

## **Effectiveness of a Constructivist Instructional Approach on Student Academic Achievement in Chemical Bonding in Ahoada East Local Government Area of Rivers State.**

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### **Abstract**

*The purpose of this study was to investigate the effectiveness of the constructivist instructional approach for improving achievement in the learning of chemistry. A sample of one hundred and twenty (120) senior secondary class two (SS2) students comprising 60 males and 60 females randomly selected from two schools in Ahoada East Local Government Area participated in the study. The design of the study was the quasi-experimental, pre-test post-test control group and experimental design. The main data collecting instruments of the study were the Achievement Test on chemical Bonding and the constructivist interview schedule for students understanding of chemistry (C.I.S) constructed and validated by the researcher. The correlation coefficients of ATCB and CIS were 0.85 and 0.92 respectively. One group of 60 students was used as the experimental group which receives instructions based on the constructivist strategy, the other class of 60 students was regarded as the control group. Students in the class receive instructions based on the conventional (lecture) method. The result of the study has revealed that students exposed to the use of constructivist instructional strategy obtained higher means score than students who were taught with non-constructivist instructional strategy. The finding further indicated that; The students that used constructivist strategy had a higher mean score in chemistry, the female students had a higher mean score than male when they construct their learning experience, there is a significant difference between the performance of a constructivist and non-constructivist students; There is a significant difference between the performance of female and male students using the constructivist strategy during chemistry instruction, there is no significant difference between the performance of female and male student without constructivist in chemistry, there is a significant difference between the performance of constructivist students with respect to age. Based on these findings, it was therefore recommended that the use of constructivist instructional approach in improving learning in chemical bonding concept appeared to be useful in fostering better performances in the student's achievements.*

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**Key Words:** *constructivism, effectiveness, learning strategies, approach, concept.*

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### **Introduction**

Learning occurs when a learner is actively involved in the learning process. Learning outcomes do not only depend on teacher's presentation, instead they are interactive results of the learner's existing structure and really encountered knowledge. Learning is the product of self-organization and reorganization of existing ideas. Knowledge cannot be transmitted to the learners mind from a textbook or by the teacher, instead, students construct their knowledge by making links between their ideas and new concepts through experience they acquire in school or daily life. These types of experiences can result in assimilation in which new knowledge is

incorporated into existing cognitive structure or they can lead to disequilibrium in which experiences cannot be reconciled within the existing structure and accommodation, where cognitive structure is reorganized.

Learning is a process of conceptual change for this reason, effective teaching requires the teacher to consider the learners' personal knowledge (Taber, 2008). Therefore, for effective teaching, the cognitive level of the learners and their conceptual development which means the extent of prior knowledge about the topic necessary for learning new knowledge should be considered. Generally, students' wrong ideas about a particular topic are called misconceptions which prevent learning and very resistant to change. In chemistry, students hold several misconceptions in many areas such as mole concept (Staver & Lumpe, 2005) chemical equilibrium (Gussarsky & Gorodetsky, 2010) and electrochemistry (Garnette, 2012). Chemical bonding is another abstract topic where student have great difficulty. Also, understanding chemical bonding require, some physics topics such as energy and force in which student hold wrong conceptions. Thus, they have a lot of misconception in chemical bonding concepts. Since this topic is essential in chemistry in order to comprehend the nature of chemical reactions and some physical properties such as boiling point, student should understand chemical bonding concepts comprehensively.

Conceptual change points to the development and transformation of students understanding from their new conceptions to scientific explanation. Conceptual change model is a learning model implying that nonscientific conceptions held by a student would be replaced if the four conditions of the conceptual change model were met (Posner, 2000), Dissatisfaction with existing knowledge, Intelligibility of a new conception, Plausibility and Fruitfulness. This model is based on constructivist theory in which knowledge acquisition is viewed as a constructive process that involves active generation and testing of alternative proposition (Cobern, 2003).

