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THE USE OF MODEL-LEAD TEST STRATEGY IN ENHANCING ACHIEVEMENT OF SENIOR SECONDARY TWO STUDENTS IN ORGANIC CHEMISTRY IN BENUE STATE, NIGERIA

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ABSTRACT: *This study investigated the use of Model-Lead Test Strategy in enhancing achievement of senior secondary two students in hydrocarbon aspect of organic chemistry in Benue State of Nigeria. The study adopted the non-randomized pre-test, post-test quasi experimental control group design. The population comprises all Senior Secondary two (SSII) students studying Chemistry as a subject in all secondary schools in Makurdi Local Government Area of Benue State. The sample of the study was made up of 145 consisting of 76 males and 69 females in Senior Secondary two drawn from two schools. Stratified random sampling technique was used for selecting the Makurdi Local Government Area which was stratified into two, that is Makurdi North and South and Makurdi East and West, then, simple random sampling technique was used to select two co-educational secondary schools. Hydrocarbon Achievement Test tagged HAT was the instrument used for data collection. The instrument was validated by three experts. The reliability coefficient of HAT was 0.99 using Kuder Richardson 20. Using Analysis of Covariance it was found that there was a significant difference between pretest and post-test achievement mean scores of the experimental and control groups of SS II students in Chemistry. It was also found that there was a significant effect of Model –Lead-Test strategy (experimental treatment) on male students' achievement in hydrocarbon aspect of organic chemistry and that there was a significant effect of Model-Lead-Test strategy (experimental treatment) on female students' achievement in organic chemistry. Based on the findings it is recommended among others that chemistry teachers should use Model-Lead-Test strategy to teach organic chemistry irrespective of gender and school type.*

KEY WORDS: teaching organic chemistry; hydrocarbon; model-lead-test strategy; achievement in chemistry; gender.

INTRODUCTION

Science is the foundation of every scientific and technological breakthrough in any nation of the world. It is a way of seeking information (process) and an accumulated body of knowledge resulting from research (products). It addresses the needs of majority through its relevance and functionality in content, practice and application. According to Grayling (2009), the aim of science is to develop the students' ability to adapt to social or cultural practices by integrating the achievement of modern science and technology with existing values and culture. The author further opines that science aims at doing things which might otherwise require a great deal of energy. The fast changing application of science and technology and the global reliance on its processes and products in all areas of human endeavours have made them valuable that any society or country such as Nigeria without a good foundation in science and technology risks being alienated from the global village. Chemistry happens to be one of the branches of science which deals with changes in matter.

What many nations like Nigeria need now is a functional Chemistry education that will assist in national development. Chemistry education has been identified to be bedrock for the transformation of the national economy. Chemistry Education is therefore the systematic process of acquiring the fundamental knowledge about the universe. With the so indispensable knowledge richly acquired, man can shape and reshape his world for his benefit. Hence, the development of the nation is usually measured by the degree and extent of growth brought to it through the enterprise of science education and a gate way to it is chemistry education but it has not reached the expectations.

Chemists perform experiments and learn to observe, record, calculate precisely and make intelligent inference. These processes train the mind of chemists to incline to scientific methods (Ababio, 2005). Chemistry is an important science subject that occupies a prominent place in the school science curriculum. It serves as a prerequisite to the study of medicine, pharmacy, agriculture, engineering, textile and clothing. Based on the foregoing relevance, it is expected that the study of Chemistry and achievement in public examinations would be on the increase.

Organic chemistry as defined by Ababio (2005) is the study of the structure, properties, composition, reactions and preparation of carbon-containing compounds, which include not only hydrocarbons, but also compounds with any number of other elements, including hydrogen (most compounds contain at least one carbon–hydrogen bond), nitrogen, oxygen, halogens, phosphorus, silicon and sulfur. The teaching of Organic Chemistry has been a challenge for some times now considering poor performance in public examinations, hence the consideration of Model-Lead Test Strategy with expectation that it would enhance achievement.

The Model-Lead Test Strategies a three phase teaching strategy where the teacher models the correct use of the strategy, the teacher will then lead the students to practice the correct use of the strategy and the teacher finally tests the students' independent use of the strategy. The model-lead test approach to teaching is used to provide and demonstrate frequent opportunities for students to develop and practice new cognitive and psychomotor skills. The model lead-test approach includes three phases. These are model phase, lead phase and test phase. The model phase is the teacher demonstrating and modeling expected skill(s); the lead phase enables the students to practise the skill and leads them towards automatically responding as a group. The test phase measures the students' ability to perform the skill correctly and automatically. This approach provides an automatic response for teachers which support the learning needs.

