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Comparative Analysis of Gender Performances in Practical Activities among Senior Secondary School Science Students in Kano Municipal Local Government Area, Kano State

S.A.A. Shawai[1*], I.I. Muhammad[2], M. Muzammil[3], F.S. Gwarzo[4]

[1]Chemistry Programme, School of Undergraduate Studies, Sa'adatu Rimi College of Education, Kumbotso, P.M.B. 3218 Kano State, Nigeria
[2]Dept. of Chemistry, School of Science Education, Sa'adatu Rimi College of Education, Kumbotso, P.M.B. 3218 Kano State, Nigeria
[3]Dept. of Integrated Science, School of Science Education, Sa'adatu Rimi College of Education, Kumbotso, P.M.B. 3218 Kano State, Nigeria
[4]Dept. of Biological Sciences, Kano State College of Education and Preliminary Studies, Kano State, Nigeria

[*]*Corresponding Author: sadiqaashawai2020@gmail.com, Tel.: +2347060427808*

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***Abstract*—**This research investigated gender differences in practical activities among senior secondary school chemistry students in Kano Municipal Local Government Area, Kano State. The study used a quasi-experimental, control approach. Ten public secondary schools (5 female and 5 male) in Kano Municipal local government area of Kano state were stratified and randomly used to pick a sample of 217 senior secondary school students. The study was guided by two objectives, questions, and a null hypothesis. The instrument for the study was Chemistry Achievement test (CAT). The collected data were analyzed using a descriptive and t-test at a significance level of 0.05. The results revealed no significant academic performance differences between the students' genders. The results showed a significant difference between students who participated in practical activities and those who did not. Conclusions and recommendations were drawn in light of the results.

***Keywords*—**Academic, education, gender, practical, performance, science

I. INTRODUCTION

While the term "science education" may imply different things to different people, one thing is for certain: it combines scientific knowledge with the study of education. In order to share science with people or communities who are not typically interested in science, it is necessary to both acquire scientific knowledge and receive education [1]. Science education is a method of teaching or training, typically in schools, that aims to increase one's environmental knowledge and make them more environmentally sensitive [2]. It also aims to improve one's ability to do systematic research and to change one's attitude toward the environment [2]. According to [3], science education is imparting scientific knowledge to those who aren't typically seen as being part of the scientific community. These people can be students, farmers, market vendors, or an entire community. In Nigeria, scientific instruction focuses on dispelling students' misconceptions about science topics as well as teaching science concepts [3]. Because it fosters a culture of scientific inquiry and facilitates in understanding the world, science education is crucial for both nations and people [4]. According to [5-6], any country's technological progress depends heavily on science education due to its many advantages. For the inhabitants' financial security, science education is equally crucial [7]. It consists of three courses that are combined with education: biology, chemistry, and physics [3].The reason why developed nations around the world continue to be developed is because they do not treat science education lazily; instead, they innovate on it [1].

Despite all the wonderful things science education may contribute to a country's growth, there are still numerous issues that work against it. Since the nation's independence, science education in Nigerian schools has faced numerous difficulties [8]. Nigeria cannot afford to joke with the advancement of science education as it currently stands if it is to become a developed nation; a change for the better is required [1]. The issues with science education are not specific to Nigeria but rather a worldwide problem [8]. Study by [9], among others, revealed that there is a lack of trained teachers to teach a number of science subjects in classrooms all around the world. Taber [10] sees teacher's lack of knowledge and skills in research methods as another potential barrier to science education development. Most schools are lacking laboratories and teaching resources [8]. According to [11], science instruction ignores the practical activity technique, which enhances teaching and learning, in favor of "chalk and talk" and a content-focused approach. Gender,

personality, grade level, location, socioeconomic situation, cultural background, teaching methods, and curricular materials were specifically mentioned by [12] as having a significant impact on attitudes toward science. The strongest and most persistent influencer of these factors is gender, although the nature of this influence has been disputed by several studies [12].

Gender prejudice is still pervasive in Nigeria, and maybe all of Africa, as [13] noted when he stated that "gender roles are rather inflexible throughout Africa and Nigeria in particular where gender disparities are highlighted". Studies have been done to see if gender influences the choice of a certain learning strategy or not. Gender stereotypes frequently appear in the day-to-day activities of the average Nigerian. For instance, [14] examined student performance in mathematics and other science courses and found that female students outperformed their male counterparts in Biology. According to [15], female students outperformed male students in scientific courses. Abu-Hola [16] found a significant difference between the science performance of male and female students, with the female students outperforming the male students. According to research by [17], female students who used the surface method in accounting had significantly higher grades than male students.

