



## Effect of Practical Chemistry Teaching Strategies on Students Interest in Senior Secondary Schools in Kogi State

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### Abstract

This study investigated the effects of practical chemistry teaching strategies on students' interest in Practical Chemistry. The study adopted the non-equivalent control group design. Two research questions and three null hypotheses guided the study. A sample of 84 SS3 Chemistry students from two intact classes in two secondary schools participated in the study. Data collection was done with a researcher developed instrument tagged "practical Chemistry skill interest scale (PCSIS). Data collected for the study were analyzed using mean and standard deviation while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The results revealed that students' group work strategy significantly increased students' interest in practical Chemistry compared with individual laboratory work strategy. Gender did not significantly influenced students' in practical Chemistry. Based on these findings' chemistry teachers should adopt the group work strategy to improve students' interaction patterns and interest in practical chemistry.

### Introduction

Chemistry as a branch of science can be taught and learned most effectively if Chemistry is practical supported. Chemistry laboratory is a building equipped with Chemistry apparatus for carrying out experiments. Laboratory experiments are characteristics features of science teaching at all levels of education (Adane & Adams, 2011). Students have a lot to benefit from practical work which may include increasing students' interest and abilities as well as their performance in Chemistry (Emoyi, 2018). The low interest of students in Chemistry reflects on their performance in both internal and external Examination (Njoku & Igboanugo, 2015). The West African Examination Council (WAEC) Chief Examiner's Report for senior secondary certificate examination for the year 2018-2022 identified that one of the reason for poor performance and low interest of students in Chemistry is teachers teaching method and students inadequate exposure to (practical) laboratory work and poor preparation.

However, as stated by Ikeobi (2014) meaningful learning is possible from a given laboratory experiments if the students are given ample opportunities to operate equipments and materials that help them to construct their knowledge of phenomena and related scientific concepts. There are two extreme thoughts regarding the importance of chemistry laboratory experiments.

The first one is that in conventional approaches where little opportunity is given to the student initiatives. In this approach all the laboratory

procedures are carefully listed in the provided manual, and frequently, the student is simply asked to fill in a

well planned report. At the end of a laboratory session, students have no real experience of practical chemistry. The second one is when students are given an opportunity to engage in practical activities. This would provide an opportunity in identifying the main objectives of the work and in planning and executing it. Achimugu (2013), Njoku (2015), have stated that a major factor in effective learning to take place is the use of interesting instructional strategy that enables students' participation in teaching/learning process. Ogbu (2013), Ajeyalmi and Owoyemi (2014) have suggested a shift from conventional method of teaching Chemistry to some innovative instructional approaches to ensure improvements in students interest and performance in Chemistry. This has created the need for this study which intends to investigate the effects of group work and individual laboratory work on students' interest in practical Chemistry. Group laboratory work is a teaching strategy of setting students to work together in small groups to solve a problem or learn new information while Individual laboratory work is a teaching strategy where each student is given a set of equipment to carry out chemistry practical activities without distraction. Teachers of chemistry usually adopt the individual work because it deals with firsthand experience regarding materials or facts obtained from personal investigation or experiment. It also motivates the student, by stimulating interest in learning Chemistry

and teaches laboratory skills that enhances learning of scientific knowledge. Most teachers usually adopt the group work for chemistry practical activities due to scarcity of chemicals and laboratory equipments. Group work has its advantages in science education as it enables learners to cooperate and tolerate one another, share ideas during problem solving activities which are often involved in chemistry practical activities (Tsobaza & Njoku, 2021). Teachers of chemistry may not have considered the efficacy of individual or group work teaching strategies on students' interest and performance in chemistry (Tsobaza, 2021). The efficacy of these two strategies is not yet clear.

Studies have shown that cognitive performance in chemistry as well as interest in Chemistry can be influenced by gender in favor of boys (Nzewi, 2020, Gongden, 2016). In contrast to the above findings Olakenmi (2015), Uzezi and Deya (2020) who reported no statistically significant difference in the performance of male and female students taught acid-base titrations using computer simulation instructional strategy. (Ibe, 2013) observed that if given equal opportunities in Chemistry, students will perform irrespective of gender. Raimi (2012) reported that the influence of gender on students' performance in chemistry practical skill acquisition was not significant. The study also found that there was no significant interaction effect of teaching strategies and gender on students' acquisition of practical skills in chemistry. The female students were also reported to have performed better than their male counterparts in computational skills. In line with this, Ogunneye (2013) found that gender has no significant influence of performance in science. The lack of clear trend for gender influence and interest in chemistry has created the need to investigate the influence of gender on students' interest in practical chemistry.

