

EFFECT OF SPACED LEARNING STRATEGY ON STUDENTS' ACHIEVEMENT IN CHEMISTRY IN GBOKO METROPOLIS, BENUE STATE

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Email: mike.tile@yahoo.com**ABSTRACT**

The study investigated effect of spaced learning strategy (SLS) on students' achievement in chemistry in Gboko metropolis. The design of the study was quasi-experimental of non-randomized pre-test post-test control type. The population of the study was 650 SS2 students out of which a sample of 130 male and female students was used. Two research questions were asked to guide the study while two hypotheses were formulated and tested at 0.05 level of significance. Data was collected using Chemistry Achievement Test, (CAT). The instrument yielded a reliability coefficient of 0.83 using Kuder-Richardson formula 21. The research questions were answered using mean and standard deviation while analysis of covariance (ANCOVA) was used to test the two null hypotheses formulated. Findings from the study revealed that there is a significant difference in the mean achievement scores of students taught using SLS than those taught with the lecture method. There was no significant difference in the mean achievement scores of male and female students taught using spaced learning strategy. Based on the findings, it was recommended that curriculum planners should incorporate SLS into Chemistry curriculum for enhanced teaching and learning of chemistry and Chemistry teachers should always employ spaced learning strategy in their lessons in order to improve students' achievement.

INTRODUCTION

Science has a major role to play in the modern era of technology worldwide. In Nigeria, science is so important that a lot of emphasis has been placed on its teaching and learning with a major aim on science education as contained in the National Policy on Education (NERDC, 2008). Within the science education context, Chemistry has been identified as a very important subject and its importance in the science and technological development of any nation has been widely reported (Usman, 2007).

Chemistry is one of the major branches of science that deals with the composition and structure of Matter. It probes into the principles governing the changes matter undergoes, (Mailumo, Agogo and Kpagh, 2007). It is one of the core science subjects that students are required to pass in order to qualify

for admission into tertiary institutions to pursue science-based programmes such as Medicine, Engineering, Pharmacy and Foods and Technology sciences amongst others (Njoku, 2007). Knowledge from the subject has other applications as well.

There are various applications of chemistry in the home such as manufacturing of soap and detergent for cleaning, hair cream and perfume, plastics for wide variety of uses are made by chemical processes. In the industry, Chemistry contributes greatly in providing our basic needs such as portable drinking water, cooking utensils and toothpaste amongst others and as well as improving the quality of life such as food, clothing, medicine, housing and transportation (Tile, 2013).

Despite the importance of Chemistry in the school and society, the achievement of students in the

subject at the senior secondary school level is generally poor (Njoku, 2007; Kola, 2012). Available evidence from literature on the level of achievement of students in Senior School Certificate Examination (SSCE) in chemistry examination is quite disturbing (WAEC 2009 - 2013). Preliminary findings by the researcher reveal that this failure is due to excessive work load on the Chemistry teacher, pressure from school management to cover the syllabus, inappropriate teaching methods employed by most Chemistry teachers. Other researchers have submitted that poor mastery of the subject by the teachers, lack of interest on the part of the students, the abstract nature of Chemistry and none use of instructional materials amongst others as the factors responsible for this unimpressive achievement by the students (Eze and Egbo, 2007; Udochukwu, 2008; Samba and Eriba, 2012). The topics taught included quantitative analysis, qualitative analysis and sulphur and its compounds. These topics are for SS2 chemistry students as approved by the National Chemistry Curriculum and are examinable by WAEC on yearly basis but students continue to score low in these aspects.

Researchers such as Adegoke (2011), Chinason, Kurumeh and Obida (2011) have argued that the quality and or nature of the teaching method employed by teachers affects learning outcomes and in most cases, teacher's persistent use of the lecture teaching method where students depend on memorization of information and facts without having a complete understanding of the subject matter only make learners' ability to retain knowledge poor. This has a serious negative effect on the achievement of students hence the need for an alternative teaching method such as spaced learning strategy.

Spaced learning strategy is a teaching method that was first designed and developed by Paul Kelley in 2005 at Monkseaton High School in North-East England (Douglas, 2005). It is a method of embedding information in our long-term memory through repetition. Spaced learning in practice

involves a lesson consisting of three inputs divided by two 10-minutes breaks which students spend doing physical activities such as ball games, juggling, modelling, paper cutting (into different shapes) to mention but a few. The first input is a lecture in which the teacher presents the learning content (information, materials, facts and skills). Students then go on 10-minutes break. The second input focuses on recall of the content presented earlier; the teacher represents the content in a slightly different way, verbatim or students may recall by answering questions from the teacher or doing some practical or solving mathematical problems relating to the contents earlier presented. A second 10-minutes break is again observed. The third input focuses on understanding; students now carry out tasks applying the knowledge or skills and confirming facts. The breaks are 10-minutes long because this time period is enough to allow the pathways (created) to be 'rested' before the next stimulation in order to strengthen the neural pathway recording the information or skills. The distractor activities during the breaks are also different as this minimises the danger of disrupting the pathways being formed. It is important to see which gender does better in achievement in chemistry.