The academic performance of secondary school students has been discovered to be significantly influenced by the gender of the students [18]. The average academic performance of male and female students differs in various subject areas, according to several previous studies conducted in the last two decades, which also identified contributing variables to this observed discrepancy. For illustration, [19] found that male students outperformed their female counterparts when it came to solving chemical problems among Nigerian secondary school chemistry students. Males exhibit better self-efficacy than females do when learning science courses [20]. In their study, [21] found that, at the junior secondary school level, male students often receive higher scores in integrated science than female students do. Study of [22], reported that male students outperformed their female counterparts in academic achievement. Males performed noticeably better than girls [23], who looked at the discrepancies between male and female secondary school science students' academic performance. In their study, [24] discovered that male students outscored female students in science education by a significant margin. Male students surpassed female students in math, physics, and chemistry as reported by [14] who examined student performance in those subjects with other science subjects. According to [25], male students in science performed academically better than their female counterparts. The actions performed throughout the learning processes that have varied impacts on the comprehension of males and females differently may be the cause of the disparities in academic performance that have been noticed [23].

Male and female students are said to study differently, with males being more individualistic and possibly preferring to work and learn independently while females are more collaborative [26]. There is no observable difference between male and female learners' overall performance in science [27]. Lawal [28] revealed no significant differences in the academic achievement of male and female students in the sciences. According to a study by [29], gender has no significant impact on the understanding of ecological concepts. Oludipe [30] assessed the proficiency in fundamental sciences between male and female students and found no significant disparities.

I.I Research Objectives

In view of the above, the study aims to;

i. Determine the difference between male and female students' performance in practical Chemistry among secondary school students of Kano Municipal local government area.
ii. Ascertain whether male and female exposed and those not exposed to chemistry practical among secondary school students of Kano Municipal local government area.

I.II Research Questions

The following research questions will guide the study:

i. What is the difference between male and female students' performance in practical Chemistry among secondary school students of Kano Municipal local government area?
ii. What is the difference between male and female exposed and those not exposed to chemistry practical among secondary school students of Kano Municipal local government area?

I.III Research Hypothesis

The following research hypotheses were formulated:

i. There is no significant difference between male and female students' performance in practical Chemistry among secondary school students of Kano Municipal local government area.
ii. There is no significant difference between male and female exposed and those not exposed to chemistry practical among secondary school students of Kano Municipal local government area.

II. RELATED STUDIES

Biology students who take extra-mural classes in public senior secondary schools were the subjects of [31] investigation of the impact of gender on academic achievement. The study used a descriptive survey approach. The population of the study was made up of the thirteen (13) government-owned schools in the Esan Central Local Government Area of Edo State that teach biology. One hundred eighty (180) students were selected as the sample size from the general community. An achievement test that was organized and had a reliability coefficient of 0.83 was used to collect the data for this investigation. Frequency counts, averages, and percentages were used to respond to research questions 1 to 3, and an

ANOVA test was used to determine the significance of the research hypothesis. The performance of male biology students who attend EMCs and female biology students who do attend EMCs was found to differ statistically significantly ($p>0.05$), with male students performing better.

Tambaya [32] examined into the performance disparities between male and female pre-degree students at Federal University Dutsin-main Katsina State, Nigeria in the subjects of biology, chemistry, and physics. For the study, 83 students who were enrolled in the pre-degree program during the 2013–2014 academic year-56 men and 27 women were used. Without any change, data that were already in the field were analyzed using an ex-posfactor design. Final cumulative grade point averages from students' School of General and Preliminary Studies (SOGAPS) examination scores were used for the analysis in the study. At significance levels of 0.05, descriptive statistics and an independent t-test were utilized to evaluate the hypothesis. The findings indicated that there were no significant disparities between male and female students' performance in biology, chemistry, and physics.

Ajayi & Ogbeba [33] used practical exercises to investigate the impact of gender on students' performance in stoichiometry. Out of a total of 8,381 SSII students in zone C of Benue State, Nigeria, 292 students from eight secondary schools were randomly chosen as the study's sample. A quasi-experimental research design was used in the study. Data were gathered using the Stoichiometry Achievement Test (SAT). Using the Pearson correlation moment coefficient, a reliability coefficient of 0.92 was determined. The study was based on two hypotheses and two research questions. In order to answer the study questions, mean and standard deviation were used, and analysis of covariance was used to test the hypotheses at a significance level of 0.05. (ANCOVA). The results of the study indicated that there is no noticeable difference in the mean achievement scores between male and female students who are taught stoichiometry through hands-on activities ($F(1, 145) = 4.160$, $p>0.05$).

