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DETERMINING THE EFFICACY OF CONTEXT-BASED INSTRUCTIONAL METHOD OF TEACHING CHEMISTRY ON STUDENTS' RETENTION IN AGBANI EDUCATION ZONE, ENUGU STATE

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Abstract: This study focused on determining the efficacy of context-based instructional method of teaching chemistry on students' retention in Agbani Education Zone, Enugu State. This method recognized the need for student centered, it also helps students develop creative and critical learning skills. Context-based instructional method (CBIM) was assigned as experimental group and exposition method was assigned as control group. Two research questions and two null hypotheses guided the study. The researchers adopted a quasi-experimental research design for the study (pretest, posttest non-equivalent control group) intact classes were used. The population for the study comprised all public co-education senior secondary school one (SSS1) which were tree thousand, five hundred and five (3,505). Sample size of three hundred and twenty (320) was purposively sampled; 155 males and 165 females. The researchers developed basic chemistry retention test (BCRT) as the instrument for data collection. The instrument was validated by experts and the reliability of BCRT was determined using Kuder Richardson's formular 20 ($K\text{-}R_{20}$). Reliability coefficient of 0.85 was obtained. The BCRT was administered to both groups (experimental and control group) as pretest, posttest and retention test. Mean and standard deviation were used to answer research questions while two-way analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings showed that experimental group recorded higher retention than the control group when taught kinetic theory and gas laws. Female students had higher mean retention scores than their male counterparts. It was recommended among others that context-based instructional method (CBIM) should be given more emphasis in the training and re-training program of secondary school chemistry teachers.

Keywords: Context-Based Instructional Method, Chemistry, Retention

Introduction

Chemistry is an important science subject also for technological development and advancement of any nation, also its emphases on reduction of chemistry to descriptive exercises through the use of lecture method. Moreso, that teaching and learning of chemistry should be learner-centered. In the same vein, it stressed that teaching of chemistry should rely between theory and practice also be taught with the most effective learner centeredness Ani & Egbo (2015) The word "context" originates from the Latin language in the verb form "contexere" meaning "to weave together". The noun form "Contextus" means "Coherence", "connection and or "relationship" (Gilbert, 2006). According to Hornby (2006) "context" is the situation in which something happens and that helps you to understand it. Context is created through the use of driving questions based on real

world experience and the use of anchoring events, which expose students to the phenomenon under study. The relevant materials for teaching the subject matter are brought into the class. Context can be created by the use if diagram, model, chart, film or map. The context created is the focal event that is put in the spotlight. Context provides a mental surrounding" to which subsequent ideas can be related Gilbert 2006).

Retention is the ability to remember or utilize already acquired knowledge or skills over an extended period of time. It is the capacity to remember something-knowledge, skills, habits, attitudes, or other responses initially acquired Ezeano (2008). Ani & Egbo (2015) carried out a study titled: use my work maps on students' achievement, interest and retention in selected units or organic chemistry in Nigeria. The study revealed that concept mapping was more effective than the conventional methods in terms of students' achievement, retention and interest in organic chemistry. Concept mapping was superior to conventional method in enhancing retention of concepts. Eze, Egbo & Omeje (2018) carried our study on the effect of two constructivist instructional package in facilitating conceptual change, achievement and retention in physics. The study revealed that there was no significant difference in the mean retention scores of physics students taught using analogy instructional package (ANIP) and constructive laboratory instructional package (CLIP) in geometric optics. Neboh (2009) carried out a study on the effect of learning activity package (LAP) on students' achievement and retention in senior secondary school biology. The study also revealed that male students' retention scores was significantly greater than those of female counterparts.

