Enugu State of Nigeria. Four co-educational Secondary Schools were randomly sampled for the study. The sample which consisted of 184 students from the four secondary schools was stratified in terms of the two groups: PEDDA and IEPT instructional approaches. One instrument was developed and validated for data collection: the Organic Chemistry Interest Scale (OCIS). The subjects were pretested and later post-tested at the end of the treatment. Data collected were analyzed using means, standard deviations and Analysis of Covariance (ANCOVA). The result showed that students gained psychosocial interest equally in both models of constructivism. There was no significant difference in the male and female students' psycho-social interest in organic chemistry. Both methods are effective in students' psycho-social interest in organic chemistry. Based on the findings and educational implication, the following recommendations were made that: the use of PEDDA and IEPT should be part of the chemistry curriculum implementation programme for students with and without disabilities, chemistry teachers need to be retrained periodically on the use of PEDDA and IEPT instructional approaches. Use of constructivism should be disseminated to all inclusive schools in Nigeria to encourage other science teachers.*

### Introduction

Assessment is to determine the rate or amount of knowledge students had acquired within a specified time. According to Scriven (2011) assessment is to judge students work using a weighted set goals usually numerical ratings. Oregon (2011) described assessment as the process of developing a deep understanding of what students' know, understand and can do when subjected to an educational experience. Assessment is of three types namely initial, formative and summative. Initial assessment is a pre-assessment or diagnostic assessment usually given before instruction. Formative assessment is usually done at the beginning or during the programme. According to Nworgu (2006), formative assessment provides immediate result of students' learning in a particular course or in a programme. Summative assessment is generally carried out at the end of a course. It is used for grading purposes. Nworgu (2006) described summative assessment as being comprehensive in nature, which, provide information about the students' learning at the end of a course or programme. Formative and summative assessments are referred to as assessment for learning and assessment to learning respectively. In this paper formative assessment is employed. This is because students' psycho-social interest will be assessed using a teaching approaches which if success is made can provide clue or next steps to students' achievements in organic chemistry.

Achievement entails a thing that somebody has done successfully especially using their own efforts and skills. Thus, the level of achievement among senior secondary school student is determined through evaluation of WAEC examination results. Available evidence on the level of achieve-

ment of students in senior school certificate chemistry examination is quite disturbing and that is why the Chief Examiners Annual Report further revealed that the error students commit in organic chemistry have been responsible for the failure of students in senior secondary school certificate chemistry examination. In fact, the state of science education is giving a lot of concern to chemists, chemistry teachers, students, researchers, and parents in particular. Efforts are being made by government, researchers, chemists, chemical society of Nigeria, (CSN) and Science Teachers Association of Nigeria (STAN) to improve science (chemistry) education in Nigeria. Interest and achievement in the subject continue to be poor year after year. A number of factors have been found to have contributed to the students' poor interest and achievement in chemistry specifically in organic chemistry of senior school certificate examination (SSCE). Some of these factors, according to Edet (1990), are poor teaching methods, ineffectiveness in terms of content coverage, teachers and students find it difficult to teach and learn organic chemistry, being complex and difficult to represent as they contain many constituents concepts. The poor achievement of students in organic chemistry can be related to their lack of interest on organic chemistry concept therefore any effort to tackle the problem of poor achievement in organic chemistry will prove abortive if the students' psycho-social interest is not taking into consideration.

The psycho-social state of interest can be generated by specific environment stimuli existing in the classroom. Hidi and Baird in Ainley, Hidi and Berndorf (2002) referred to it as situational interest. This Interest is an important variable in learning because when one becomes interested in an

activity, one is likely to be more deeply involved in that activity. It is the preference for particular type of activity, that is, the tendencies to look out for and participate in certain activities. Students seem to learn more efficiently those things that are of interest to them. In this paper therefore situational interest is considered. Psycho-social interest of students in organic chemistry is assessed using constructivist approaches.