Several research reports indicate that students achieve poorly in secondary school science subjects especially Chemistry (Igboanugo, 2011; Babafemi, 2016; Amelia, Allen, Lucenario & Yangco, 2016). This is supported by indices from examinations such as those organized by National Examinations Council (NECO) and West African Examinations Council (WAEC) showed low achievement (Ibiene, 2009; Igboanugo, 2011; Babafemi, 2016).The disparity in the achievement of males and females in the sciences has been studied over the years. Some of the studies show that girls achieve poorly when compared to boys at all levels of science education in Nigeria. Researchers such as Nwagbo and Obiekwe (2010) and Busola (2011) observed that the achievement and the results of learning efficiency of male and female students are different. However, the writers submitted that this is because some schools, out of omission or commission, provide a platform for channeling students into prescribed gender activities. Such activities include the grouping of subjects in schools in such a way as to encourage stereotypical choice of subjects. However, results from external examinations: National Examinations Council (NECO) and

West African Examinations Council (WAEC) have shown poor achievement in Chemistry (Ibiene, 2009; Igboanugo, 2011, Babafemi, 2016) is not gender sensitive. Omwirhiren and Ubanwa (2016) found that gender was not a relevant factor in academic achievement in organic chemistry. In their studies, they reported that students believed that organic chemistry was interesting and that they enjoyed organic chemistry more than other branches of chemistry and that there was no significant difference between male and female students performance in organic chemistry. However, these findings contradict those of Omwhrhiren and Anderson (2016), which reported gender as a significant predictor of academic achievement in science with males achieving higher than females.

Statement of the Problem

Several research reports indicate that students achieve poorly in secondary school science subjects especially Chemistry (Ibiene, 2009; Igboanugo, 2011; Babafemi, 2016; Amelia, Allen, Lucenario & Yangco, 2016). The teaching and learning of Chemistry has grown and brought with it many instructional strategies. Yet, the students' achievement has remained low. This poor achievement of students in Chemistry in Senior Secondary School Certificate Examinations (SSCE), according to Chief Examiners Reports (2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 and 2017) has meant that many prospective students are unable to gain admission into higher institutions to study chemistry related courses.

This suggests that Chemistry has not been taught effectively and therefore recent attention has focused on some aspects of Chemistry in order to find out what exactly is responsible for the high failure rate in chemistry. Much of the literature points to poor and ineffective instructional strategy as well as students' anxiety towards organic Chemistry. Method like M-L-T, which is more participatory than the traditional instructional method could enhance performance, hence achievement. Most of the researchers have used different teaching methods to correct and solve this problem of poor achievement to no avail. Thus this study seeks to employ the M-L-T strategy to see if it will boost the achievement of secondary school students in inorganic chemistry in Makurdi Local Government of Benue State

Research Questions

The following research questions were answered in this study:

1. What are the pre-test and post-test achievement mean scores of SSII experimental and control groups when exposed to Model-Lead-Test strategy?

2. What are the pre-test and post-test achievement mean scores of males and female in the experimental and control group when exposed to Model -Lead –Test strategy?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant difference between pretest and post-test achievement mean scores of the experimental and control groups of SS II chemistry students.

2. There is no significant difference between pretest and post-test achievement mean scores of males in the experimental and control groups of SSII chemistry students.

3. There is no significant difference between pretest and post-test achievement mean scores of females in the experimental and control groups of SSII chemistry students.

RESEARCH METHODOLOGY

The study adopted the non-randomized pre-test, post-test quasi experimental control group design. The non-randomized pretest post test design is an experiment where measurements are taken both before and after treatment. Intact classes were used. The population comprised all SSII students studying Chemistry as a subject in all secondary schools in Makurdi Local Government Area of Benue State. The choice of Makurdi Local Government Area is due to the fact that achievement in organic chemistry in the headquarters is usually low compared to the rural areas, hence the choice of the headquarters for this study to know if the model-lead-test strategy would boost achievement of students.

