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EDITORIAL

STEM Journal of Anambra STAN (STEMJAS) is a publication of **Science Teachers Association of Nigeria, Anambra State Chapter.** STEMJAS is developed to disseminate information on Science, Technology, Engineering and Mathematics (STEM) to teachers, teacher-trainers, researchers and other interested persons. Articles that are of relevance to STEM education are published in this journal.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Rita N. Nnorom

Editor-in-Chief

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EFFECTS OF LABORATORY PRACTICAL WORK AND DEMONSTRATION METHOD ON STUDENTS ACHIEVEMENT AND INTEREST IN CHEMISTRY

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Abstract

This study investigated effects of laboratory practical work and demonstration method on students' achievement and interest in Chemistry. The design adopted for the study was quasi– experimental research design. The sample consists of 96 SS2 chemistry students selected from one education zones in Enugu State. The purposive sampling technique was used for the selection of the two co-educational schools from the zone. One school was used for laboratory practical work (LPW) consisting 50 Chemistry students (30 female and 20 male) while one was use for demonstration method (DM) consisting 46 Chemistry students (14 female and 32 male). The criteria being that the schools must have presented candidates for West African Senior School Certificate Examination (WASSCE) for at least three times. Secondly, the school must have a qualified Chemistry teacher with at least five years' experience. For effective study four purpose of study, four research question and four hypotheses where formulated by the researchers. The two instruments which were developed by the researchers' were titled Acid- Base Achievement Test (ABAT) and Chemistry Learning Interest (CLI). The ABAT was produced base on the Chemistry concept of volumetric analysis and CLI was produced base on the perceived interest of Chemistry students with reliability of .81 and .76 using Kuder Richardson 21 and Cronbach alpha technique test. This indicating that the instruments were reliable; the instruments were scrutinized by two experts from Department of Science Education. Mean and standard deviation were used to answer the research questions while t-test was used to test the null hypotheses. The result revealed that there is a statistical significance difference in achievement in pre-test and post-test of students taught Chemistry with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM) in favour of LPW, there is a statistical significance difference in achievement in male and female students taught Chemistry with LPW in favour of female, there is a statistical difference in achievement in male and female students taught Chemistry with DM in favour of male students, there is a significance difference in interest on students taught Chemistry with LPW and DM in favour of LPW, there is a significance difference in interest on male and female students taught Chemistry with LPW in favour of female students and is a significance difference in interest on male and female students taught Chemistry with DM in favour of male students. Based on these findings conclusions and recommendations were made.

Keywords: Laboratory Practical Work (LPW), Demonstration Method (DM), Achievement, Interest

Introduction

Teaching is an important part of the process in education which is aimed at the development of learners' understanding and skills which enables them to become useful citizens in the society. Education involves total effort of the community to raise its political, social and economic standard of living (Nyamida, 2020). The implication of this is that the development of a nation which depends largely on the level of its scientific and technological literacy which can only be obtained through education. Obikezie et al (2020) opined that education comprises of science education and Chemistry is an important branch of science education. Thus, the importance of Chemistry as a subject and scientific process cannot be underrated especially in Nigeria where the nation rest on petroleum and petrochemical industries.

Chemistry as a branch of science, deals with the study of composition and properties of matter, changes in matter, the law and the principles that governing the nature (Samuel & Obikezie, 2020). Chemistry has a lot of importance to man and his environment which include basis for technological development. Furthermore uniqueness of Chemistry and the central role that it stands to play in the development of any nation, when considered are however not evident in the performance of students (Obikezie, et al 2021). Due to this, teachers are expected to device ways of motivating their students to develop positive attitudes towards Chemistry and science related discipline in order to facilitate the process of knowledge transmission to bring about abstract nature of Chemistry to reality to motivate students interest in it. Teachers are expected to apply appropriate teaching methods and approaches that best suit specific objectives and level exit outcome especially in Chemistry teaching and learning (Nyamida, 2020). Quit regularly, regular poor academic performance by the majority of students in Chemistry is fundamentally linked to application of ineffective teaching, lack of laboratory practical work and teaching methods use by teachers to impact knowledge to students (Samuel & Obikezie, 2020). Teacher variables, student's variables are always intricately linked to teaching methods used to impart knowledge to Chemistry students (Chikendu, et al 2021). According to the authors, methods used in teaching and learning vary from one country to another depending on the information or skills that is being taught and also influenced by the aptitude enthusiasm and interest of the students. The choice of a particular method of teaching and learning used by teachers are determined by a number of factors which includes the content to be taught, the objectives which the teacher plans to achieve, availability of teaching / learning resources, the ability / willingness of the teacher to demonstrate and improvise

if the laboratory resources are not available for laboratory practical works (Adunola, 2011; Emendu & Udogu, 2013; Kitti 2014; Udogu & Emendu, 2017).