Teaching science focuses on providing students with opportunities in which they have cognitive conflict and they develop different structures based on their experiences. Conceptual change can be accomplished if students are given opportunity to be aware of their ideas, to encounter ideas other than their own and to realize the deficiency in their reasoning. This can be promoted by group discussion which allow students to construct their own knowledge out of exchange with their friends and the teacher. In this way students can control their learning process. Research studies showed that oral discussion develop students' critical thinking ability and understanding of the content (Gall & Gall 1990, Horgan, Nastasi, & Pressley, 2000). In essence, the constructivist approach oriented instruction used in this study was to activate the students' existing misconception related to chemical bonding.

### **Statement of Problem**

It has been observed that many science students are unable to understand and assimilate science concept or employ the scientific knowledge in new situation. Chemistry is generally regarded as a very difficult subject everywhere in the world. But the serious problem in Nigeria is that very little is being done to alter this state of affairs (Rowell, 2006). The Nigerian Educational System experiences deep crises for many years. Vital literacy indicators reveal a deplorable condition (Obasanjo 2000). Most of the schools, all levels lack teachers and basic infrastructure, including teaching aids and laboratories. They suffer from overcrowding, poor sanitation, resulting in poor quality of teaching and poor quality of products (Obasanjo, 2000). The educational system has equally been burdened by frequent industrial disputes and strike actions. It suffers from poor management, manifested in poor intra-sectoral allocation,

multiplicity of agencies with duplicated functions and inadequate coordination. One of the factors that could be responsible for the downward trend in students' performance is their negative attitude to the subject. Secondly, teacher's failure to employ appropriate methods of teaching chemistry scares the students away from the subject.

Similarly, chemical bonding is one of the fundamental topics in chemistry that many students find it very difficult to learn and which constitutes some pedagogical problem to the teacher (Sidhu, 2002, Hardiman and Mestre 1993 Walberg, 2000). Thus the efficacy of constructivist instructional strategy is attempted to fill the vacuum between the situation and existing research. Hence, the study will investigate the relative efficacy of the constructivist instructional strategy for improving achievement in the learning of the chemical bonding concept in chemistry among senior secondary class two (SSC2) students of secondary schools in Ahoada East Local Government Area.

### **Purpose of the Study**

The main purpose of the study was to investigate the effectiveness of a constructivist instructional approach on student academic achievement in chemical bonding in Ahoada East Local government Area. The study specifically;

1. Find out if constructivism enhances academic performance in chemistry
2. Find out if constructivism affects male and female student's performance in chemistry
3. Find out the extent to which constructivism affects the performance of student in chemistry with respect to age.

### **Research Questions**

The following research questions were formulated to guide this study.

1. What are the differences in the mean score of student taught with constructivist learning strategy and those taught with lecture method?
2. What are the differences in the mean scores of male and female chemistry students taught with constructivist learning method.
3. How will constructivism in learning affect students' performance in chemistry with respect to age?

### **Research Hypotheses**

The following research hypotheses tested in the study at 0.05 level of significance;

- H0<sub>1</sub>** There is no significant difference between the performance of student taught with constructivist learning strategy and those taught in lecture method.
- H0<sub>2</sub>** There is no significant difference between the performance of male and female student who received instruction in chemistry using constructivist.
- H0<sub>3</sub>** There is no significant difference between the performance of male and female students who received instruction in chemistry without constructivist.
- H0<sub>4</sub>** There is no significant difference between the performance of student who received instruction in chemistry with constructivist with respect to age.
- H0<sub>5</sub>** There is no significant difference between the performance students who received instruction in chemistry without constructivist with respect to age.

### **Review of Empirical Studies.**

Constructivism has been no less prominent in chemistry instruction.

AS Davis (2001) lightly remarked, anyone who observes chemistry education has to be impressed by the quite sudden eruption of "Constructivism" as a central concern of so many researchers.

As in science education, constructivism has offered accounts of the epistemology of chemistry, teaching strategies and curriculum development.

There is much that is laudable insightful and progressive about constructivist theory and practice.

It is far superior to the behaviourist theory of mind and learning against which Piaget, and early cognitive psychologists such as Bruner struggled Mathew (2009). Constructivism stress on students' engagement in learning and the importance of understanding students current conceptual schemes in order to teach fruitfully, are progressive, as is its stress on dialogue conversation, argument and the justification of student and teacher opinions in a social setting. Importantly, constructivism, stress on understanding as the goal of science and chemistry instruction.

