



Effect of Inductive and Deductive Teaching Methods on Students' Performance in Basic Science Among Junior Secondary Schools Students: A Gender Study

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Abstract: The study investigates the impacts of Inductive Teaching Method (ITM) and Deductive Teaching Method (DTM) on the performance of Junior Secondary School three (JSS III) students in Basic science. The study applied a pretest-posttest quasi-experimental design. Six (6) junior secondary schools three (JSS III) were purposively chosen inside Abuja Municipal Area Council (AMAC), of the Federal Capital Territory (FCT), Nigeria. A total of six hundred and twenty (620) participants comprising of three hundred and fifty-five (355) male students and two hundred and sixty-five (265) were involved in the study. The intact class was used in each of the selected schools, and the instruments for data collection was the Basic Science Performance Test (BSPT). The arithmetic means standard variation and One-way Analysis of Covariance (ANCOVA) were applied using Statistical Package for Social Sciences (SPSS) version 26 to test two hypotheses at the 0.05 level of significance. The preliminary test result revealed that the data collected met the normality assumption, few outliers and homogeneity of variance. The main result showed that the most effective and preferred teaching method is the inductive teaching method. There was a significant difference in the male student's mean performance [$F(2,351)=25.911, p=0.000$] between the three groups. The study also discovered no significant difference in the female student's mean performance [$F(2,260)=0.154, p=0.857$] between the three groups while adjusting for the pretest score. Given the discoveries, it is suggested that the utilization of inductive teaching method should be encouraged and the necessary facilities and equipment needed for proper implementation should be provided by the school authorities.

Keywords: Inductive Teaching Method, Deductive Teaching Method, Basic Science Performance Test (BSPT), Analysis of Covariance (ANCOVA), Quasi-experimental Design

1. Introduction

In recent times, countries world-wide especially the developing ones like Nigeria are striving hard to develop technologically and scientifically, since the world is turning scientific and all proper functioning lives depend greatly on science. Basic science is a subject that is worried about exploring living and non-living things, and it is a mix of different topics like science, science and physical science. It can likewise be characterized as the information about the

regular and actual world's structure and conduct dependent on realities demonstrated by leading analysis [5]. Basic science is a progressive new starting science educational program created for understudies thinking about a science vocation. Essential science is officially known as coordinated science. A kid runs over at the lesser optional school level for centre science subjects (Physics, Chemistry, Biology, Mathematics, geology) at the senior secondary school level, which infers that for understudies to have the option to contemplate single science subjects at the senior secondary school level effectively, such understudies must be all around grounded in basic science at

the junior secondary level. There are so many methods used in solving scientific problem. Some of them incorporate; posing, inquiries, perception, recording, performing tests, theories testing, distinguishing cases, and reaching substantial determinations. As an integrated science course, basic science is instructed at an essential and junior level to set up the centre science subject's youngster. Since handled, writing uncovers are scarcely surveyed in Nigerian optional schools [1]. The Nigerian Basic Science project's major point, a cycle-arranged educational program is to create an understudy's science situated aptitudes.

Educating essential science includes various strategies and methods to make the subject extremely fascinating and intelligent [2]. Nobody single instructing plan or procedure is completely appropriate for essential, auxiliary and more significant level schooling as the understudies of each level contrast in age, development, mental capacities, mental turn of events, numerical comprehension and so on accordingly, one technique can't be applied to show fundamental science to all the classes. Other than this, with the utilization of one design, all the understudies of a class can't be outfitted with an equivalent measure of information since singular contrast lies among them. The superior difference is a significant mental wonder which influences instructing and its result generally. Instructors and understudies ought to be effectively engaged with educating and learning measures. Children learn best by doing a thing, appreciate addressing puzzles, become exhausted if an instructor constantly talks for over 10 minutes without pragmatic work, learn preferably through discipline, and create a comprehension of logical thoughts gradually and in a specific succession [3]. In this way, an instructor needs to apply various strategies to encourage the same subject to the same class with the goal that each understudy could comprehend and get familiar with the given substance [4]. They must have the qualities, aptitude, information, and instructional fitness for effective and practical execution. As of late, the educating of fundamental science and innovation schooling has been a basic focus at the principal upper level of the Nigerian informative system. There is a requirement for utilizing training techniques like the inductive and deductive educating strategies to accomplish viable instructing and learning measures.