According to Ibrahim et al (2018), laboratory practical work (LPW) is commonly intercalated with experimental, theoretical and seminar classes in packaged content that cover single units of a given course program. It emphasis is put-in to illustrate important theoretical and experimental concepts and to improve scientific interest. According to Udogu and Emendu (2017) laboratory practical work are those works performed in a laboratory equipped for experimental study in science related subjects like Chemistry. The authors further opine that laboratory practical work in Chemistry consists of various tools and equipment used by science students either for the finding of new knowledge or to ascertain previous finding by both male and female students. Ezeliora, et at (2021) revealed that male Chemistry students taught practical using improvised instructional materials achieve better than their female counterpart. The authors further opine that though the effect of use of improvisation instructional materials in teaching Chemistry practical's resulted a high achievement on both genders but there was significance different in achievement which favour's the male students. Ibe, et at (2021) consented to the opinion that male Chemistry students perform more than female Chemistry students when doing laboratory practical work using improvised instructional material and have high retention and interest scores than their female counterpart. In a contrary view, Udogu and Emendu (2017) maintained that there was no significant different in achievement and interest in teaching Chemistry using laboratory practical work among students. The authors were of the opinion that gender has nothing to do with the achievement, retention, and interest of Chemistry students when taught with laboratory practical work method. Macmillan and Joseph (2020) observed that there was no significant difference between the post-test achievement of SS2 male and female students who were taught practical wave and measurement of heat energy using circle –the sage cooperative learning strategy and those taught with laboratory practical work teaching method. The authors further opined that the result may be unconnected to the fact that both male and female students were exposed the different treatment of teaching using circle –the sage cooperative learning strategy and laboratory practical work teaching method. Kitti (2014) asserted that provided the practical was first demonstrated by the teacher there will be no significant difference in achievement of the students in science related subject especially in Chemistry because demonstration methods will create room for students to do practical works by themselves while looking at the way teacher did his/her own.

Demonstration method (DM) as defined by Okotubu (2020) is the type of teaching method in which the teacher is the principal actor while the learners watch with the intention to act later. Here the teacher does whatever the learners are expected to do at the end of the lesson by showing and displaying to them how to do it and explaining the step by step process in them (Adekoya & Otakoye, 2011). The display or an exhibition is usually done by the teacher while the students watch with keen interest. The interest by the student or learner is determined by the manifestation of what was done by the teacher is repeated by the student who watch the demonstration. Demonstration provides a multi-sensory means to describe a concept, ideas, or product that may otherwise be difficult to grasp by verbal description alone (Okotubu, 2020). The author further revealed that students taught with demonstration teaching methods in Auto mechanics trade in technical colleges in Delta state in Nigeria score higher in post-test and shows high technological achievement than those taught with cooperative teaching method. In a related manner, Nyamida (2020) asserted that male students taught using demonstration teaching method show higher level of achievement and interest in auto mechanical trade than their female counterparts. In another development, Basheer, et al (2017) revealed that students taught oxidation- reduction concept using demonstration method exhibit better understanding of the subject than those taught with individualized method not minding the gender. The researchers' findings were found to promote thinking skills, interest and to enable students to think more creatively using demonstration method of teaching. Ekeyi (2013) also supported this by revealing in a study that students who were taught with the demonstration method were found to have high achievement score in Agricultural subjects and found to be better in practical than those taught with contextual method of teaching. More so, Akani (2015) revealed that many secondary schools surveyed in three education zones in Ebonyi State of Nigeria (Abakiliki, Onueke and Afikpo) agree that the use of demonstration method develop Chemistry students interest towards learning the subject than use of collaborative method. The study also agreed that the use of demonstration method in teaching and learning develops scientific skills in the students for problem solving than any other teaching method. Udogu and Emedu (2017) maintained that both laboratory practical works and demonstration method may induce the scientific attitude in a student than conventional teaching method. They also asserted that laboratory practical work make the students to maintain interest in Chemistry especially among male students.