Lohead and Mestre (2000) Describes an effective inductive techniques for the purpose of instruction the techniques induces conflict by drawing out the contradictions in students misconception. In the process of resolving the conflict a process that takes time, student reconstruct the concept.

The following discussion illustrates the three steps of this technique;

- i. Probe for qualitative understanding the teacher should keep on looking out for misconceptions. A simple well placed question can show if a students' difficulty comes from linguistic confusion, naire misconceptions or both.
- ii. Probe for quantitative understanding, the teacher should find out if the students understand the quantity or quantities of the variables involved.
- iii. Probe for conceptual understanding the students should be asked to write down the statement. Alternatively, they should make the statement verbally from the students' statement, the teacher looks for common error, patterns the teacher at this point, induces conflict (Benander and Clement, 2006).

With the inductive approach, the classroom can serve as a forum for some heated discussions among students who will disagree on answer. At this point, the teachers does not tell the students the right answer. Instead, the teacher guides them toward constructing it. In this way, students most important and most effective learning has to do with concepts not just correct numbers or answers. An active classroom discussion, with the teacher serving as guide, helps student air their misconceptions and together, truly overcomes them.

According to Von Glasersfeld (1991) conceptual models based on explanatory theories, enhance teachers' understanding of students' and students understanding of chemistry. Since teaching and learning of chemistry and complex tasks, certain teaching strategies and methods are worth careful consideration as teachers strive to improve their chemistry teaching practices. However, there is evidence that students can learn new skills and concepts while they are working out solutions to problems (Wallberg, 2000).

### **The Design of the Study**

This study adopted a quasi-experimental research design. A pre-test post-test experimental design was employed to examine any possible treatment effect on the subjects. The pre-test post –test experimental design was considered appropriate because the research condition included both treatment and non-treatment condition, and lend itself to manipulation and also, the dependent variable outcomes are quantifiable.

### **Area of the Study**

This study was carried out in Ahoada East Local Government Area of Rivers State. The choice of this educational zone is based on the fact that the researcher is familiar with the location of

the various schools which give the researcher the ample opportunity to thoroughly monitor and supervise the study.

### **Population for the Study**

The population of the study comprised of 900 senior secondary two students (SS2) studying chemistry in Ahoada East Local Government Area. The population for this research was made up of two (2) selected secondary schools in Ahoada East Local Government Area. This therefore constituted the population for the study.

### **The Sample and Sampling Technique**

A random sample of One Hundred and Twenty (120) Senior secondary class (SS2) students were drawn from two (2) schools in Ahoada East Local Government Area. Western Ahoada County High School for boys and Government Girl Secondary School Ahoada for girls. Each school was made up of sixty (60) students. The sixty students in a school were selected by a systematic random sampling to obtained 30 students that form the experimental group. The other remaining 30 students were used as the control group.

### **Development of Research Instruments**

The main data collecting instruments were the Achievement Test on Chemical Bonding (ATCB) and the constructivist interview schedule for students understanding of the chemical bonding Concept in Chemistry (CIS). The ATCB consisted of twenty five (25) item multiples choice (objectives) questions developed by the researcher. The ATCB was constructed to cover various aspects of chemical bonding concept. The constructivist interview schedule (CIS) was actually a teaching material for the experimental group. The (CIS) for students' understanding of the chemical bonding concept in chemistry will be subdivided into three sections namely; preliminary information students' personal educational characteristics and the constructivist interview schedule on chemical bonding like the ATCB, the CIS consisted of twenty five (25) items constructed in line with the scheme of work and syllabus for senior secondary chemistry.

### **Method of Data Analysis**

Data obtained from the five null hypotheses raised were analysed. Mean scores and standard deviation were used to test and analyse all the data for the questions raised in the study. The null hypotheses one (H<sub>01</sub>) was analysed using Z-test and t-test of significance were used to analysed the null hypotheses two to five (H<sub>02</sub> to H<sub>05</sub>). The hypotheses of the study were analyzed using Z-test and t-test of significance. Summary of the major findings from the result was highlighted. The P<0.05 level of significance formed the basis of acceptance and rejection of the null hypotheses.