The sample consisted of 145 respondents consisting of 76 males and 69 females in Senior Secondary II drawn from two schools namely Special Science Secondary School and Mount Saint Gabriel Secondary School. Stratified random sampling technique was used for selecting the schools in Makurdi Local Government Area. Makurdi Local Government Area was stratified into two, that is, Makurdi North and South and Makurdi East and West. Thereafter simple random sampling technique was employed to select two co-educational secondary schools.

Instrument for Data Collection

Hydrocarbon Achievement Test tagged HAT was used in this study to collect data. HAT was used to measure students' achievement in organic chemistry topics that were taught during the period of the study. HAT is a 50 multiple choice objective items with four options (A-D) in which the students were expected to choose the correct option. The total mark obtainable was 50. The test items covered the organic chemistry topics that were taught during the period of the study.

The instrument was developed by the researchers. HAT was constructed according to lower ordered questions based on knowledge, comprehension and application of the cognitive domain and higher order questions covering, analysis, synthesis and evaluation. The two research assistants were trained on use of their respective strategy.

The HAT was subjected to scrutiny by three experts, two experts in Chemistry Education and one expert in Research, Measurement and Evaluation unit. They scrutinized the items in terms of comprehensiveness, appropriateness and clarity in the language based on the content of organic chemistry in line with the hypotheses formulated for the study. The HAT was scored out of a maximum of 100 marks and a minimum of zero. Factor analysis was used to establish the construct validity of the instrument.

From the trial testing, the data collected were analyzed using Kuder Richardson 20 to determine the reliability coefficient of the instrument and it was 0.99. This was considered appropriate for the study according to Nwabueze, (2009).

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Procedure for Data Collection

Lesson notes were planned and written for each unit and they were used by the research assistants. In all, they were fourteen lesson notes, seven for the experimental group using M-L-T where students were expected to construct organic structures using M-L-T and seven lesson notes for the control group. The experimental group that were exposed to the treatment were divided into groups of two-three members. All the groups received 80 minutes (double periods) of instruction in organic chemistry based on their respective methods of teaching. The first began with the training of research assistants and the administration of pre-test to both groups in the schools. Lessons commenced in the second week and continued to the seventh week. The teacher taught the students in the experimental group using the Model-Lead-Test instructional strategy for six weeks. Students in the control group learned the same content with the experimental group using the lecture method. They were taught by the untrained research assistant while the exercise was being monitored by the researchers.

In the eight week, there was a general review of all the topics taught and strategies used. Then a post test was administered for all the groups. Data were finally collected with the HAT. The scores obtained from the pre-test and post-test were analyzed according to the research questions using mean and standard deviation for answering the research questions and ANCOVA was used to test all hypothesis at 0.05 level of significance.

RESULTS

The raw data that were used to answer the research questions and test the formulated hypotheses.

Research Questions One

What are the pre-test and post-test achievement mean scores of SSII experimental and control groups when exposed to Model-Lead-Test strategy?

Table 1 shows a summary of pre-test and post-test achievement mean scores of SSII experimental and control groups when exposed to Model-Lead-Test strategy.

Table 1:Mean and Standard Deviations of Pre-Test and Post-Test Achievement Mean Scores of SSII Experimental and Control Groups when Exposed to Model-Lead-Test Strategy

	Pre-Test			Post-Test		
Group	**N**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean gain**
Experimental Groups	76	25.03	5.99	32.42	6.58	7.39
Control Groups	69	9.93	3.64	10.52	3.93	0.59

Table 1 revealed the achievement mean scores of SSII experimental and control groups when exposed to Model-Lead-Test strategy. From the results, those taught using Model-Lead-Test strategy (experimental group) had a pretest achievement mean score of 25.03 while their counterparts taught using conventional strategy (control group) had a pretest achievement mean score of 9.93. However, the posttest achievement mean scores of students in the experimental group after exposure to Model-Lead-Test strategy was 32.42, while that of their counterparts in the control group was 10.52 respectively. The findings showed that students in the experimental group had a higher achievement mean score in organic chemistry with mean gain of 7.39 after exposure to the Model-Lead-Test

strategy than their counterparts in the control group who were taught organic chemistry using the Conventional strategy with mean gain of 0.59. This implies that the achievement mean scores of the students can be improved by using Model-Lead-Test strategy to teach organic chemistry rather than using the conventional strategy.

Research Questions Two

What are the pre-test and post-test achievement mean scores of males and female in the experimental and control group when exposed to Model -Lead –Test strategy?

Table 3 showed the summary of pre-test and post-test achievement mean scores of males and female in the experimental and control group when exposed to Model -Lead –Test strategy.