Worthy of consideration in this study is gender. Gender as a factor in retention has for sometimes generated the research interest of some science educators worldwide. Williams (2006), in his study to determine the efficacy of contextual learning instructional package (CLIP) on learner's academic achievement in biology revealed that no difference existed in the performance of male contextual learners and their female counterparts in an achievement test. He discovered that contextual learning was gender insensitive as there was no significant difference between the mean achievement score of male and female learners in biology. Eze, Egbo & Omeje (2020) corroborated this indifference in gender achievement in chemistry. Eze Egbo & Omeje (2021) observed that female students had higher retention scored than male students in biology irrespective of the teaching strategy (co-operative learning and concept mapping) used. Considering all these views, one cannot draw conclusion on the effect of gender on retention of students in chemistry. Therefore, there is need to consider gender as a factor in this study. All these forgoing discussions make this study inevitable. Therefore, it becomes necessary to address the efficacy of context-based instructional method (CBIM) of teaching chemistry on students' retention in Agbani Education Zone.

Statement of the problem

Studies have shown that students' retention in senior secondary school certificate examinations (SSCE) in chemistry has been consistently poor. Some educators have blamed the poor retention students in chemistry on a number of factors such as: lack of perception of relevance of the content of the curriculum to real life by the students and use of ineffective teaching methods. The expository method of teaching science which is predominantly employed by chemistry teachers in Nigerian secondary schools does not take care of alternative conceptions. It does not place concept and application side by side and does not

emphasize relevance of task to explain concepts. Poor method employed in teaching science results in poor retention in chemistry by students. Some science educators have also observed gender sensitivity in science while others have not found any significant effect of gender on science retention. It may be the realization of the importance of effective science teaching and learning by science educators that has given rise to the search for innovative methods of teaching (chemistry) science. Innovative teaching methods include target tasks, guided-inquiry, co-operative learning, and context-based instructional method. Context-based instructional method as one of the innovative methods, has been found effective in teaching science courses in other parts of the globe. Its' efficacy in the teaching of chemistry in Agbani Education Zone has not been established, according to literature available to researchers. Poor and ineffective method of teaching chemistry has implications for the nations' education system: firstly, the desire of the federal government to reposition the country through education as scientifically and technologically developed country before the year 2030 will be an illusion. Secondly, on the side of students, they will not compete favorably with their peers in the developed nations of the world. It is based on the desire to arrest the downward trend in students' retention in chemistry that the researchers sought to investigate the efficacy of Context-Based Instructional Method (CBIM) of teaching chemistry on students' retention in Agbani Education Zone.

Purpose of the study

The general purpose of the study is to determine the efficacy of context-based instructional method of teaching chemistry on students' retention in Agbani Education Zone specifically intended to:

- Investigate the effect of context-based instructional method (experimental) on students' retention in senior secondary one (SS1) when taught kinetic theory and gas laws as measured by basic chemistry retention test (BCRT).
- Examine the influence of gender on SS1 students' mean retention scores in chemistry when taught kinetic theory and gas laws, using CBIM and expository method (EM), measured by basic chemistry retention test (BCRT).

Research questions

The following research questions guided the study:

- What are the mean retention scores of SS1 chemistry students when taught kinetic theory and gas laws using context-based instructional method and expository method measured by basic chemistry retention test (BCRT).
- What are the mean retention scores of male and female students taught kinetic theory and gas laws using context-based instructional method and expository method, as measured by basic chemistry retention text (BCRT).

Hypotheses

The following hypotheses which were tested at 0.05 level of significance were formulated to guide the study:

HO_1. There is no significant difference in the mean retention scores of SS1 chemistry students when taught kinetic theory and gas laws using context-based instructional method and expository method as measured by basic chemistry retention test.

HO_2. No significant difference exists in the mean retention scores of male and female SS1 chemistry students when taught kinetic theory and gas laws using context-based instructional method and expository method and measure by Basic Chemistry Retention Test (BCRT).

Research Method

The design for this study was quasi-experimental research design, specifically pretest, posttest, non-

equivalent control group design. The design was used because of non-randomization of the subject. The research subjects were not randomized because of problems of re-arrangement or re-grouping of intact classes. The population for the study consisted of all senior secondary class one (SSI) chemistry students in public co-education schools in Agbani Education Zone of Enugu State numbering one thousand seven hundred and fifty-two students (1752).