Apata [34] examined how pupils' gender affected their numerical ability in physics at the secondary school level in the state of Kwara. The purposive sample technique was used to choose 81 co-educational secondary schools. Knowledge of numbers Students in the third year of physics in secondary school in each of the schools took a test that included both theoretical and practical physics problems. The test lasted for 2hr 40min. sampled students of 405 males and 405 females were involved. The t-test was used to analyze the data. The 0.05 level of significance was used to test the two null hypotheses that were formed. The findings indicate that in physics theory, men were more numerically proficient than women. For physics practical, a comparable trend was seen. Male pupils outperform female students in terms of numerical skill, according to research. In terms of numerical competency in secondary school physics, it was found that male students do better than female students.

III. METHODOLOGY

The study used a quasi-experimental-control approach. Five hundred and nine (509) chemistry students formed the population of the study. Ten public secondary schools (5 female and 5 male) in Kano Municipal local government area of Kano state were stratified and randomly used to select a sample of 217. The instrument for the study was Chemistry Achievement test (CAT). Three science Educators from school of education and science Education, Sa'adatu Rimi College of Education, Kumbotso Kano, edited and validated the instrument as covering the area of study. The data for the study was gathered by the researcher and analyzed using a descriptive and t-test at a significance level of 0.05.

IV. RESULTS

IV.I Personal Information of the Respondents

The demographic information of the respondents on the age is presented in the **Figure 1** below. From the Figure, it shows that 165(76%) of the respondents were between the age of 14-17years. Also from the finding, 35(16.1%) of the respondents were between the age of the 18-21years. Of the 217, 17(7.8%) of the respondents were 22-above years. This revealed that majority of the respondents were between the ages of 14-17years. With regard to students level or class, 113(38.8%), 102(35.1%) and 76(26.1%) of the respondents represented SSI, SSII and SSIII respectively. **Figure 2** show that, students from SSI dominated the study. The results also showed that 110(50.7%) and 107(49.8%) of the respondents were male and female respectively. From the finding females slightly dominated the study (**Figure 3**).

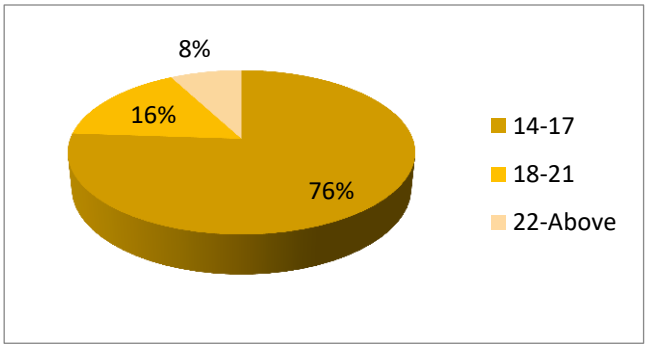

Figure 1: Age Distribution of the Respondents

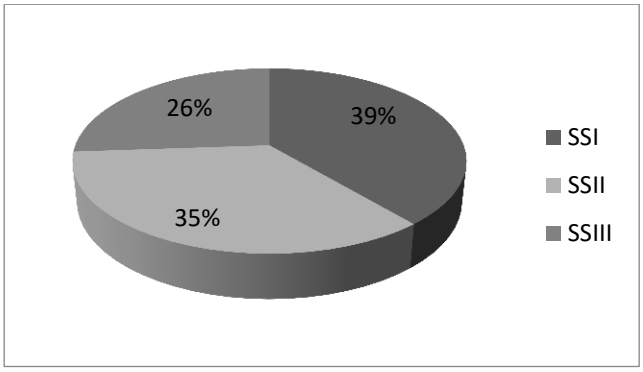

Figure 2: Class Distribution of the Respondents

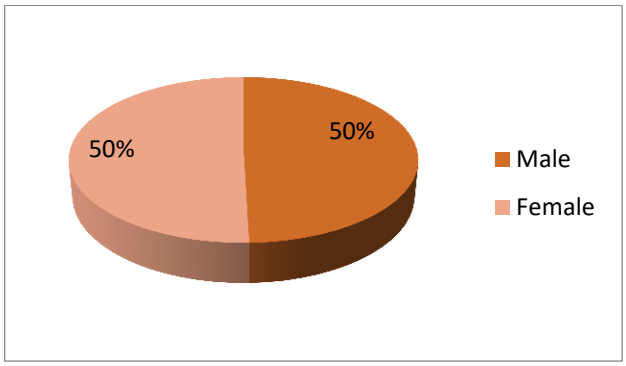

Figure 3: Gender Distribution of the Respondents

IV.II Performance of Girls and Boys Exposed to Chemistry Practical and Those Not Exposed