1.1. Inductive Method

The inductive strategy depends on the rule of acceptance. Enlistment intends to set up a generally accepted fact by indicating that on the off chance that it is valid for a specific case and is further validation for a sensibly sufficient number of instances then it is useful for all such claims. Consequently, in this strategy, from the outset stage, an issue is tackled based on past information, thinking, thinking and knowledge of the student. At this stage, understudy doesn't think about any equation, standard or technique for tackling the given issue. When a satisfactory number of comparable models, realities or items is introduced to the students, they attempt to come to a result for each one of those (See figure 1). The inductive teaching technique is profoundly dug in science

training, utilizing the inductive technique. The instructor gives the understudies a particular test or issue, for example, an investigation that should be deciphered or a certifiable issue should be tackled. The understudies should then utilize their base-information to research, test, investigate and reach their own decision or arrangement. The inductive strategy, which is usually deciphered in schools as the logical technique is generally utilized as a guide for perception, request based learning and fills in as a rule for understudy examination concerning next to zero consideration is at first paid to the subject of why any of that is being done, what true wonders can the models clarify, what viable issues would they be able to be utilized to address, and why the understudies should often think about any of it. The lone inspiration to discover that understudies get on the off chance that they get any whatsoever is proposals that the material will be significant later in the educational program or vocations [6] (Prince and Felder, 2006). In inductive teaching, just different realities and models are introduced to the students and from where they need to discover or set up an overall equation. Along these lines, it is a strategy for developing a recipe with the assistance of a sufficient number of solid models. Hence, an inductive method for showing leads from known to obscure, specific to general or guide to available standard and cement to extract. At the point when various solid cases have been perceived, the student himself can endeavour for speculation.

1.2. Deductive Method

Deductive method for educating depends on an allowance; it continues from general to specific and from dynamic and cement. In this technique for instructing the teacher tells the standard, head or law to the understudies and afterwards, the average is introduced, authority or regulation with the assistance of explicit models. Above all else, the standards are given, and after that, understudies are approached to apply these guidelines to tackle more issues. This strategy is utilized for showing fundamental science in junior auxiliary, higher optional or higher classes. The deductive methodology continues from the general (rules, laws, administrators or recipe) to explicit (models), obscure to know, unique direction to solid model and from complex to basic. A deductive technique for instructing includes away from the issue, looking for a provisional theory, planning a speculative idea, and checking (See figure 1) for compelling acknowledgement of the case. Deductive thinking or sensible derivation or "top-down" rationale, is the way toward thinking from at least one proclamations to arrive at a consistently certain resolution. The deductive technique for educating is very surprising from an inductive strategy. A deductive method is more instructor focused methodology which implies that the educator gives the understudies another idea, clarifies it, and afterwards has the understudies utilize the concept.

The summary of literatures on inductive and deductive training techniques demonstrates that both teaching methods are unique; however, very successful. There have been

countless such investigations on using inductive and deductive instructing methods to a few subjects. For instance; too high organized introductions, [7]; Agricultural Economics, [8]; Mathematics, [9, 10] and [11]; French and Spanish language, [12]; French, [13]; Rodex reaction in chemistry [14]; Chemistry, [15]; Circle geometry and trigonometry, [16]; Electrochemistry, [17]; Art, [18]; English grammar, [19-23]; Iranian learners of French as a foreign language [24]. Numerous studies have been directed to research the effectiveness of inductive and deductive methods of teaching various subjects, the summary of the comparative studies by scholar reviewed above shows that studies in the area of effectiveness of inductive and deductive methods of teaching basic science, gender and among junior secondary schools' students in Abuja FCT have not been investigated so far. This study shall therefore fill the research gaps and provide a solution with the established problems.