From the researchers best of knowledge and the literatures reviewed shows that the two teaching methods under consideration has not being compared for effective teaching and learning of Chemistry subject in secondary school. Also the studies reviewed were done outside the population of the present study. These are what prompted the present study which tries to find the effects of laboratory practical work and demonstration method on students' achievement and interest in Chemistry in Enugu State.

Cognitive Flexibility Theory CFT introduced by Spiro, Feltovich and Coulson in the 1988 relates to in-depth content knowledge construction through practice. The theory relies upon the idea that learners must not be able to manipulate the means by which knowledge and content are being represented, but also the processes that are in charge of operating those representations in laboratory practical work process or demonstration process. The main principles of CFT are thus: to help learner knowledge in context dependent, knowledge cannot be oversimplified, knowledge is constructed and knowledge is interconnected (Spiro, et al 1992). The theory has it that effective learning is context – dependent, so instruction need to be very specific, visible, practical oriented and demonstrated. Thus this theory best explain LPW, DM and its importance which includes that it consolidates subject knowledge, it introduces disciplinary methods and procedures, it develops cognitive skills, it promotes team work and increase personal motivation (ULLI, 2020). With these numerous benefits of CFT on laboratory practical work (LPW) and demonstration method (DM) the researchers sought to investigate comparative effects of the two teaching methods on secondary school Chemistry students' achievement and interest taught volumetric analysis in Enugu State Nigeria.

Purpose of the study

This study aimed at investigating the effect of laboratory practical work and demonstration method in students' achievement and interest in chemistry in Enugu of Nigeria. Specifically, the study tends to;

1. Determine pre-test and post-test achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).
2. Determine pre-test and post-test academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).

3. Determine pre-test and post-test mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).
4. Determine pre-test and post-test mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)

Research Questions

The following research questions were formulated based on the purpose of the study.

1. What is the pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM)?
2. What is the pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)?
3. What is the pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM)?
4. What is the pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)?

Hypotheses

The following hypothesis were formulated

1 There is no significant difference in the pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

2 There is no significant difference in the pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).

3 There is no significant difference in the pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

4 There is no significant difference in the pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)

Method

The design adopted for the study was quasi– experimental research design. The sample consists of 96 SS2 Chemistry students selected from an education zones in Enugu State. The purposive sampling technique was used for the selection of the two co –educational schools from the zone. One school was used for laboratory practical work (LPW) consisting 50 Chemistry students (30 female and 20 male) while one was use for demonstration method (DM) consisting 46 Chemistry students (14 female and 32 male). The criteria being that the schools must have presented candidates for West African Senior School Certificate Examination (WASSCE) for at least three times. Secondly, the school must have a qualified Chemistry teacher with at least five years' experience. The study covered a period of five weeks. First week was for familiarizing visit and training of the Chemistry teachers in the selected schools who acted as research assistants. First day of the second week was used to administer a pretest and a questionnaire on the interest of the Chemistry students involved in the study. From the second day of the second week teaching the Chemistry concept in both selected schools commenced using LPW and DM for three weeks respectively. The Chemistry teachers were given detailed information and instructions concerning the study. Each teacher used the lesson notes prepare by the researchers for both LPW and DM. At the end of the fifth weeks, both LPW and DM teacher assistants gave posttest to the students based on what they taught. Equally, the same test and questionnaire given in pretest was given to the students before the posttest but this time rearranged. Twenty marks were awarded to each question prepared for both teaching method groups achievement test which constituted four (4) questions. If all the questions were answered correctly by the student, his/she is entitled to hundred (100) marks. The pretest score as well as posttest scores in both LPW and DLM groups in each sitting had 100 marks. The pretest scores were recorded as achievement of the students grouped as well as the pre responses from interest questionnaire was recorded too to determine their means responses of the students in both groups. Posttest scores were recorded as achievement of the students when taught with LPW and DM in both groups and post responses from post questionnaire were also recorded as interest when taught with LPW and DM in both groups. Data collected was used for analysis.

Instrument

Base on the test for achievement and questionnaires for interest designed by the researchers, the two instruments were titled Acid- Base Achievement Test (ABAT) and Chemistry Learning Interest (CLI).