The purpose of the research was to compare secondary school students who had practical experience with those who had not in order to determine whether there were gender disparities in academic performance. Table **1** presents descriptive statistics comparing the performance of males and females who participated in chemistry practical classes to those who did not, while Table **2** presents the results of an independent t-test on the performance of males and females who participated in chemistry practical classes compared to those who did not. When comparing the mean score on a continuous variable for different groups of participants, an independent-samples t-test is a useful technique of statistical analysis.

In the post-test, the findings indicated that the male students had higher mean score of 11.067, with a standard deviation of 1.812 in academic performance scores, compared to the female students who had a mean score of 10.750, with a standard deviation of 1.963 in the academic score. From group statistics, male students reflected better academic achievement scores than their female counterparts. Similarly, in pre-test male students had higher mean score of 9.317, with a standard deviation of 1.501 in academic performance scores, compared to the female students who had a mean score of 7.400, with a standard deviation of 1.915 in the academic score. The findings indicate that male had performed better than the female in both tests.

Table 1: Comparison of Male and Female Performance

	Gender	N	Mean	Std	Variance
Pre-test	Male	60	9.317	1.501	2.254
	Female	60	7.400	1.915	3.668
Post-test	Male	60	11.067	1.812	3.284
	Female	60	10.750	1.963	3.852

Table **2** presents the results of an independent t-test on the chemistry performance of male and female students who participated in chemistry practical and those who were not. The significant difference between two means for both pre-test and post-test male and female is compared using the independent t-test. The t-value for the post-test mean comparison of male and female is 0.918 with 118 degrees of freedom. The test's corresponding two-tailed p value is 1.980. The null hypothesis, "There is no significant difference in post test performance in chemistry for male and female exposed to chemistry practical and those not exposed," is accepted because 1.980 is greater than 0.05.

Table 2: t-test Results on Performance of Male and Female Exposed to Chemistry Practical and Those Not Exposed

	t	df	Mean diff.	Std error Mean	Sig.
Pretest	-6.101	118	-1.917	0.314	1.980
Posttest	0.918	118	0.317	0.345	1.980

In the pre-test mean comparison for male and female, the t-value is -6.101 with degrees of freedom of 118. The two-tailed p value associated with the test is 1.725. The decision rule is given by: If $p \leq \alpha$, then reject the hypothesis. In this analysis, 1.725 is greater than 0.05 and therefore the null hypothesis is retained. This implies that there is no significant difference in pre-test performance in chemistry male and female exposed to chemistry practical and those not exposed.

IV.III Performance in Chemistry by Gender for Experimental and Control Groups

The study sought to find out if there was any significant difference in performance in Chemistry between male and female in either experimental or control groups. Table 3 and 4 shows descriptive statistics on performance in chemistry for experimental male and female groups and for control male and female groups respectively. In the post-test, the findings indicated that the male students had higher mean score of 12.333, with a standard deviation of 1.155 in academic performance scores, compared to the female students who had a mean score of 12.012, with a standard deviation of 1.123in the experimental groups. Similarly, in pre-test male students had higher mean score of 6.867, with a standard deviation of 1.332in academic performance scores, compared to the female students who had a mean score of 6.100, with a standard deviation of 1.561in the experimental group. From group statistics, male students reflected better academic achievement scores than their female counterparts.

Table 3: Performance in Chemistry by Gender for Experimental Group

	Gender	N	Mean	Std
Pre-test	Male	30	6.867	1.332
	Female	30	6.100	1.561
Post-test	Male	30	12.333	1.155
	Female	30	12.012	1.123

Table **4** shows the descriptive statistics for the post test and pre- test for control male and female students. The findings on the post test indicate a mean of 9.800 for male and a mean of 9.333 for female while in the pretest the findings indicate a mean of 6.867 for male and a mean of 6.100 for the female. This indicates that girls performed better than boys before treatment.

Table 4: Performance in Chemistry by Gender for Control Group

	Gender	N	Mean	Std
Pre-test	Male	30	6.867	1.332
	Female	30	6.100	1.561
Post-test	Male	30	9.800	1.242
	Female	30	9.333	1.213

Table **5** below shows the findings of the independent t-test on pre-test and post test performance in chemistry by gender for the experimental group. The independent t-test is used to decide whether the difference between the two means for both pre-test and post test scores are significant.