Constructivist teaching is based on the belief that learners are actively involved in a process of meaning and knowledge construction rather than passively receiving information. Learners are the makers of meaning and knowledge. Constructivism fosters critical thinking and creates motivated and independent learners. Learning occurs as the students tries to hypothesize, predict, manipulate objects, pose questions, research, investigate, imagine and invent. Nworgu (2006) defined constructivism as a kind of learning strategy that lays emphasis on active role of learners in the process of constructing their own knowledge. In other word, science instruction should be child centered and learning should be an interactive process involving both the teacher and the learners. The meaning of constructivism varies according to one perspective. The central principle of constructivist approach is that learners can only make sense of new situation in terms of their existing understanding. Learning involves an active process in which learners construct meaning by linking new idea with existing knowledge. This implies that the development of understanding requires the learners' active engagement in meaning making.

Constructivism indicates that each learner must put together ideas and structure that have personal meaning if he or she is to learn. In other words, individual actively generate his or her own meaning. Edward and Mercer (1987) confirmed the above by saying that learning is regarded as a social activity which learners are engaged in constructing meaning through activities, negotiations among peers, students and teachers. Constructivist theory agrees that the learner come into classroom with ideas concerning the new problems. therefore, learning occurs as a result of interaction between the new information in the learning situation and experiences gathered as a result of interaction, organic chemistry concepts implies that the learners must engage in actively constructing knowledge into already existing knowledge for meaningful learning to occur and to facilitate their psycho-social interest and achievement in organic chemistry.

Constructivist classroom exhibit a number of discernible qualities markedly different from a traditional or direct instruction classroom. The constructivist classroom is democratic, the activities are interactive and student centered and the students are empowered by a teacher who operates as a facilitator or consultant. The classroom, thus provide a psycho-social state in which interest is generated and learning occurs.

Many writers and researchers have proposed different theoretical instructional model in their bids to enhance teaching and learning of science and science related subjects (Chemistry) and their attempt to describe constructivist instructional approaches. These writers and researchers have come up with various phases of constructivist instructional models. The phases vary from model to model:

The five phase constructivist based model, the biological science curriculum study (BSCSS (1993) cited in Nwosu and

Nzewi (1998) the models are:

They 5-steps in PEDDA instructional model are listed sequentially as follows.

- Prior- knowledge (P)
- Exploration (E)
- Discussion (D)
- Dissatisfaction (D) and
- Application (A)

The analogy model of instruction by Harison and Treagust as cited in Nzewi (2000) described analogy as being characterized by aspects of science discourse in which familiar situation similar to the unfamiliar phenomenon to be explained is used. It is an instructional strategy used in explaining less familiar domain (Nzewi 2000). Glynn (1989) formulated a guide called teaching with analogy, model (TWA). The model consists of six steps which are:

- Introduction to target concepts
- Recall analogy concepts
- Identify similar features of concept
- Map familiar features
- Draw conclusions about concept
- Indicate where analogy breaks down.

The four phase constructivist model (IEPT) presented by Bybee, Buchwald, and Crossbeam Hail, Cuerbis, Matsumto&Melnerly (1989) are:

- Invitation: Recognizing the problem through observation and then having decision to tackle the problem.
- Exploration/Discovery: In this stage, several attempts would be made to solve the problem (trial and error) but perseverance is needed to continue.
- Proposing explanation and solution: when one has arrived at solution, then information would be to communicate to others, which is the explanation sage.
- Taking action: this phase is the application phase where new knowledge is transferred to develop product and produce idea.

In this paper PEDDA and IPET were considered while analogy was not used. This is because the researchers wished to use only two groups which they could manage.

Thus, the researchers assessed the effect of PEDDA and IEPT on students' psycho-social interest in organic chemistry concepts.