The choice of co-education secondary schools was that gender was a factor in the study. Sample of three hundred and twenty (320) chemistry students were used. Random sampling technique was purposive used to select two co-education schools. In each of the sampled schools all the SS1 chemistry students were used as research subjects. One intact class was assigned to Context-Based Instructional Method (CBIM) group while the other intact class was assigned to Expository Method (EM) group. Basic Chemistry Retention Test (BCRT) was used as instrument for the study. The instrument consisted of forty (40) multiple choice objective questions developed by the researchers. The choice of SSI students was due to the fact that kinetic theory and gas laws are under SSI chemistry scheme of work as contained in the chemistry curriculum of Federal Ministry of Education. The instrument was subjected to both content and face validation. The instrument was validated by three experts, two experts in the department of Science Education and one expert from measurement and evaluation, all from Enugu State University of Science and Technology (ESUT). For the reliability, BCRT was used to determine the internet consistency of the instrument using Kuder-Richardson Formula- 20 (K-R_{20}). An internal consistency of the co-efficient of 0.85 was obtained for BCRT was administered to both groups as post-test and retention test.

Experimental Procedures

Two instructional methods were used for the study. The context-based instructional method (CBIM) and expository method (EM). CBIM was for the experimental group while the EM was used as control group. The regular chemistry teachers were used for the treatment both the pretest and posttest were administered to the experimental and control subjects in the first and fourth week respectively. One hour was allowed for both the pretest and posttest. The question papers and the answers collected from each student in both the experimental and control group. The reason for retrieving question papers was that the same question will be used for the post test. After the treatment, the pretest was reshuffled and printed on a coloured paper to give it a different look, before it was used for the posttest. The subject teachers did the supervision and invigilation. The treatment was administered for a period of four weeks. Data collected were analyzed using mean and standard deviation. Specifically, mean and standard deviation were used to answer the research questions while analysis of covariance ANCOVA was used to test the hypothesis at 0.05 level of significance. The same test was reshuffled and administered to both experimental group and control group after two weeks interval; the scores are for the Basic Chemistry Retention Test (BCRT)

Result

Table1 Showed the Mean scores and standard deviations SS1 chemistry students taught
kinetic theory and gas laws on experimental and control groups measured by basic chemistry retention test (BCRT).

Pretest posttest retention * Method

Method	Statistics	Pretest	Posttest	Retention
Experimental	**Mean**	12.05	20.49	23.18
	N	160	160	160
	SD	7.39	6.65	7.07
Control	**Mean**	10.83	14.75	14.31
	N	160	160	160
	SD	5.76	6.18	4.39
Total	**Mean**	11.44	17.62	18.74
	N	320	320	320
	SD	6.65	7.02	7.37

Research Question One

What are the mean retention scores of SS1 chemistry students when taught kinetic theory and gas laws using context-based instructional method and expository method measured by basic chemistry retention test (BCRT).

It indicated that the experimental group obtained mean retention scores of 20.49 and 23.18 respectively in the post-BCRT and the retention-BCRT. The experimental group also got standard deviations of 6.65 and 7.07 respectively in the post-BCRT and the retention-BCRT. On the other hand, the control group had mean scores of 14.75 and 14.31 respectively in the post-BCRT and the retention-BCRT. The standard deviations for the control group in the post-BCRT and the retention-BCRT were 6.18 and 4.39 respectively. The result presented in table three indicated that experimental group obtained a higher mean retention score (23.18) than the control group in the retention-BCRT (14.31).

Table Two: The Mean and standard deviation scores of male and female students when taught kinetic theory and gas laws using Context-Based Instructional Method and Expository Method, measured by pre-BCRT and the post-BCRT.