### **Data Analysis and Result**

The instrument used for the data collection was Achievement Test on Chemical Bonding (ATCB) and the Constructivist Interview Schedule (CIS).

### **Research Question 1**

What are the differences in the mean score of student taught with constructivist learning strategy and those taught with lecture method?

**Table 1 Relevance of constructivism in learning of chemistry**

Group	N	Pretest		Post test	
		$\bar{X}$	SD	$\bar{X}$	SD
Constructivist	60	58.70	8.14	65.90	16.20
Non-constructivist	60	58.60	8.69	62.33	5.03

The information on table 1 shows a high mean score of (65.90) on students treated with constructivism. Also a mean score of (62.33) was observed on students taught without constructivism, with a low standard deviation. The data indicates a high spread of performance on constructivist's students as indicated with a standard deviation on (16.20). While a low variability was indicated on the non-constructivist students with a standard deviation of (5.03).

### Research Question 2

What are the differences in the mean score of male and female chemistry students taught with constructivist learning method?

**Table 2 Constructivism to male and female in chemistry**

			Pre-test		Post -test	
Group	Sex	n	$\bar{X}$	SD	$\bar{X}$	SD
Constructivist	Male	30	58.30	7.30	57.33	5.60
	Female	30	58.70	8.14	58.90	6.03
Non-constructivist	Male	30	58.17	8.90	56.40	5.49
	Female	30	57.91	3.46	56.01	4.90

Table 2 indicate that constructivism does not make much impart within the male and female groups with respect to their performances. This is observed from the pre-test and post-test performances. But there was a remarkable performance on male and female treated with constructivism than those male and female without constructivism. This could be seen from their mean score performances. The female students using constructivism has a high mean score (58.90) than the non-constructivist ones with a mean score (56.01). The female students mean score of constructivist group is higher than the male students mean score (57.33). While male students using constructivism has a high mean score (57.33) than the male students with non-constructivist (56.40).

This shows that constructivism influences female students than male students.

### Research Question 3

How will constructivism in learning affect students' performance in chemical bonding with respect to age?

**Table 3: Constructivism and Age Attainment in Chemical Bonding**

Group	Age (Yrs)	Pretest		Post test	
		$\bar{X}$	SD	$\bar{X}$	SD
Constructivist	10-15	55.5	5.3	58.67	7.7
	16-22	55.8	4.88	57.60	6.0
Non-constructivist	10-15	56.7	7.9	57.07	5.24
	16-22	57.6	7.85	55.10	5.0

Table 3 shows an improved performance within the age brackets (10-15) years and (16-22) years when treated with constructivism than when there was no constructivism principle. This is informed by their mean performances. Students within the age bracket (10-15) years had a mean score of (58.7) after been taught with constructivism principle than when there was no constructivism. A cursory look at the table shows that certain age is susceptible to constructivism principle.

### Hypothesis 1

There is no significance difference between the performance of students taught with constructivist learning strategy and those taught with lecture method.

In testing of this hypothesis, the achievement score of students from the two schools Government Girl Secondary School Ahoada Western Ahoada County High School Ahoada who received instruction with constructivism and the scores of those who received instruction without constructivism were added separately. The mean calculated separately. The researcher used Z-test to determine whether the difference between the two means were significance.

**Table 4 Z-test Analysis for Constructivist and Non constructivist Students**

Group	n	Pretest		Post -test		Z- Cal.	Z- Crit	Level of significance	of Decision
		$\bar{X}$	SD	$\bar{X}$	SD				
Constructivist	60	58.7	8.14	65.39	16.2	2.176	1.96	P<0.05	Rejected
Non-constructivist	60	58.60	8.6	62.33	5.03	1.88			

Table 4 shows that the calculated Z is greater than the critical value of Z when students used constructivism (Pre-test and Post-test) Z = 2.176, P<0.05. But the Z calculated on non-constructivist group (Pretest and Post test Z= 1.88) is less than the critical value of 1.96.