The information in Table **5** shows the post test and pre-test mean comparison by gender for experimental group. The t-value for the post-test mean comparison of male and female is 0.485 with 58 degrees of freedom. The test's corresponding two-tailed p value is 2.002. The null hypothesis, "There is no significant difference in post test performance in Chemistry by gender for experimental group" is accepted because 2.002 is greater than 0.05.The pretest mean comparison for experimental male and female, the t-value is 0.383, so the null hypothesis which implies that there is no significant difference in pretest performance in chemistry between experimental groups is accepted since 2.002 is greater than .05.

Table 5: t-test Results on Performance in Chemistry by Gender for the Experimental Group

	T	df	Mean diff.	Standard error Mean	Sign.
Pretest	0.383	58	0.456	0.347	2.002
Posttest	0.485	58	0.167	0.344	2.002

Table **6** shows the post test and pre-test mean comparison by gender for control group. The t-value for the post-test mean comparison of male and female is 1.366 with 58 degrees of freedom. The test's corresponding two-tailed p value is 2.002. The null hypothesis, "There is no significant difference in post test performance in Chemistry by gender for control group" is accepted because 2.002 is greater than 0.05. The pretest mean comparison for experimental male and female, the t-value is 2.046, so the null hypothesis which implies that there is no significant difference in pretest performance in chemistry between experimental group is accepted since 1.672 is greater than .05.

Table 6: t-test Results on Performance in Chemistry by Gender for the Control Group

	T	Df	Mean diff.	Standard error Mean	Sign.
Pretest	2.046	58	0.767	0.375	1.672
Posttest	1.366	58	0.467	0.342	2.002

IV.IV Discussion

This research investigated how senior secondary school science students in Kano Municipal Local Government Area, Kano State, perform academically in practical activities differently depending on their gender. The results from tables 1, 2, 3, 4, 5, and 6 demonstrate that there were no statistically significant differences between male and female students' academic performance means scores in practical chemistry. Notwithstanding, the male students' academic performance means scores at the dependent measures level were slightly higher than those of the female students, despite the differences not being statistically significant. In both the experimental and control groups, the study's findings indicated that there was no significant difference in male and female students' performance in Chemistry. Reference [35-36] proved that gender had no significant effect on students' achievement science. The result is consistent with the research by [37], who established that there were no significant differences between performance and retention scores between male and female students, demonstrating their equal ability to compete in mathematics. Despite the fact that females were less active than males in the classroom interaction during teaching and learning, [38] study found no statistically significant difference between genders in school performance.

The results of the study contradict those of [39-41] who found that gender roles had a considerable impact on students' academic achievement and that male students performed better in the sciences than female students did in the arts. This study also contradicts [42] assertion that male students outperformed female students in disciplines requiring numeric aptitude. The results are in opposition to a study by [24] that revealed that male students performed noticeably better than female students in scientific classes. The results demonstrated a significant difference between chemistry students who were taught or exposed to practical activities and those who were not. The results of the study were consistent with that of [43] who found that when students are taught through practical activities, they have a tendency to learn more and retain it for longer periods of time, show greater satisfaction with their practical work, and perform better on exams than when they are taught through other instructional formats. The study concurs with [44] who discovered a significant difference between students who were taught using practical and those who were not in terms of academic achievement. As a result, [45] argued that if we want to create students who will be able to acquire the necessary knowledge, skills, and competence needed to meet the demands of the nation, the use of practical activities approach to the teaching and learning of scientific concepts should be made mandatory rather than an option to science teachers. The study was corroborated by [31] findings, which showed a significant difference in the academic performance of biology students who take extracurricular activities and biology students who do not.

IV. CONCLUSION AND FUTURE SCOPE

The study concluded that no statistical significant differences between male and female students' academic performance means scores in practical chemistry. Notwithstanding, the male students' academic performance means scores at the dependent measures level were slightly

higher than those of the female students, despite the differences not being statistically significant. In both the experimental and control groups, the study's findings also indicated no significant difference in male and female students' performance in chemistry practical. It is concluded that there is a significant difference between chemistry students who were exposed to practical activities and those who were not. Therefore, when students are taught through practical activities, they have a tendency to learn more and retain it for longer periods of time, show greater satisfaction with their practical work and perform better on exams than when they are taught through other conventional approaches.

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