Pretest posttest retention *gender

Gender	Statistics	Pretest	Posttest	Retention
Male	**Mean**	12.48	18.07	18.08
	N	155	155	155
	SD	6.47	6.83	6.98
Female	**Mean**	10.46	17.19	19.37
	N	165	165	165
	SD	6.68	7.19	7.69
Total	**Mean**	11.4	17.62	18.74
	N	320	320	320
	SD	6.65	7.02	7.37

Research Question Two

What are the mean retention scores of male and female students taught kinetic theory and gas laws using context-based instructional method and expository method, as measured by basic chemistry retention test (BCRT).

Table two indicated that the male students obtained the Mean scores of 18.07 and 18.08 in the pre-BCRT and the post-BCRT respectively. The male students got standard deviations of 6.83 and 6.98 in the pre-BCRT and retention-BCRT respectively. The female students had mean scores of 17.19 and 19.37 in the post-BCRT and retention-BCRT respectively. They also 17.19 and 7.69 in the post-BCRT and retention-BCRT respectively. The results presented in the table two indicted that the female students had higher mean retention scores (19.37) than the male counterparts (18.08).

Table Three: Analysis of covariance of students mean retention scores in BCAT Instructional Method × Gender
Dependent Variable: Retention

Variance	Sum of sq	df	mean Square	F	sig	Decision
	6872.34	4	1718.09	51.79	0.00	NS
	10925	1	10925.92	329.33	0.00	NS
	94.81	1	94.81	2.86	0.09	S
	210.91	1	210.91	6.36	0.01	NS
	4676.65	1	4676.65	140.96	0.00	NS
Gender*Method	246.40	1	246.40	7.43	0.01	NS
Error	10450.64	315	33.18			
Total	129748.00	320				
	17322.99	319				

a. R Squared= .397 (Adjusted R Squared = 389); NS not significant; S signif

HO1 There is no significant difference in the mean retention scores of SS1 chemistry students when taught Kinetic theory and gas laws using Context-Based Instructional Method and Expository Method as measured by Basic Chemistry retention test.

Table3 showed that the calculated F-value for the effect of Context-Based Instructional Method on students' retention in BCRT was 140.96 significant at 0.00 level of significance. This was less than 0.05 set for the study. The null hypothesis was therefore accepted. This means that no significance difference existed in the mean retention scores of chemistry students taught with CBIM and those taught with Expository Method.

HO2 No significant difference exists in the mean retention scores of male and female SS1 chemistry students when taught Kinetic theory and gas laws using Context-Based Instructional Method and Expository Method and measured by Basic Chemistry retention Test.

Table Three also showed that the calculated F-value for the effect of gender on students' retention in Kinetic theory and gas laws was 6 36 significant at 0.01 level of significance. This was less than 0.05 level meant for the study. The null hypothesis was accepted l. It meant that there was no significant difference in the mean retention scores of male and female students in the retention BCRT.

Discussion

The female students had slightly higher mean retention scores than the male counterparts. This difference was not significant. The finding was not in agreement with the finding of Anidu 2007 who found out that there was a significant difference in the retention of male and female students in science subjects. But the study was in agreement with Nnadi 2002 who found out the no significant difference in the retention of the male and female. It may be that the female's latter teamed up and comprehend the focal event more than the males. The findings lend credence to the works of Egbo 2005, Neboh 2009 who found out in their individual studies that learner centered methods enhance retention.

Conclusion

Chemistry students taught using context based instructional strategy retained the chemistry context better than those taught with expository method. The female students had slightly higher mean retention scores than the male counterparts. This difference was not significant.

Recommendations

The following recommendations were made.

- The use of CBIS should be given greater emphasis in the curriculum for the pre-service teachers of chemistry and other science subjects.
- Curriculum planners should incorporate and emphasize the use of CBIS in the senior secondary school chemistry and other science subjects in general/
- Authors of chemistry books should develop books which reflect context-based instructional method with the teacher's guide.

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