The ABAT was produced base on the Chemistry concept of volumetric analysis and CLI was produced base on the perceived, interest of Chemistry students. To ensure the reliability of the instrument, the four (4) theory achievement questions and thirty two (32) item questionnaires were administered on a group of twenty students outside the place of this study. The results were subjected to Kuder Richardson 21 and Cronbach alpha technique test to determine the reliability coefficient. A mean coefficient of 0.81 and 0.76 were obtained indicating that the instruments were reliable. In both achievement scores and interest scores in both groups, the date obtained from the pretest and posttest were analyzed using mean, standard deviation for research questions and t –test hypotheses.

Results

Research Question 1: What is the pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM)?

Table 1: Mean and Standard Deviation of pretest and posttest achievement scores of Chemistry students' taught with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre LPW	59.36	50	9.735	1.377
	Post LPW	79.30	50	3.032	.429
Pair 2	Pre DM	34.57	46	11.824	1.743
	Post DM	61.80	46	8.150	1.202

Table 1 shows the Mean and Standard Deviation pretest and posttest achievement scores of Chemistry students' taught with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM). The results indicated that pretest and posttest mean of Chemistry students taught with LPW are 59.39 and 79.30 with standard deviations of 9.735 and 3.032 respectively. The table also shows pretest and posttest mean scores of Chemistry students taught with DM as 34.57 and 61.80 with standard deviations of 11.824 and 8.150. This indicated different mean and standard deviation in both teaching methods compared

Research Question 2: What is the pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)?

Table 2: Mean and Standard Deviation of pretest and posttest Academic Achievement scores of male and female students' taught Chemistry concept with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM).

Gender		Mean	N	Std. Deviation	Std. Error Mean
Pre LPW	Female	30.26	30	6.603	1.377
	Male	29.10	20	3.132	
Post LPW	Female	46.19	30	2.021	.429
	Male	33.11	20	1.011	
Pre DM	Female	10.14	14	3.111	1.743
	Male	24.43	32	8.713	
Post DM	Female	20.10	14	3.020	1.202
	Male	41.70	32	5.130	

Table 2 shows the Mean and Standard Deviation of pretest and posttest Academic Achievement scores of male and female students' taught Chemistry concept with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM). The table has it that pretest and posttest mean academic achievement scores of female and male students taught with LPW is 30.26, 29.10, 46.19 and 33.11. The standard deviation is 6.603, 3.132, 2.021, and 1.011. The table also shows the pretest and posttest mean academic achievement scores of female and male students taught with DM as 10.14, 24.43, 20.10 and 41.70. The standard deviations are 3.111, 8.713, 3.020 and 5.130. This shows different values in both gender in their mean and standard deviation for both teaching methods.

Research Question 3: What is the pretest and posttest mean interest scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM)?

Table 3: Mean and Standard Deviation of pretest and posttest interest scores of Chemistry students' taught with Laboratory Practical Work (LPW) and taught with Demonstration Method (DM)

	Mean	N	Std. Deviation	Std. Error Mean	
Pair 1	PRE LPW	95.16	50	15.905	2.249
	POST LPW	97.56	50	14.982	2.119
Pair 2	PRE DM	99.50	46	13.259	1.955
	POST DM	104.72	46	17.229	2.540

Table 3 shows Mean and Standard Deviation of interest scores of pretest and posttest of Chemistry students' taught with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM). The pretest and posttest mean interest of students taught with LPW are 95.16 and 97.56 while the standard deviations are 15.905 and 14.982. Also the pretest and posttest mean interest scores of students taught with DM are 99.50 and 104.72 while the standard deviations are 13.259 and 17.229.

Research Question 4: What is the pretest and posttest mean interest scores of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)?

Table 4: Mean and Standard Deviation of pretest and posttest interest scores of male and female students' taught Chemistry concept with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM).

Gender		Mean	N	Std. Deviation	Std. Error Mean
Pre LPW	Female	40.03	30	8.901	2.249
	Male	35.13	20	7.804	
Post LPW	Female	56.51	30	8.151	2.119
	Male	41.08	20	6.831	
Pre DM	Female	40.09	14	4.157	1.955
	Male	59.41	32	9.102	
Post DM	Female	42.11	14	6.126	2.540
	Male	62.61	32	11.103	

Table 4 shows Mean and Standard Deviation of pretest and posttest interest scores of male and female students' taught Chemistry concept with Laboratory Practical Work (LPW) and those taught with Demonstration Method (DM). The table has it that pretest

and posttest mean academic interest of female and male students taught with LPW are 40.03, 35.13, 56.51 and 41.08. The standard deviations are 8.901, 7.804, 8.151 and 6.831. The table also shows the pretest and posttest mean academic interest of female and male students taught with DM as 40.09, 59.41, 42.11 and 62.61. The standard deviations are 4.157, 9.102, 6.126 and 11.103. This shows different values in both gender in their mean and standard deviation for both teaching methods.