#### **Objective of the study:**

Ascertain the effect of group work and individual work on students' interest in chemistry.

Ascertain the influence of gender on students' interest in practical Chemistry.

Ascertain the interaction effect of strategy and gender on students' mean interest scores in practical chemistry.

#### **Research Questions**

What are the students' mean interest scores in practical chemistry when taught using individual laboratory work and group work?

What are the students' mean interest scores of male and female in practical chemistry when taught using individual laboratory work and group work.

#### **Research Hypothesis**

The following three null hypotheses were tested at five percent level of significance.

Ho<sub>1</sub>: There is no significant difference in the mean interest scores of students taught chemistry using group work and those taught using individualized work. ( $p < 0.05$ )

Ho<sub>2</sub>: There is no significant difference in the mean interest scores of male and female students in practical chemistry when taught using individual laboratory work and group work.

Ho<sub>3</sub>: There is no significant interaction effect of teaching strategies and gender on students' mean interest scores in practical chemistry. ( $p < 0.05$ )

#### **Methodology**

The pre-test posttest quasi-experimental nonequivalent group design was adopted for the study. The design is suitable because intact classes were used for the study. The population of the study comprised all SSIII Chemistry students in Ankpa Education Zone of Kogi State, Nigeria.

A sample of 84 SSIII Chemistry students from two intact classes of two secondary schools participated as research subject(s) in the study. The two treatment conditions were randomly assigned to group work and individual work. The two treatment conditions were group work and individualized work laboratory strategies. The researcher developed lesson plans in quantitative analysis in practical Chemistry. Quantitative analysis is suitable for this study because the emphasis is on volumetric or titrimetric analysis where the students will be given ample opportunity to do practical work in chemistry laboratory. The lesson plan was face validated by two experienced teachers in Chemistry. These lesson plans were used for teaching all the lessons needed in this study. For data collection, the researcher developed an instrument tagged, 'practical Chemistry skill interest scale (PCSIS)' It is a four point likert scale with responses Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree

(SD). The instrument is designed to measure the interest pattern of the students towards practical Chemistry. The instrument is made of 26 items, which the students are required to tick ( $\sqrt{\phantom{x}}$ ) for one of the responses that tally with the extent he/she agree or disagree with each of the statements. The instrument was face validated by two experts from Education Measurement and Evaluation and two experienced Chemistry teachers. The PCSIS was pilot tested on twenty students from a secondary near the area of study. The result of the pilot study helped us determine the reliability of the instrument using Chronbach Alpha formular. Cronbach's Alpha is suitable for calculating internal consistency of test items that have different scoring response scale. The internal consistency reliably coefficient of PCSIS was (0.762). The Chemistry teachers in the sampled schools were trained as research assistants. They were trained on how to teach the validated lesson plans and also to administer the PCSIS which lasted for two days. Each of the sampled schools was pretested before the treatment commenced. The sampled school was taught individual laboratory work experiments (group one)

this group is regarded as the conventional group method. The teaching was done by the trained research assistant; precisely the normal chemistry teachers in the sampled school who had been trained on the effective use of plans prepared by the researcher. The duty of the teacher was to assist the researcher carry out the teaching using the prepared; lesson plans, while the researcher supervised to ensure procedures were followed at all times. The topics covered were on quantitative chemical analysis. The second school was taught group work strategy using the same topics on quantitative chemical analysis. There were 48 students per group of five giving a total of ten working groups. The regular Chemistry teachers were thoroughly trained to use the group work strategy. The students were administered pre-test before the commencement of the treatment. After the treatment, the student were administered PCSIS and the instruments were collected on the spot. At the end of the exercise a post-test was administered to both groups. The statistics involved in the data analysis were mean and standard deviation and Analysis of Covariance (ANCOVA) was used to test the hypothesis as 5% level of significance.

## Results

**Table 1:** Mean and standard deviation of students' interest in chemistry when taught using group work strategy and those taught using individual laboratory work.

Groups	Pre-test			Post-test		Mean Scores	Gain	Mean Difference	Gain
	N	Mean	SD	Mean	SD				
Students' Group Work	48	60.06	19.79	105.46	23.59	45.40		17.98	
Individual Laboratory Work	36	58.64	21.28	86.06	21.14	27.42			

Result in Table 1 shows the mean interest scores of chemistry students taught using individual laboratory work strategy and those taught using group work strategy. Students exposed to group work strategy had a mean interest score of 60.06 with standard deviation of 19.79 at the pre-test and mean interest scores of 105.46 with standard deviation of 23.59 at post-test. On the other hand, students who were taught using individual laboratory work had

mean interest score of 58.64 with standard deviation of 21.28 at pre-test and mean interest scores of 86.06 with standard deviation of 21.14 at post-test. There was a mean gain score difference of 17.98 recorded for the two groups in favor of the students exposed to group work strategy. The result indicated that the use of students' group work strategy increased students' interest in chemistry.