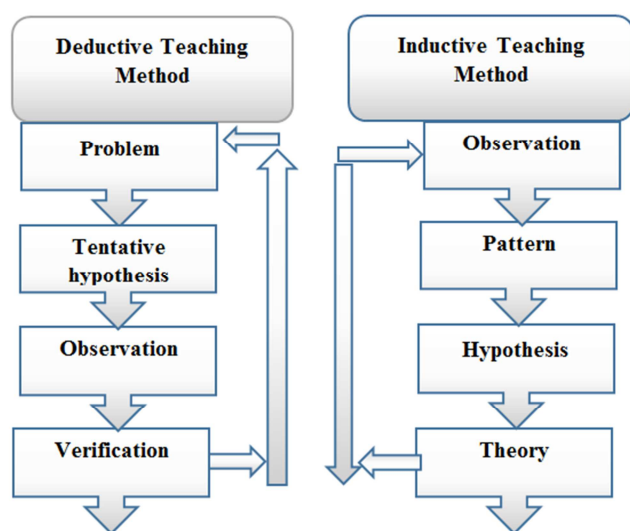


Figure 1. Stages of deductive and inductive teaching method.

Aim and Objectives

This study investigates the effect of inductive and deductive teaching methods on male and female students in basic science in some selected public junior secondary schools three (JSS III) in Abuja Municipal Area Council (AMAC), FCT, Nigeria.

The accompanying goals have been figured to accomplish the point:

(1) To examine the effectiveness of inductive and deductive teaching techniques on male and female students' performance in basic science.

(2) To determine which teaching strategy is preferred by the teachers in teaching and learning basic science.

Research Questions

1. Which of the two teaching methods is the most effective and preferred for teaching male students' basic science in junior secondary school three (JSS III)?

2. Which of the two teaching methods is the most effective and preferred for teaching female students' basic science in junior secondary school three (JSS III)?

Research Hypotheses:

H₀₁: Inductive teaching method (ITM) and Deductive teaching method (DTM) have no significant effect on JSS III male students' performance in Basic science.

H₀₂: Inductive teaching method (ITM) and Deductive teaching method (DTM) have no significant effect on JSS III female students' performance in Basic science.

2. Methods

2.1. Research Design

This study embraced a semi test plan with pretest and posttest. Six (6) schools were purposively selected within the Abuja Municipal Area Council (AMAC) in Abuja, FCT based on the availability of qualified basic science teachers, some functional facilities for teaching students through inductive and deductive methods. The design was considered appropriate because it will enable the researcher to determine the level of detecting or notice rules, examples, patterns, and rules interaction among the junior secondary school three (JSS III), students. It also allows obtaining an opinion of the sample population, analyzing the data collected using appropriate data analysis technique, and reaching a reasonable conclusion about the people from the study's findings [25].

2.2. Population and Sample Size

This study population comprises the Junior Secondary School three (JSS III) students of JSS Maitama, JSS Gwarinpa estate, JSS Jabi, JSS Jikoyi, JSS Asokoro, JSS Area 11 selected through balloting from the Junior Secondary in Abuja Municipal Area Council (AMAC). The target population of the study is three thousand three hundred and twenty-two (3,322) students which comprised one thousand eight hundred and fifty-four (1,854) male students and one thousand four hundred and sixty-eight (1,468) female students. The sample size of six hundred and twenty (620) students comprising of three hundred and fifty-five (355) male students and two hundred and sixty-five (265) female students were selected through Krejcie and Morgan table of determining the sample size for research activities [26]. Proportional sampling method was used to select 79 out of 410 JSS III students in JSS Maitama, 108 out of 602 JSS III students in JSS Gwarinpa estate, 110 out of 594 JSS III students in JSS Jabi, 97 out of 504 JSS III students in Jikoyi, 105 out of 593 JSS III students in Jikoyi and 121 out of 619 JSS III students in Area 11. Stratified random sampling technique was applied to choose the sample of 620 students, to ensure that every member of the population has equal rights and a chance of being selected. Thus, the procedure ensured that each JSS III students in the six (6) schools have an equivalent possibility of being chosen in this investigation [27].