HO_1: There is no significant difference in the pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

Table 5: Test of Significant Difference in pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

		Mean	Std.Dev	Std.Error mean	95% Confidence interval of the difference Lower Upper	t	df	Sig.(2-tailed)
Pair 1	Pre LPW Post LPW	-19.940	9.464	1.338	-22.630 17.250	-	-14.898	49 .000
Pair 2	Pre DM Post DM	- 27.239	11.689	1.723	-30.710 23.768	-	-15.805	45 .000

Table 5 points that the mean achievement scores of students in Chemistry both in LPW and DM were -19.940 and – 27.239. The standard deviations were 9.464 and 11.689 respectively while t values are -14.898 and -15.805 respectively. At its corresponding value .05 level of significance, since t value is less than .05 there were a significance differences in both teaching methods.

HO_2: There is no significant difference in the pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).

Table 6: Difference in the pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).

	Gender	Mean	Std.Dev	Std.Error mean	95% Confidence interval of the difference Lower Upper	T	df	Sig.(2-tailed)
LPW	FEMALE MALE	-19.940	9.464	1.338	-22.630 -17.250	-14.898	49	.000
DM	FEMALE MALE	-27.239	11.689	1.723	-30.710 -23.768	-15.805	45	.000

Table 6 shows that the mean achievement scores of male and female students in Chemistry both in LPW and DM were -19.940 and – 27.239. The standard deviations were 9.464 and 11.689 respectively while t values are -14.898 and -15.805 respectively. At its corresponding value .05 level of significance, since t value is less than .05 there were a significance differences in gender influence on achievement in Chemistry at both teaching methods where LPW favours the female students and DM favours the male students.

HO_3: There is no significant difference in the pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

Table 7: Difference in the pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

		Mean	Std.Dev	Std.Error mean	95% Confidence interval of the difference		t	df	Sig.(2-tailed)
					Lower	Upper			
PAIR 1	Pre LPW Post LPW	-2.400	13.619	1.926	-6.270	-1.470	-1.246	49	.219
PAIR 2	Pre DM Post DM	-5.217	11.689	1.723	-8.688	-1.746	-15.805	45	.004

The Table 7 shows that the mean interest scores of students taught Chemistry both in LPW and DM were -2.400 and – 5.217. The standard deviations were 1.926 and 1.723 respectively while t values calculated are -14.898 and -15.805 and the corresponding values of .05 were .219 and .004 by comparison , t calculated were less than t-table. Hence, the hypothesis of no significance on interest in Chemistry on students taught with LPW is uphold because table value is .219 which is above .05 but there was a significant different on interest in Chemistry on students taught with DM because the table value is .004 which is below .05.

HO_4: There is no significant difference in the pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)

Table 8: Difference in the pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)

	Gender	Mean	Std.Dev	Std.Error mean	95% Confidence interval of the difference Lower Upper	t	df	Sig.(2-tailed)
LPW	Female	-2.400	13.619	1.926	-6.270 1.470	-1.246	49	.219
	Male							
DM	Female	-5.217	11.689	1.723	-8.688 1.746	-15.805	45	.004
	Male							

In Table 8 shows that the mean interest scores of male and female students taught Chemistry both with LPW and DM were -2.400 and – 5.217. The standard deviations were 1.926 and 1.723 respectively while t values calculated are -14.898 and -15.805 and the corresponding values of .05 were .219 and .004 respectively by comparison , t calculated were less than t-table in both teaching methods. Hence, the hypothesis of no significance on interest in Chemistry on male and female students was accepted in LPW while DM was not accepted which slightly favour's male Chemistry students.

Discussion

The results of the findings are discussed under the following sub-headings:

1. Pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).
2. Pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).
3. Pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

4. Pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).

Pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM)

Information presented in Table 1 and 5 shows pretest and posttest achievement scores of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM) in favour of Chemistry students taught with LPW with high scores in mean and standard deviation. The result also show there was a significant different in both teaching methods in favour of those taught with LPW. The findings are not in line with Okutubu (2020) who revealed that students taught with demonstration teaching method in auto mechanics trade in technical colleges in Delta state in Nigeria score higher in posttest shows high technological achievement than those taught with cooperative teaching method. The findings in also in contrast with Basheer et al (2017) findings who revealed that students taught oxidation-reduction concept using demonstration method exhibit better understanding of the subject than those taught with individualized method. Chemistry students achievement on those taught with LPW than those taught with DM could be as a result of learning through practical works and asking question while being taught with that teaching method which gives room for questioning.

Pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM).

The findings in Table 2 and 6 indicates Pretest and posttest academic achievement scores of male and female students' taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM) in favour of female Chemistry students in LPW with high mean score and standard deviation than their male counterparts, but in DM if favours the male Chemistry students with high score in both pretest and posttest. The findings is inconsonance with the finding of Nyemida (2020) who observed that male taught using demonstration teaching method shows high level of laboratory practical work and ability in author mechanics trade than their female counterparts. In contrary, the findings is not in line with the findings of Udogu and Emendu (2017) who opined that gender has nothing to do with the achievement,

retention, attitude and interest of Chemistry students when taught with laboratory practical work method and conventional teaching method. More also, the results is not in line with Macmillan and Joseph (2020) who observed that there was no significant difference between the posttest achievement of SS two male and female students who were taught practical wave and measurement of heat energy using circle-the sage cooperative learning strategy and those taught with laboratory practical work teaching method. The reasons while female Chemistry students achieved better than their male counterpart in LPW could be as a result learning together among the female students and ability of them asking much questions which leads to significance differences in achievement of both gender in the use of LPW. In a related manner, the reason of male Chemistry students achieving better than their female counterparts could be as a result of man nature in focusing on his mentor and working independently which led to significant different in achievement while using DM in both gender.

Pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM).

The findings in Table 3 and 7 indicates Pretest and posttest mean interest score of students' taught Chemistry concepts with laboratory practical work (LPW) and those taught with demonstration method (DM) in favour of Chemistry students taught with DM with high mean and standard deviation scores both in posttest and pretest. The findings is in line with Akani (2015) who revealed that many secondary schools surveyed in three education zones in Ebonyi state of Nigeria agreed that use of demonstration method in teaching and learning attitude and interest in students towards learning the subject than use of collaboration method. But the findings are contrary to Udogu and Emendu (2017) who asserted that laboratory practical develop students' interest that demonstration method. The results of findings in table 3 and 7 could be as results of teachers' demonstration before the students could do theirs or as a result of watching what the teacher did and do it the same way.

Pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM)

The findings in Table 4 and 8 indicates Pretest and posttest mean interest score of male and female students taught Chemistry concept with laboratory practical work (LPW) and those taught with demonstration method (DM). the result has that female

Chemistry students developed more than their male counterparts in LPW while in DM male Chemistry students developed more interest than their female counterpart. The result in contrary Udogu and Emedu (2017) assertion which stated that LPW makes male Chemistry students maintains high interest in the subject than their female counterpart. The reason while there was a significant difference in interest in LPW which favours the female could be a result of collaborative learning among the female students which led to arouse their interest in the subject. Similarly, the reason for greater interest among male Chemistry students in DM could be a result of mentorship that normally occurred among men (Okotubu, 2020).

Conclusion

From the findings of this study, the following conclusions were drawn; Chemistry students taught with LPW achieved better than those taught with DM, so doing there was a significance difference in both teaching methods in favour of LPW. More also, female Chemistry students achieved better than their male counterpart in LPW while male Chemistry students achieved better than their female counterparts in DM. The findings also revealed that Chemistry students taught with DM developed high interest than those taught with LPW there by indicating a significant different in both teaching method via interest in favour of DM. Finally, there was a significant difference in interest on students taught Chemistry using LPW in favour of female students and there was a significant difference in interest on students taught Chemistry using DM in favour of male students.

Recommendations

From the findings to this study, the following recommendations were made

1. For effective achievement, interest and participation of female science secondary school students, laboratory practical work (LPW) teaching method should be considered while teaching some Chemistry concepts to them since gender show high achievement and interest why using the teaching method.
2. Similarly, demonstration method (DM) should be considered in teaching and learning of Chemistry concepts because the method help to develop high level of interest among students not minding the gender.
3. Both teaching method should be examine by Chemistry curriculum planner to see it could be used inter changeably with other teaching methods as when due to help increase students academic achievement and interest to help riase future scientists and for technological growth of any nation.

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