Constructivist theorists such as Jean Piaget, Jerome Bruner and Lev Vygotsky have extended the traditional focus on individual learning to address collaborative and social dimensions of learning. Thus, the theories of construction put forth by these scholars have implications for contemporary classroom practice. . The implication of these theorists to science is that the teacher has to organize group work, debate, group discussion for the child's learning in a social context. These group activities are in line with constructivism as classroom interaction pattern.

Obiekwe (2008) investigated the effects of constructivist instructional approach on students' achievement and interest in basic ecological concept in biology. A sample of 154 SS 2 students from four single schools (two male and two females) were drawn from Ogidi educational zone of Anambara State using pre-test posttest non-equivalent control group design. The experimental group was taught biology

using constructivist instructional approach while the control group was taught using the conventional (lecture) method. Research questions were answered using mean and standard deviation and hypotheses were tested using analysis of covariance (ANCOVA). The results showed that the constructivist instructional approach was more effective than the conventional method of teaching.

Ukuzor (2011) investigated the effect of constructivist teaching strategy on senior secondary school students' achievement and self-efficacy in physics. A sample of 154 students from four secondary school in Orlu local government area of Orlu zone in Imo state were used. The design was pretest posttest control group. The experimental group was taught physics using constructivist instruction approach while the control group was taught using conventional (lecture) method. Research questions were answered using mean and standard deviation and the hypothesis were tested using analysis of covariance (ANCOVA). The result showed that boys benefited more than girls in achievement.

Gender according to Okeke (2001) is a socially/culturally constructed characteristics and roles, which are associated with males and females in a society. It is different from sex which is a biological distinction in appearance (morphology) and function (physiology) as well as reproductive contribution of men and women (Eniayeju, 2008). Hence, in career choice, women are discouraged from choosing certain professions arguing that such career will conflict with their marriage chances, marriage responsibilities, motherhood etc. Thus, women who venture into those masculine professions such as engineering (mechanical, civil, electrical, aeronautic, etc) are sometimes ridiculed and their work life purposely made unpleasant for them. Similarly, a man who ventures into those feminine professions such as catering, home economics, textile weaving, and dye etc are similarly ridiculed.

From the view point of Bryne (1978), Okeke (2001) and Eniayeju (2008), therefore gender and gender stereotyping permeate every aspect of human endeavor and come to mould and colour our thoughts and expectations of capabilities of individuals. The fact that science and technology have been stereotyped as masculine means that women and girls engaged in such studies will grapple with a lot of discriminations and difficulties (Okeke, 2008). Shaibu and Mari (1997) revealed that, available literatures showed that there were existences of male domination of female students in science learning in schools. Most of this study according to them is mostly focused on the effect of gender factors on conceptual understanding of science. The study of Jahun and Momoh (2001) showed that the male students perform better than their female counterpart. Following the feminist theory applied in science education which emphasizes that it is only by changing the features of schools in science curriculum and how science is taught will significant changes be made in the participation of women in science. This study will investigate the effect of instructional methods and gender on students' psycho-social interest on organic chemistry.

**Purpose of the Study:** The general purpose of this study is to assess the effect of constructivist approaches and gender on student's psycho-social interest in organic chemistry. The researchers specifically sought to:

1. determine the effect of IEPT and PEDDA instructional approaches on students' psycho-social interest in or-

ganic chemistry.

2. determine the influence of gender on psycho-social interest mean scores of male and female students when taught organic chemistry using IEPT and PEDDA instructional approaches.
3. determine the interaction effect of instructional approaches and gender on students' psycho-social interest in organic chemistry.

**Scope of the Study:** This study was conducted using senior secondary school two (SS II) students in Nsukka Educational Zone of Enugu State. The use of (SS11) student was necessitated by the fact that they were preparing for SSCE the following academic session. The study was restricted to organic chemistry concept in chemistry. In terms of content coverage, the researchers selected a unit from chemistry curriculum of Federal Ministry of Education (FME, 2009).