Achievement by students in the views of some education researchers have continued to reveal inconsistent results as regards gender even in a typical chemistry class where boys and girls interact and learn. For instance, Obrentz (2012) reported that there was a significant difference in the final chemistry grades between university males and females; that is Male students scored better than female students. Also, Amunga, Amadalo, and Musera (2011) also found out male students outperformed female students in chemistry. But Agwagah cited in Olom (2010) revealed that females were significantly better than their male counterparts. Interestingly, Aiyedun (2010) and Afuwape (2011) found no significant difference in achievement between male and female students after treatment. The disparity in reports on gender regarding achievement in chemistry needs to

be investigated using SLS to determine its match or mismatch with the reports.

Statement of the Problem

In spite of the important position of chemistry in science and science related disciplines, students' achievement has consistently been below expectation and unimpressive. Students are challenged by an ever-growing amount of material to review and an on-going imperative to master new content. Efforts made through research has indicated that ineffective teaching method such as the lecture method is employed by Chemistry teachers to impart knowledge thereby making it cumbersome for students to assimilate and accommodate easily, hence persistent failure. Also, due to the fact that science especially chemistry in particular is cumulative in nature and abstract, so requires periodic review. Forgetting old content makes teaching of new content difficult. This difficulty of recalling is said to be as a result of ineffective science teaching methods such as the "chalk and talk" method.

Thus, the students' low achievement in chemistry requires alternative and effective learning techniques that are believed to favour high achievement and retention (abilities). Studies by various researchers herein on gender show that there are inconsistencies in their findings, hence, this present research is set to use spaced learning strategy on achievement with the hope of enhancing long-term memory and closing the gaps between genders. The problem of this study posed as a question therefore is, what is the effect of spaced learning strategy on achievement in senior secondary 2 Chemistry students?

Objectives of Study

The objective of this study is to determine the efficacy of spaced learning strategy (SLS) on achievement of senior secondary 2 chemistry students. Specifically, the study seeks to achieve the following objectives:

1. Determine whether SLS will enhance students' achievement in chemistry.
2. Find out if SLS will improve male and female students' achievement in chemistry.

Research Questions

Two research questions have been raised for answering as follows:

1. What is the difference in the mean achievement scores of students taught using SLS and those taught using the lecture method?
2. What is the difference in the mean achievement scores of male and female students taught using SLS?

Hypotheses

The following null hypotheses have been formulated for testing at 0.05 level of significance.

1. There is no significant difference in the mean achievement scores of students taught using SLS and those taught using the lecture method.
2. There is no significant difference in the mean achievement scores of male and female students taught using SLS.

METHODOLOGY

The research design for this study is quasi experimental design. The non-randomized pre-test post-test control group design is adopted for this study. The study was carried out in Gboko metropolis of Benue state. One Hundred and Thirty senior secondary Two (SS2) Chemistry students were randomly drawn for the study. The instrument Chemistry Achievement Test, (CAT) was constructed by the researcher and validated by four experts in Test, Measurement and Evaluation and Science Education respectively. The instrument yielded a reliability coefficient of 0.83 using Kuder-Richardson formula 21. Four research assistants were trained and used to collect data for the study. The experimental group was taught using spaced learning strategy and the control group was taught using lecture method for

seven weeks. The pre-CAT was administered on the students before the treatment while the post-test was administered after the treatment. The research questions were analysed using mean and standard deviation while analysis of covariance (ANCOVA) was used to test the two null hypotheses at 0.05 significant level.

RESULTS

The results were presented, analyzed and interpreted based on the research questions and hypotheses formulated for the study.

Research Question 1

What are the mean achievement scores of students taught using SLS and those taught using the Lecture method?

Table 1: Mean achievement scores and standard deviation of students taught chemistry using SLS and those taught using the LM.

Groups	N	Pre-CAT		Post-CAT	
		Mean	S.D	Mean	S.D
SLS	80	27.06	11.28	44.74	15.50
LM	50	26.28	10.01	38.24	12.34
Mean difference				6.50	
Total	130				

Table 1 reveals that students taught chemistry with SLS had a mean of 27.06 with standard deviation of 11.28 in the pre-CAT, while those that were taught Chemistry with LM had a mean of 26.28 with a standard deviation of 10.01. The table also shows that students taught chemistry with SLS had a mean of 44.74 with standard deviation of 15.50 in the post-CAT, while that taught chemistry with LM had a mean of

38.24 with a standard deviation of 12.34. Based on the mean achievement scores of the two groups in the post-test, a mean difference of 6.50 was recorded.