**Table 5: Z Test summary for Post test of constructivist and non-constructivist students.**

Group	n	Pretest		Post-test		Z cal	Z Crit	Level of Significance	of Decision
		$\bar{X}$	SD	$\bar{X}$	SD				
Constructivist	60	-	-	65.39	16.2				Rejected

Non constructivist	60	-	-	62.33	5.02	2.75	1.95	P < 0.05
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Table 5 shows that Z calculated for post test of constructivist and non-constructivist groups as 2.75. This means that there is a significant difference between the mean performance of students in the constructivist and non-constructivist group at P<0.05 level of significance. Since the Z calculated value 2.75 is greater than Z critical value of 1.95, this indicate that students in the constructivist group performed better than those in non-constructivist group. Therefore the null hypothesis is rejected.

### Hypothesis 2

There is no significance difference between the performance of male and female student who received instruction in chemistry in-built constructivism. In testing for this hypothesis, the mean achievement scores of male and female students were calculated separately. A t-test of significance was used to determine whether the difference between the mean of the two groups was significance.

**Table 6 T-test summary showing the performance of male and female students treated with constructivism.**

Group	Sex	N	Pre-test		Post test		t-cal	Level of significance
			$\bar{X}$	SD	$\bar{X}$	SD		
Constructivist	Male	30	58.30	7.30	57.33	5.60	0.416	P < 0.05
	Female	30	58.70	8.14	58.90	6.03	0.077	

Critical value of t = 2.048 df = 28, two tailed according to the information in table 6, the calculated t value for male pretest and post-test and female pretest and post test for constructivist group were (t=0.416 and 0.077) respectively. These values are less than the theoretical table value at (P<0.05 df 28 two tailed) Hypothesis 2 is therefore accepted.

### Hypothesis 3

There is no significant difference between the performance of male and female students who received instruction in chemistry without constructivist.

**Table 7 t-test summary for the achievement scores of male and female students who were accessed using non constructivism.**

Group	Sex	n	Pretest		Post test		t Cal.	Level of Significance
			$\bar{X}$	SD	$\bar{X}$	SD		
Non constructivist	Male	30	58.17	8.90	56.40	5.49	0.668	P < 0.05
	Female	30	57.90	3.46	56.01	4.49	1.33	

Critical value (C.V) = 2.048



Table 7 shows that value of t calculated for male pretest and post test as ( $t=0.668$ ). While that of female pretest and post test as ( $t= 1.33$ ). This indicates no significant relationship with respect to non-constructivism principle during teaching of students.

**Table 8 t-test summary for constructivist and non-constructivist post test performance**

Group	Age (yrs)	N	Post test		t Cal	Level of Significance
			$\bar{X}$	SD		
Constructivist	Male	30	57.30	5.61	0.75	P<0.05
	Female	30	58.90	6.03		
Non constructivist	Male	30	56.40	5.49	0.225	
	Female	30	56.00	4.49		

Critical value (C.V) = 2.048 df = 28. A cursory look at table 4.8 revealed that there is no significant relationship between students (male and female) treated with constructivist and without constructivist. This is informed from t calculated ( $t= 0.75$  and  $0.225$ ) respectively. Hypothesis 3 is accepted.

#### Hypothesis 4

There is no significant difference between the performance of student who received instruction in chemistry with in-built constructivism with respect to age.

**Table 9: t-test analysis of the achievement scores of students using constructivism with respect to age.**

Group	Age (yrs)	n	Pretest		Post test		t Cal.	Level of Significance
			$\bar{X}$	SD	$\bar{X}$	SD		
Constructivist	10-15	30	55.50	5.31	58.70	7.70	0.440	P< 0.05
	16-22	30	55.80	4.90	57.60	7.60		

Table 9 informs that there is no significance difference between the performance of students in chemistry who were treated with constructivism with respect to age. This is because the calculated t-test is less than the theoretical value of ( $t=0.440$ ,  $P<0.05$ ,  $df = 28$ ) two tailed. Hypothesis 4 is accepted.

#### Hypothesis 5

There is no significance difference between the performance of students who received instruction in chemistry without constructivism with respect to age.