The content scope includes the following: Meaning of organic chemistry, hydrocarbon, Isomerism, Classes of hydrocarbons and Alkanes.

**Research Questions:** The following research questions guided the study:

1. What are the psycho-social interest mean scores of students taught organic chemistry with IEPT and PEDDA?
2. What are the psycho-social interest mean scores of male and female students when taught organic chemistry concepts using IEPT and PEDDA?
3. What is the interaction effect of instructional method and gender on students' psycho-social interest on organic chemistry?

**Hypotheses:** The following null hypothesis will be formulated and tested at 0.05 level of significance :

**H<sub>01</sub>:** There is no significance difference in psycho-social interest mean scores of students taught organic chemistry concepts using the IEPT instructional approach and those taught using PEDDA instructional approach.

**H<sub>02</sub>:** There is no significance difference in psycho-social interest mean scores of male and female students taught organic chemistry concepts using IEPT and those taught using PEDDA.

**H<sub>03</sub>:** There is no significant interaction effect of instructional approaches and gender on the psycho-social interest mean scores of students in organic chemistry concepts.

**Method:** The study adopted quasi-experimental design. Specifically, pretest-posttest, non-equivalent control group design. This design was adopted because it was not possible for the researchers to randomly sample the subjects and assign them to groups without disrupting the academic programme of the existing schools involved in the study.

The study was carried out in Nsukka education zone of Enugu State, Nigeria. The study covered fifty eight secondary schools in the zone. The choice of the area is because students from Nsukka education zone always experience difficult in answering questions on organic chemistry and secondly, the researchers are very familiar with all the locations of the schools and this gave them the opportunity to monitor and supervise the teachings.

The population of this study consisted of all the four thousand five hundred and ninety two (4592) senior secondary two (SSII) students in fifty eight (58) secondary schools in Nsukka educational zone. Two thousand one hundred and thirteen (2113) of the total numbers are males while two thousand four hundred and seventy nine (2479) are female. Source, Post Primary School Management Board, 2011/2012 session. The researchers decided to use SSII because basic organic chemistry concept is in their scheme of work

The samples for the study consist of 184 SS II students drawn from four out of 58 senior secondary schools in the study area. Purposive random sampling technique was used to select four co-educational schools that are identical. The selected schools were identical in that each had two chemistry teachers in SS11, in terms of qualification and experience of the chemistry teachers and classroom space. The minimum qualification of a chemistry teacher that participated in the study is B.Sc in chemistry education. For the two classes in each of the four schools, one class was labeled A and the other class B, all the A classes were taught using IEPT instructions while all the B classes were taught using PEDDA instructions.

The researchers used Organic Chemistry Interest Scale (OCIS) for data collection and it was designed to measure the level of psycho-social interest of students in organic chemistry before and after treatment. OCIS is also made up of two parts: section A personal data and section B chemistry interest scales. OCIS is a 20-item scale constructed using a four point scale of strongly agree (SA) - 4 points for positively directed questions and 1 point for negatively directed questions; Agree (A) - 3 points for positively directed questions and 2 points for negatively directed questions; Disagree (D) - 2 points for positively directed questions and 3 points for negatively directed questions; Strongly Disagree (SD) - 1 point for positively directed questions and 4 points for negatively directed questions.

The OCIS was face validated by one science educator and a specialist in measurement and evaluation, 20 items emerged satisfactorily and were used for the study. Validates looked at the instrument in terms of their relevance, clarity and general coverage of the contents. Their criticism, comments and suggestions were used to develop the final instrument; the comments and recommendations of these experts served as a guide to modification of items in the instruments.

The instrument was trial- tested using sample school that will not be part of the sample size. Twenty copies of the instrument (OCIS) were distributed to twenty SSII students. All of the instruments were retrieved without losing any. For OCIS, Cronbach alpha internal consistency estimate was used and reliability index of 0.802 was gotten, this was done using SPSS (version 17.0) statistical package for social sciences.