**Table 2:** Mean and standard deviation of male and female students' interest in chemistry.

Gender	Pre-test			Post-test		Mean Scores	Gain	Mean Difference	Gain
	N	Mean	SD	Mean	SD				
Male	47	60.47	21.90	100.55	18.64	40.08		5.43	
Female	37	58.16	18.35	92.81	29.96	34.65			

Result in Table 2 revealed that at the pre-test, male students had mean interest scores of 60.47 with a standard deviation of 21.90 while their female counterpart had mean interest scores of 58.16 with standard deviation of 18.35. At the post-test, male students had mean interest scores of 100.55 and standard deviation of 18.64 while female students had mean interest scores of 92.81 with standard deviation

of 29.96. The mean gain score of the male students was 40.08 while the mean gain score of the female students was 34.65. The results therefore, show that male students had a higher mean interest score compared to their female counterpart. This can be seen from slight mean gain score difference of 5.43 in favor of the male students.

**Table 3:** Analysis of Covariance (ANCOVA) of mean interest scores of students taught chemistry using individual laboratory work and those taught using group work.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12975.883 <sup>a</sup>	8	1621.985	3.328	.003
Intercept	77523.073	1	77523.073	159.057	.000
PretestInt	24.521	1	24.521	.050	.823
Method	6570.542	1	6570.542	13.481	.000
Gender	939.814	1	939.814	1.928	.169
Method * Gender	497.030	1	497.030	1.020	.316
Error	36554.403	75	487.392		
Total	842216.000	84			
Corrected Total	49530.286	83			

Result in Table 3 shows that teaching strategy is a significant factor on students' interest in practical chemistry;  $F(1, 75) = 13.481$ ,  $P = .000$ . Thus, the null hypothesis of no significant difference in the mean interest scores of students is rejected. This is because the exact probability value of .000 is less than level of significance set at 0.05. Therefore, the researcher concludes that there is a significant difference in the mean interest scores of students taught chemistry using individual laboratory work and those taught using group work in favor of group work.

## Research Hypothesis 2

There is no significant difference in the mean interest scores of male and female students in practical chemistry when taught using individual laboratory work and group work. Results of the analysis of Table 3 was also used to test hypothesis 2. The table shows that gender is not a significant factor on students' interest scores in chemistry;  $F(1, 75) = 1.928$ ,  $P = .169$ . Therefore, the null hypothesis of no significant difference was accepted because the exact probability level of .169 is greater than level of significance set at 0.05. The researcher therefore, concludes that there is no significant difference in the mean interest scores of students across gender.

From table 3 it can be observed that treatment by gender interaction effect is not significant at 5% level of significant. The actual value of the level of significant is,  $F(1, 75) = 1.020$ ,  $P = .316$ . Thus the null hypothesis is accepted since the probability value of .316 is greater than the level of significance set at 0.05. Therefore, the researcher concludes that the interaction effect of teaching strategies and gender on students' mean interest score in practical chemistry is not significant.

## Discussion

Results obtained in table 1 and 3, the first research question that was posed to guide the study revealed that students exposed to group work strategy increased students interest in Chemistry. A further analysis also show that there is a significant difference in the mean interest scores of students taught chemistry using individual laboratory work and those taught using group work. The results showed that group work have significant influence on students' mean interest scores in practical chemistry. The result of this study is in agreement with the findings of studies of Anekwe (2006); Okoli(2006); Okebukola (2004b). As they concluded that group work promoted students interest and performance in science. The second research question was answered in table 2 and





3, revealed that gender has no significant difference in the mean interest scores of students in practical chemistry. The result of this study is in agreement with that of Ifeanchi(2012); Ibe (2013) and Raimi (2012), they found that gender has no significant influence on performance in science.

### Conclusion

Based on the findings of the study, the researcher drew the following conclusions. Students' group work strategy significantly increased students' interest in practical chemistry. Gender did not significantly influence students' interest in practical chemistry. The male and female students have equal interest in practical chemistry.

### Recommendations

Chemistry teachers should adopt the group work teaching strategy to improve students' interaction patterns and interest in practical chemistry. Chemistry teachers should guide and give students of different gender equal activities and opportunities in chemistry laboratories and classes so that students of different gender could have maximum and equal interest in chemistry.

Workshops should be organized regularly to retrain chemistry teachers on the use of group work learning interest

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