Hypothesis 1

There is no significant difference in the mean achievement scores of students taught chemistry using SLS and those taught using the LM

Table 2: Summary of one-way Ancova of chemistry achievement scores of the groups taught using SLS and those taught using LM.

Source	Type III sum of Squares	df	Mean squares	F	Sig.
Corrected model	9662.200 ^a	2	4831.100	33.963	0.000
Intercept	8337.671	1	8337.671	58.614	0.000
Pre-CAT	8363.200	1	8363.200	58.793	0.000
Group	1074.234	1	1074.234	7.552	0.007
Error	18065.408	127	142.147		
Total	259659.000	130			
Corrected Total	27727.608	129			

Table 2 indicates that the hypothesis of no significant difference in the mean achievement scores of students taught chemistry with SLS and those taught using LM is not accepted. This implies that there is a significant difference in the mean achievement scores of students taught using SLS.

Research Question 2

What are the mean achievement scores of male and female students taught using SLS?

Table 3: Mean and standard deviation of achievement scores of male and female students taught chemistry using SLS.

Gender	N	Pre-CAT		Post-CAT	
		Mean	S.D	Mean	S.D
Male	44	24.96	10.19	43.50	16.83
Female	36	29.64	12.13	43.00	13.41
Mean difference				0.50	
Total	80				

Table 3 indicates that in the pre-CAT, the mean achievement scores of male and female students taught using SLS were 24.96 and 29.64 respectively with corresponding standard deviations of 10.19 and 12.13. The table also shows that the Post-CAT mean scores of male and female students taught with SLS were 43.50 and 43.00 respectively with corresponding standard deviation of 16.83 and 13.41. A

mean difference of 0.50 was recorded in favour of males.

Hypothesis 2

There is no significant difference in the mean achievement scores of male and female students taught using SLS.

Table 4: Summary of one-way ANCOVA of achievement scores of male and female students taught using SLS.

Source	Type III sum of Squares	df	Mean Squares	F	Sig.
Corrected model	2935.519 ^a	2	1467.759	7.273	0.001
Intercept	21515.721	1	21515.721	106.620	0.000
Pre-CAT	2930.569	1	2930.569	14.522	0.000
Gender	2.840	1	2.840	0.014	0.906
Error	15538.431	77	201.798		
Total	168292.00	80			
Corrected Total	18473.950	79			

Table 4 shows that the hypothesis of no significant difference in the mean achievement scores of male and female students taught using SLS was retained. The implication is that the difference in the mean achievement scores of male and female students taught using SLS is not statistically significant.

DISCUSSION OF FINDINGS

Results in Tables 1 and 2 reveal that significant differences exist in the mean achievement scores of the group taught chemistry using SLS than those taught with LM. The students in the experimental group had achieved higher than those in the control group. The difference was significant as indicated by

the results of hypothesis one. The difference could be as a result of the use of spaced learning strategy to teach the contents under consideration in the study.

These findings agree with Achor and Agamber (2013) who showed that frequency of practical work has significant effect on students' achievement. The findings also agree with Aniodoh (2013) who showed that students achieved higher when taught with inquiry method rather than the expository (lecture) method.

The results also show that male and female students improved on their achievement in chemistry. There is no significant difference in the mean achievement scores of male and female students taught chemistry using SLS as confirmed by results in hypothesis two. This also means that SLS helped bridged the gap in achievement between genders in chemistry. This indicates that SLS is not gender bias; both sexes can learn using SLS and be long lasting on their cognitive abilities.

The findings of this study concord with the results of Nwagbo and Uzomaka (2006) and Achor and Agamber (2013) who all established that no significant differences exist in achievement scores of male and female students. Based on the findings of this research, gender has no influence on achievement of male and female students in chemistry. This means that the use of spaced learning strategy by chemistry teachers has become imperative as it has yielded improved achievement and has also, helped bridge the gap existing between male and female students in achievement.

CONCLUSION

Based on the findings of the study, it was concluded that the use of spaced learning strategy improved students' achievement than the lecture method. Again, that spaced learning strategy did not show bias to any gender since no significant difference in the mean achievement scores of male and female students was established.

RECOMMENDATIONS

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

1. Chemistry teachers should always employ spaced learning strategy in their lessons in order to improve students' achievement.
2. Schools should always provide teaching and learning resources for smooth teaching and learning of chemistry.

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