Before the actual experiments, a pre- treatment conference or training session by the researchers with the regular chemistry teachers who participated in the experiment was held, the meeting was necessary for the teachers for teaching both the PEDDA and IEPT because the two instructional strategies were rooted in constructivist instructional pedagogy, which the secondary school teachers had poor knowledge and application of (Nzewi and Nwosu, 1997).The training exercise involved discussing and practicing the use of lesson notes prepared by the researchers

for teaching those topics to the students. OCIS was administered by the co-coordinated regular chemistry teachers. This was to ascertain the level of psycho-social interest of the students. After the pre-test the chemistry teachers started the experiment in their respective school adhering strictly to the lesson plans. The experiment was conducted during the normal school period following the normal time table of the schools. Within the second, third and fourth weeks, the content areas were taught and covered. The post-test on interest have the same content as the pretest, though it was reshuffled and administered by the same sample students immediately after the four weeks of teaching. The experiments lasted for four weeks and the students in PEDDA and IEPT groups were taught under the same experimental conditions.

Data on the research questions was analyzed using mean and standard deviations. Mean and standard deviation were used, because mean is the most reliable measure of central tendency and standard deviation is the most reliable estimate of variability. The pre test scores were used to find the gain scores. A gain score is the difference between the post-test and pre-test scores of a group. Analysis of covariance (ANCOVA) was used in testing the hypotheses; ANCOVA was used for this study because ANCOVA is usually employed when regression is suspected between pretest and post-test of a study (Ali,2006). Specifically, covariance test is used in a pre-test and post-test quasi experimental research design when subject are selected (Ali, 2006). After the test, the gain scores were analyzed to determine the statistical significance between and within groups, as covariates between pre-test and post-test.

**RESULTS:** The results are presented in tables according to the research questions and hypotheses that guided the study.

**Research Question1:** What are the psycho-social interest mean scores of students taught organic chemistry with IEPT and PEDDA?

**Table 1: Means and Standard Deviations of Students' psycho-social interest on the experimental groups.**

METHOD	Mean	Std. Deviation	N
PEDDA	2.81	.33	96
IEPT	2.82	.34	103
Total	2.82	.34	199

Table 1 above shows that the PEDDA group had a psycho-social interest mean score of 2.81 with a standard deviation of 0.33 while the IEPT had a psycho-social interest mean score of 2.82 with standard deviation of 0.34. The total psycho-social interest mean deviation is 2.81 with a standard deviation of 0.34.

For each of the experimental groups, the students had almost the same mean score and standard deviation on the interest scale. This is to show that students in the two groups have the same psycho-social interest when exposed to difference models of constructivism.

**Hypothesis1 (H<sub>0</sub>):**There is no significance difference in psycho-social interest mean scores of students taught organic chemistry using IEPT and those taught using PEDDA.

**Table 2: Analysis of covariance (ANCOVA) for students' psycho-social interest in organic chemistry.**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.009(a)	1	.009	.078	.780
Intercept	1577.322	1	1577.322	13835.661	.000
METHOD	.009	1	.009	.078	.780
Error	22.459	197	.114		
Total	1602.007	199			
Corrected Total	22.468	198			

Table 2 above shows the result of the ANCOVA used in testing of hypothesis 1. From the data, it is observed that the F-ratio of 0.780 were obtained with a level of significance of 0.780. Since this is greater than the significance level of 0.05. The null hypothesis (H02) was not rejected.

There was no significant difference in organic chemistry psycho-social interest using IEPT and PEDDA instructional approaches. This implies that the instructional approaches had no effect on the psycho-social interest level of students.

**Research Question 2:** What are the psycho-social interest mean scores of male and female students when taught organic chemistry using IEPT and PEDDA?