Table 2: Mean and Standard Deviations of Pre-Test and Post-Test Achievement Scores of Males and Females in the Experimental and Control Group when Exposed to Model -Lead –Test Strategy

		Pre-Test			Pre-Test		
Strategies	**Gender**	**N**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean gain**
Experimental Groups	Male	59	24.85	5.98	31.31	6.04	6.46
	Female	17	25.59	6.19	36.29	7.10	10.70
Control Groups	Male	58	9.93	0.21	10.56	3.89	0.90
	Female	11	9.90	0.13	10.30	3.37	0.40

Table 2 revealed the achievement mean scores of males and female students in the experimental and control groups when exposed to Model -Lead –Test strategy. The findings revealed that male and female students in the experimental group that were taught using Model-Lead-Test strategy had a pretest achievement mean score of 24.85 and 25.59 respectively. When both students were exposed to the treatment using Model-Lead-Test strategy, the achievement mean score of the female students in the experimental group improved to 36.29 as against 31.31 for their male counterparts. This implies that despite the fact that both male and female students were exposed to the treatment of Model-Lead-Test strategy, female students had a slightly higher achievement mean score than their male counterparts as revealed by their post-test achievement mean score of 36.29 for female as against 31.31 for the male students. Similarly, the findings from the control group revealed that male and female students had achievement mean scores of 10.56 and 10.30 respectively at post test. Thus it is a little improvement over their pre test achievement mean scores of 9.93 and 9.90 for males and females respectively. This means that organic chemistry should be taught to both male and female students using the Model -Lead –Test strategy for better achievement in the subject.

Hypotheses One

There is no significant difference between pretest and post-test achievement mean scores of the experimental and control groups of SS II chemistry students.

Table 3 provides a summary of the analysis of covariance (ANCOVA) results of achievement mean scores of the experimental and control groups of SS II chemistry students

Table 3: ANCOVA of Achievement Mean Scores of the Experimental and Control Groups of SS II Chemistry Students

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18.473[a]	2	9.236	.233	.793	.003
Intercept	11999.551	1	11999.551	302.195	.000	.680
PreHAT	.195	1	.195	.005	.944	.000
Strategies	9.124	1	9.124	.230	.032	.002
Error	5638.534	142	39.708			
Total	154906.000	145				
Corrected Total	5657.007	144				

a. R Squared = .003 (Adjusted R Squared = -.011)

Table 4: Results of Sidak Post hoc Comparison of Difference Between the Achievement Mean Scores of the Experimental and Control Groups of SS II Chemistry Students

I Experimental Groups	J Control Groups	X – diff (I – J)	Std Error	P-value
32.42	18.71	13.71	.525	0.032

$p<0.05$

Analysis of covariance (ANCOVA) was conducted to determine if a significant difference exists between the achievement mean scores of the experimental and control groups of SS II chemistry students. Table 4 shows that $F(1,142) = 0.230$, $p < 0.05$, since the p value of 0.032 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there is a significant difference between pretest and post-test achievement mean scores of the experimental and control groups of SS II chemistry students. Thus Model -Lead –Test strategy had significant effect on students' achievement in organic chemistry. The results further revealed an adjusted R squared value of 0.011 which means that 1.1 percent of the variation in the dependent variable which is students' achievement in organic chemistry is explained by the treatment, while the remaining is due to other factors not included in this study. The sidak post hoc test in Table 4 confirmed that the corrected difference between experimental group and control group was statistically significant, $(I – J) = 13.71$. Hence we say that Model-Lead–Test strategy does increase students' achievement in organic chemistry compared to conventional strategy.

Hypotheses Two

There is no significant difference between pretest and post-test achievement mean scores of males in the experimental and control groups of SSII chemistry students.

Table 5 provides a summary of the Analysis of Covariance (ANCOVA) results of post-test achievement mean scores of males in the experimental and control groups of SSII chemistry students.