**Table 10 t-test analysis of students within the age bracket (10-15) years and (16-22) years taught without constructivism.**

Group	Age (yrs)	n	Pretest		Post test		t Cal.	Level of Significance
			$\bar{X}$	SD	$\bar{X}$	SD		

				SD				
	10-15	30	56.70	7.90	57.07	5.24	1.09	P< 0.05
Non constructivist	16-22	30	57.60	7.85	55.11	5.01		

Critical value  $t=2.048$   $df=28$ . Table 10 reveals that there is no significant relationship between the mean achievement scores of students learning instruction without constructivism with respect to age. The calculated t-test is less than the critical value ( $t= 1.09$ ,  $P< 0.05$ , two tailed,  $df 20$ ). Hypothesis 5 is accepted.

### Summary of Finding

1. The constructivist students had a higher mean score while non-constructivist student had a lower mean score in learning chemistry.
2. The female had a high means score than male when constructivist approach is used
3. The students at a certain age bracket (10-15) years had a higher mean score using constructivism. While students within the age bracket (16-22) years had a lower mean score.
4. There is a significance difference between the performance of the student using constructivism and student without constructivism.
5. There is no significance difference between the performance of male and female students who were taught using constructivism during chemistry instruction.
6. There is no significance difference between the performance of male and female students who learn chemistry without constructivism
7. There is no significance difference between the performance of students who were taught using constructivism with respect to age during chemistry instruction.
8. There is no significance difference between the performance of students who were taught with non-constructivism during chemistry instruction.

### Discussion of Findings

Research questions set in the study guided the discussion of the major findings.

#### Research Question One

The first research question was on the differences in the mean scores of student taught with constructivist learning strategy and those thought with lecture method. The students who received instruction with constructivism in chemistry had a higher mean score. While those non-constructivist student had a lower mean score. This could be as a result of the teaching approach the constructivist applied in the teaching methodology which the researcher used in the lesson plan. A situation where the researcher entrenched all the constructivist learning styles on the experimental group, but non-constructivist on the controlled group performance. This invariably, makes the students developed interest in learning chemistry, which rewarded to a higher performance.

This is in agreement with many researchers and observations as carried out by (Confrey 2009), (Barrass 2005) and (Alamina 2001) who were of the view that constructivism drives an individual to action. This action is promoted through appropriate constructivism, teaching methodology, praises and approval of individual intrinsic achievement. Among the variable that motivates student to construct their own knowledge is their academic ability. (White 2000) concluded in his research that students performed well when they were told of their performances. This shows that students appreciate any thing that can energies them to learn.

Contrarily, they fall out of favour of chemistry when their unreadiness to learn is not given opportunity to construct their experiences.

However, the high performance in chemistry is an acceptance of these strategies by students who acknowledged them as a source of constructivism. For example, a student may be interested on constructing his experiences to his academic success and thereby constructing new ideas to learning. On the other hand, if a students does not do well in class assignment the teacher may pick on the student area of weakness and informs possible remedy. This remedy begins to acts as he is allowed to construct his own ideas.

### **Research Question Two**

What are the differences in the mean scores of male and female chemistry students taught with constructivist learning method. This study shows that girls are more amiable to principle of constructivism than boys. This is revealed in their mean score, where the female had a high mean score (table 4.2).

The susceptibility on the constructivist principle shown by girls may be due to the present educational awareness. This is being enhanced by women uproar in education emancipation. People have come to know the importance of education to individuals as well as the need of the Nigerian economic sector.

This principle of constructivism may heightened the girl's internal locus of control, hence the finding revealed that girls are better encouraged in chemistry than boys.

This finding is in agreement to the recent study by Dreyfus (2008) who found that male students have internal drive to learn than female while female students exhibit more of external drive to learn. The study also revealed that many students believed that girls are better off in chemistry than boys.

### **Research Question Three**

Research question three raised question on how constructivism in learning affects students' performance in chemistry with respect to age. Regarding to this, table 4.3 shows a high mean score (58.67) for age bracket of (10-15) years. It therefore implies that chemistry as one of the major science subjects could be introduced at a learning age attainment.