**Table 3: Mean and Standard Deviation of psycho-social interest of students taught with IEPT and PEDDA by gender.**

METHOD	GENDER	Mean	Std. Deviation	N
PEDDA	MALE	2.81	.31	49
	FEMALE	2.81	.35	46
IEPT	MALE	2.78	.34	61
	FEMALE	2.89	.35	42

Table 3 above shows that the male students in PEDDA group had psycho-social interest mean score of 2.81 with standard deviation of 0.31 while the female students had psycho-social interest mean score of 2.81 with a standard deviation of 0.35 and for the IEPT group; the males had psycho-social interest mean score of 2.78 with standard deviation of 0.34 while the females had psycho-social interest mean score of 2.89 with the standard deviation of 0.34. The difference in the mean scores shows that the male had higher psycho-social interest than their female counterparts. To establish whether or not the observed difference in the mean is significant hypothesis 2 is tested.

**Hypothesis 2 (Ho<sub>2</sub>):** There is no significant difference in psycho-social interest mean scores of male and female students taught organic chemistry using PEDDA.

**Table 4: Analysis of covariance (ANCOVA) result of psycho-social interest scores of students with reference to approaches and gender**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.328(a)	4	.082	.719	.580
Intercept	113.969	1	113.969	998.671	.000
METHOD	.026	1	.026	.226	.635
GENDER	.168	2	.084	.737	.480
METHOD * GENDER	.144	1	.144	1.258	.263
Error	22.139	194	.114		
Total	1602.007	199			
Corrected Total	22.468	198			

Table 4 reveals no significance effect on male and female students' psycho-social interest in organic chemistry. F-ratio of 0.226 was obtained with significance level of 0.635 which is greater than that of 0.05. The null hypothesis was accepted, therefore there is no significance difference on male and female psycho-social students' interest in organic chemistry.

**Research Question 3:** What is the interaction effect of instructional approaches and gender on psycho-social students' interest in organic chemistry?

**Table 3** above shows that the total mean score of males exposed to both groups are 2.791 with standard deviation of 3.259 while the mean score for females exposed to both groups are 2.750 with standard deviation of 3.509. This implies that the male students interact more with the instructional approaches than the female students.

**Hypothesis 3 (Ho<sub>3</sub>):** There is no significant interaction effect of instructional approaches and gender on the psycho-social interest mean scores of students in organic chemistry concepts.

**Table 4** above reveals the interaction of instructional methods and gender on students' psycho-social interest in organic chemistry. The result shows F-ratio of 1.258 with a significance difference of 0.283 which is higher than that of 0.05. Hence, the null hypothesis (Ho<sub>3</sub>) was accepted.

**Discussion of results:** The findings of the study were discussed under the following sub-headings:-

1. Effect of PEDDA and IEPT instructional model on psycho-social interest of senior secondary students' on organic chemistry.
2. The interaction effects of the instructional approaches and gender on the students' psycho-social interest in organic chemistry.

Effect of PEDDA and IEPT instructional model on psycho-social interest of senior secondary student on organic chemistry

In table 1, the result showed that the mean score of psycho-social interest of students' taught using PEDDA was 2.51 while their counterparts taught with IEPT had a mean score of 2.82. The result showed that psycho-social inter-

est mean scores of those taught with IEPT is slightly higher than those taught with PEDDA.

Further, investigation on table 2, showed that the calculated value of F is 0.780 and is greater than the computer significance F value at 0.05 level of significance. So there is no difference in the psycho-social interest of student taught with PEDDA and IEPT. This also shows that there is no significance difference in the psycho-social interest of students taught with PEDDA and IEPT.

### The Interaction Effects of the Instructional Approaches and Gender on Students' psycho-social Interest in Organic Chemistry

The interaction effect of the instructional methods and gender on students' psycho-social interest was not significant. Table 4 shows that the F-ratio of 1.258 and 263 level of significant is greater than 0.05. This was consistent with Ayogu (2011) who reported no significant interaction effect between teaching methods and scientific level on acquisition of science process skills. The result therefore implies that the combined effects of the instructional approaches and gender differences of the students did not influence their psycho-social interest in organic chemistry. In other words, the effectiveness of the interaction was the same for male and female students with respect to their psycho-social interest.