Table 5: ANCOVA of Post -Test Achievement Mean Scores of Males in the Experimental and Control Groups of SSII Chemistry Students

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	343.706[a]	2	171.853	4.322	.017	.106
Intercept	10778.656	1	10778.656	271.061	.000	.788
PreHAT	15.218	1	15.218	.383	.538	.005
Male	322.440	1	322.440	8.109	.006	.100
Error	2902.820	114	39.765			
Total	83132.000	117				
Corrected Total	3246.526	116				

a. R Squared = .106 (Adjusted R Squared = .081)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the achievement mean scores of male students in the experimental and control groups in SSII chemistry. The effect of treatment on the groups (experimental and control) yielded, experimental (M = 31.31; SD = 6.04) and control (M = 12.42; SD = 6.58). It indicates that the achievement mean scores of male students in the experimental group differ from that of control group. Table 5 further showed that $F(1,114) = 8.109$, $p = 0.006$, since the p value of 0.006 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant effect of Model -Lead –Test strategy (experimental treatment) on male students' achievement in organic chemistry. The results further revealed an adjusted R squared value of 0.081 which means that 1.8 percent of the variation in the dependent variable which is male students' achievement in organic chemistry is explained by the Model -Lead –Test strategy (experimental treatment), while the remaining is due to other factors not included in this study.

Hypotheses Three

There is no significant difference between pretest and post-test achievement mean scores of females in the experimental and control groups of SSII chemistry students.

A summary of the Analysis of Covariance (ANCOVA) results of post-test achievement mean scores of females in the experimental and control groups of SSII chemistry students is provided in Table 6.

Table 6: ANCOVA of Post-Test Achievement Mean Scores of Females in the Experimental and Control Groups of SSII Chemistry Students

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	20.380[a]	2	10.190	.284	.754	.009
Intercept	7579.973	1	7579.973	210.926	.000	.762
PreHAT	1.569	1	1.569	.044	.835	.001
Female	19.274	1	19.274	.536	.004	.008
Error	2371.823	25	35.937			
Total	71774.000	28				
Corrected Total	2392.203	27				

a. R Squared = .009 (Adjusted R Squared = -.022)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the achievement mean scores of female students in the experimental and control groups of SSII chemistry students. The effect of treatment on the groups (experimental and control) yielded, experimental (M = 32.91; SD = 6.07) and control (M = 13.71; SD = 5.93). It indicates that the achievement mean scores of female students in the experimental group differ from that of control group. Table 6 further showed that F(1, 25) = 0.536, p = 0.004, since the p value of 0.004 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant effect of Model-Lead –Test strategy (experimental treatment) on female students' achievement in organic chemistry. The results further revealed an adjusted R squared value of 0.022 which means that 2.2 percent of the variation in the dependent variable which is female students' achievement in organic chemistry is explained by the Model -Lead –Test strategy (experimental treatment), while the remaining is due to other factors not included in this study.

DISCUSSION

It is found in this study that students in the Model-Lead-Test strategy (experimental group) performed better than the students in the conventional strategy (control group). Therefore, the Model-Lead-Test strategy is more facilitating than the conventional strategy in teaching organic aspect of chemistry. Further, from the corresponding hypothesis it is found that there is significant effect (difference) of Model -Lead –Test strategy on students' achievement in organic chemistry. This result is further confirmed by the sidak post hoc test of I – J = 13.71 as the corrected difference between experimental and control group showing statistical significance. The test proves that Model -Lead –Test strategy indeed does increase the achievement scores of students in the study of organic chemistry.

The above results is in agreement with the results of the study by Adeneye (2011) who investigated the effects of computer assisted instruction (CAI) on secondary school students' performance in biology and found that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction. Similarly, Nnorm (2015) examined the effect of cooperative learning instructional strategy on senior secondary school students' achievement in biology in Anambra State, Nigeria and found that students taught using cooperative learning instructional strategy perform better in Biology Achievement Test than those taught using lecture method of instruction. In the same vain, Jirgba, Eriba and Achor (2018) conducted a study on effect of peer collaboration learning strategy on students' achievement in Basic Science in Makurdi Local Government Area of Benue State and found that peer collaboration learning strategy enhanced students' achievement in Basic Science better than demonstration method.

The positive nature of Model-Lead-Test strategy springs from the views of Chijioke, Okwelle and Omeodu (2016) that the model-lead-test instructional strategy is a student-centered instructional methods in that it is ultimately intended to give students a solid conceptual foundation and also to aid them to reason effectively and succeed at problem-solving tasks in putting for greater emphasis on engaging students in a variety of specific classroom activities. The very purpose of the M-L-T strategy is to maximize the cognitive and learning abilities of students by increasing their rate of success and their achievement. Also, Jirgba, Eriba and Achor (2018) investigated the effect of peer collaboration learning strategy on students' achievement in Basic Science in Makurdi Local Government Area of Benue State and found that there is a significant difference between the mean achievement scores of students taught basic science using peer collaborative learning strategy and those taught using

demonstration method. However, there was no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy.