### **Hypothesis One**

There is no significant difference between the performance of students taught with constructivist learning strategy and those taught with lecture method. A significant difference was observed when students constructs their learning through their experiences. The (table 4.5) shows that the Z-test ( $Z = 2.75$   $P < 0.05$ ) was greater than the theoretical value at probability level of 5 percent. This rejected the null hypothesis one.

This means that students who received instruction with constructivist learning strategy performed better than those who received instruction with non-constructivist. The researcher observed that during the lesson the students who received instruction with constructivist learning strategy were more serious and committed to the learning experience presented to them. But the controlled (non-constructivist) group where not committed to the learning of chemistry. This may have contributed immensely to bring about the difference in the performance of the two groups. To the experimental group (constructivist) group, promise of reward for success in the test that would come at the end of the lesson was made and other incentive announced before the commencement of the lesson.

This may have committed the students during the instruction in order to deliver the set objectives of the lesson; succeed in the test and gain the reward. But the control group to which no promise have made and no incentive were announced, felt that nothing was at stake and hence were less serious and less committed.

### **Hypothesis Two**

There is no significant difference between the performance of male and female students who received instruction in chemistry in in-built constructivism.

No significant difference was observed in (table 4.6)  $t = 0.416$  and  $0.77$   $P < 0.05$ , two tailed) and twenty eight degree of freedom. This implies that male and female have no influences by external locus of control. A mean score (58.9) on the part of the female shows that the influence on constructivism is felt on them. Much as male could be influenced by their internal Locus of control, the female is equally influenced by both internal and external Locus of control in the learning of chemistry.

The sex syndrome on subjects that have to do with skills and manipulation is to be harnessed. Both boys and girls are fully aware of the present day academics reality. Hence could not be proved to act or response to any thing that will further energize them, other than the innate desire to learn.

This compliment the work of Clement (2014), Carpenter (2005) and Caroll (2013) who found that student's performance is hastened by their internal Locus of control. This implies that external reward has a little Locus to the learning of chemistry as it may assist in suffering this innate readiness to learn.

### **Hypothesis Three**

There is no significant difference between the performance of male and female students who received instruction in chemistry without constructivist. The findings as shown in Table 4.7 ( $t = 0.66$  and  $1.33$   $P < 0.05$ ,  $df = 28$ , two tailed); shows no significant difference between the performance of male and female when lesson was free of constructivism. Even, there is no pronounceable difference in their mean performance.

This result, no doubt, informs that box sex are equal in their academic ability. They have the need to study chemistry. This result is in agreement with Driver (2005), D' Ambrosio (2006) acknowledge this- self-academic awareness when it was described as a contrived constructivism. This implicates a voluntary desire to learn and satisfaction of emotional needs.

### **Hypothesis Four**

There is no significant difference between the performance of students who received instruction in chemistry with in-built constructivist with respect to age. The finding on table 4.9 revealed no significant difference on the mean performance of male and female when constructivist strategy is used during instruction. ( $t = 0.407$   $P < 0.05$ ,  $df = 28$  two tailed. The students who attained the learning age between 10 and 15 years are more susceptible to constructivism as could be shown on the high mean performance (58.7) But there is no pronounceable significant in their performances.

The result equally revealed that students using constructivist strategy does not depend on age in their academic pursuit, rather, when a certain learning age is reached. Students who are more mature to learn have their internal desire to learn. Constructivism to an extent does not mean much in their learning desire when there is internal need to learn, constructivism only produces a slight difference in performance.

### **Hypothesis Five:**

There is no significant difference between the performance of students who received instruction in chemistry without constructivist with respect to age. No significant difference between the mean performance of students within the age bracket was observed table 4.10 ( $t = 1.09$   $P < 0.05$ , two tailed). This became possible in view of the fact that students under the study were equivalent in terms of academic ability.

## Conclusion

The purpose of the study was to find out the effectiveness of using instructions based on constructivist approach on the performance of students in chemical bonding concepts. The study has revealed that students exposed to the use constructivist instructional strategy obtained higher mean score than students who were taught without constructivist instructional approach. It was therefore concluded that teachers should learn to use constructivist instructional approach in teaching not only chemical bonding concepts, but also other difficult –to-learn topics in chemistry to the students.

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