### Conclusion

This study investigated how instructional approaches, PEDDA and IEPT could support learners' cognitive process in terms of students' psycho-social interest in organic chemistry. The two instructional approaches were found capable of enhancing students' psycho-social interest in chemistry. The two instructional thrust could revamp teaching and learning of organic chemistry with reasonable functionality and pre-vision. The two instructional models are constructivist instructional models and as such both of them have proved very effective in enhancing students' application of organic chemistry. Since both instructional approaches provided the students with opportunities to learn organic chemistry by doing which helped them investigate nature of things and arrive at observations and explanations that are satisfying and as well make sense to them. These instructional processes helped the students improve on their psycho-social interest in organic chemistry.

Male and female students achieve equally in both PEDDA and IEPT instructional approaches. This is because both students benefited equally in the teaching. This is necessitated by the fact that both models are approaches of constructive instructional strategies.

The extra cognitive load impacts are suspected to be the major determinant of how the students enjoy the instructions and these enhance the psycho-social interest of students. So there was no interaction between instructional approaches and gender. Also the interaction effect of gender and psycho-social interest of students was not significant in both teaching approaches, this is because both models are of the constructivist instructional approaches.

Therefore, constructivist approach has been acclaimed as one of the best theories of learning. It is not only a theory of learning; it is equally a philosophy of learning which prefers that learners construct knowledge for themselves. One thing that underscores this strategy is that it embraces all other methods of teaching.

### Implications of the Finding

The results of this study have implications in science education programme. For instance, constructivist instructional strategies provide frameworks for identifying and modifying misconceptions based on preconceptions which the conventional instructional methods in use could not. The existence of the misconceptions in the minds of learners might have accounted for the consistent learning failures and students moving away from the sciences especially chemistry. Therefore, the identification and modification of misconceptions would enhance students' interest for long term use. The constructive instructional approaches give opportunities for learning science by doing. Stimulating curiosity and effective reasoning potentials among students and these are the primary ingredients for effective and meaningful learning. In other words, the instructional environments of the constructivist instructional approaches function as scaffolds for learners' discovery activities, organizations and integration of concept into students' knowledge. Structures which help students arrive at learning outcomes that are satisfying, explicable and relevant to their learning needs thereby producing resultant positive influences on their achievement to learning science including chemistry. All these imply that the chemistry teachers, chemistry curriculum planners and textbooks writers and science education policy makers should not hesitate to include the constructivist instructional methods in chemistry education programme.

Furthermore, psycho-social interest is a strong factor to whatever one is doing including learning. The learning of 'bits' of information through talk-chalk/ textbook-oriented instructions had been widely criticized because they usually result in rote learning of science concepts. The use of activity oriented approaches of PEDDA and IEPT help students do arrive at instances/idea organized and integrate concepts in the manner that make sense to them. These learning opportunities make way for better achievements and favourable students' interest to science learning including chemistry.

The instructional approaches were beneficial to male and female students equally. The use of the two instructional approaches would go a long way in reducing examination malpractices commonly exhibited by students. The models would promote science students' full study habits and healthy mental operations during instructions.

### Recommendations:

Based on study findings, the following recommendations were made:

1. Chemistry teachers need to be periodically given orientation course on the use of PEDDA and IEPT instructional approaches to help them get used to their use in instructions.
2. PEDDA and IEPT instructional activities needs much time. The preparation of official school time tables should take cognizance of that and make provisions.
3. Constructivism should be disseminated to all schools in Nigeria to encourage other science teachers.
4. PEDDA and IEPT instructional mechanisms engage learners in minds- on and hands – on activities. Their use in instructions would usually require sufficient instructional materials and space. Schools have to make such provisions.

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