It is also found that female students in the Model-Lead-Test strategy (experimental group) had a higher achievement mean score in chemistry than the male students while in the conventional strategy (control group) male students had a higher mean achievement score than the female students. The overall implication of this result is that organic chemistry could be taught to both male and female students in their classes using the Model-Lead-Test strategy bearing in mind that it is gender sensitive. Also, Model-Lead-Test strategy is a better teaching strategy for male and female students in organic chemistry. Again, male and female students' achievement is higher and better with Model-Lead-Test strategy than with conventional strategy. This there by supports the use of Model-Lead-Test strategy in teaching organic chemistry to students.

In this study, female students in Model-Lead-Test strategy (experimental group) performed better than their male counterparts contrary to oppositely held popular view that males are better in the sciences than females. This achievement may have been due to the fact that improvised materials used during interaction of the students with one another, provided higher understanding and increase motivation more in the females than in the males. Model-Lead-Test environment may have provided a situation in which females were not neglected or unrecognized in the class during learning. The Model-Lead-Test strategy allowed the way teachers go about teaching and interacting with students which is sometimes filled with gender bias whereby a tendency to be more teacher-students interaction for female students prevail. In most cases, female students do not have half as much questioning and answering time as the male from the teacher, which the Model-Lead-Test teaching strategy removed. In Model-Lead-Test strategy, the views of Kavara, (2011) that there is intentional or unintentional treatment of females in chemistry class in our educational system where boys receive significantly more remediation, criticism and praise than girls is minimized. In these practical and empirical matters, there has been also developed feminist argument about bias in the very nature of science and its practice. This bias that is held by some feminists may be responsible for girls shunning science or underachieving in it. All these were erased by the use of Model-Lead-Test strategy, thereby making it possible for the females to perform better than the males.

The result is in agreement with the result of the study by Ejodamen and Onoselease (2018) who assessed the effect of mastery learning strategy on academic achievement of Male and Female students' in Basic Technology Education (BTE) in Edo State and found that female students taught BTE with MLS performed relatively higher in their post-test academic achievement than the male students. However, the findings disagreed with that of Busola (2011) who investigated gender differences on students' achievement in secondary school Chemistry in Kakamega District Kenya and found that males performed better than females in Chemistry achievement test.

Another finding is that there is significant effect (difference) of Model -Lead –Test strategy on male students' achievement in organic chemistry. Also that there is a significant difference in the pretest and post-test achievement mean scores of the experimental and control groups of SS II chemistry female students. The tests prove that Model -Lead –Test strategy indeed does increase the achievement scores of male and female students in the study of organic chemistry.

The above significance in the result is in agreement with Ajayi, Angura and Audu (2017) who carried out comparative effects of guided and structured inquiry instructional strategies on students' achievement in Basic Science and Technology in Zing Local Government Area of Taraba State Nigeria and found that there is significant difference was in the mean achievement scores between male and female students taught Basic Science and Technology using guided inquiry instructional strategy. However, the finding disagreed with that of Ogbuanya and Owodunni (2013) that investigated the effect of reflective inquiry instructional technique on students' achievement in Radio Television and Electronic works trade (RTVE) among technical college students in Lagos State, Nigeria and found that gender affected students' mean achievement and interest scores in RTVE in favour of boys though the difference was not statistically significant. Similarly, Ernest, Olanrewaju and Ugwuanyi (2016) examined the effect of the Computer Assisted Instruction (CAI) on senior secondary school students' achievement in chemical reaction and equilibrium and found that there is no significant difference in mean achievement between male and female students taught chemical reaction and equilibrium using CAI strategy

CONCLUSION AND RECOMMENDATIONS

It can be concluded that achievement mean scores of the students can be improved by using Model-Lead-Test strategy to teach organic chemistry better than using the conventional strategy. Organic chemistry can be taught to both male and female students using the Model -Lead –Test strategy for better achievement in the subject as the strategy is not gender sensitive.

It is therefore recommended that Chemistry teachers should use Model-Lead-Test strategy to teach Organic aspects to both male and female students. Curriculum experts, textbook writer and workshop experts should consider including the Model-Lead-Test strategy in their future endeavours.

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