2.3. Research Instrument

Students in two of the selected schools (JSS Maitama and JSS Gwarinpa Estate) formed the experimental group one (1) and two (2) respectively while the remaining four schools

(JSS Jabi, JSS Jikoyi, JSS Asokoro and JSS Area 11) served as the control group. The experimental group one (I) was taught basic science using deductive teaching method (DTM) for about two months dependent on those topics from junior secondary school three (JSS III) curriculum. Experimental group two (II) were taught basic science using inductive teaching method (ITM) while students in the control group were taught basic science using combined teaching methods. The intact class was used in each of the schools with a sample size of six hundred and twenty (620) participants. The pretest was carried out before the treatment's commencement, and posttest was conducted after the treatment. The instruments for the study was the Basic Science Performance Test (BSPT).

2.4. Reliability and Validity

The instruments were presented to experience basic science teachers of junior secondary school for content validity. The tools were administered to forty (40) randomly selected students, twenty (20) in each of the two schools excluded from the study. The students' score in the Basic Science Performance Test (BSPT) were subjected to Pearson's Product Moment Correlation Coefficient (PPMCC) test and a reliability level of 0.83 were obtained.

2.5. Method of Data Analysis

This study's collected data were analyzed using descriptive and inferential analysis techniques after a preliminary test to check for the normality, presence of outliers, and equality of variance. To provide answers to the two research questions in this study, descriptive analysis like; mean and standard deviation was applied. One-way Analysis of Covariance (ANCOVA) was applied to the scores to test the research hypotheses. This statistical technique is used to detect a difference in at least three independent variables while controlling for scale covariates. A covariate isn't normally essential for the primary variable, but could influence the dependent variable and therefore needs to be controlled. In this study, ANCOVA was used because it seeks to investigate the effect of two different teaching methods on male and

female students' performance in basic science. The dependent variable is the mean posttest students' scores obtained from the basic science performance test (BSPT), the covariate is the pretest score while the independent variable is the three (3) groups, namely; experimental group one (I), two (II) and control group. The decision rule for the one-way Analysis of Covariance (ANCOVA) statistical techniques is; reject the null hypothesis (H_0) if the p-value is less than or equal to the level of significance of 0.05, and accept the alternative hypothesis (H_1) if the p-value is greater than the level of significant of 0.05, then. All the statistical analysis was performed using the Statistical Software for Social Science (SPSS) version 26.

3. Results

The study results are presented in three parts: the preliminary test results and descriptive and inferential statistics.

3.1. Preliminary Test Result

The results in (Table 1) presents Kolmogorov Smirnov, and Shapiro Wilks' test for normality of the student mean difference score according to the three groups. The p-values in all the group were greater than the level of significant=0.05, since $P > 0.05$, the proposed data is assumed to be normally distributed. In the same vein, the Levene's test for equality of variance of the students' performance in basic science in the three groups presented in (Table 2) indicated that; p-values of all the groups based on their gender were greater than the level of significant=0.05, which also meant that homogeneity of variance is assumed.

Figures 2 and 3 presented the normal Quartile- Quartile (Q-Q plot) and histogram with a normal curve for an experimental group I (a), experimental group II (b), control group (c) and the box plot (d) for the male and female students. The graphs confirm the normality results presented in Table 1. Since $P > 0.05$, the proposed data is assumed to be normally distributed.

Table 1. Normality test for male and female performance in basic science in the three groups.

		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Groups	Statistic	df	Sig.	Statistic	Df	Sig.
Male	Exp. group I	.092	42	.200*	.983	42	.760
	Exp. group II	.147	59	.003	.954	59	.025
	Control	.063	163	.200*	.991	163	.443
Female	Exp. group I	.101	42	.200*	.972	42	.371
	Exp. group II	.071	59	.200*	.984	59	.639
	Control	.049	163	.200*	.991	163	.431

*. Lower bound of the true significance. a. Lilliefors Significance Correction

Table 2. Levene's test for equality of variance test for male and female performance in basic science in the three groups.

Gender	F	df1	df2	p-value
Male	.530	2	352	.864
Female	.101	2	261	.904

3.2. Descriptive Statistics Results

Research Questions 1: Which of the two teaching methods is the most effective and preferred for teaching male students' basic science in junior secondary school three (JSS III)?

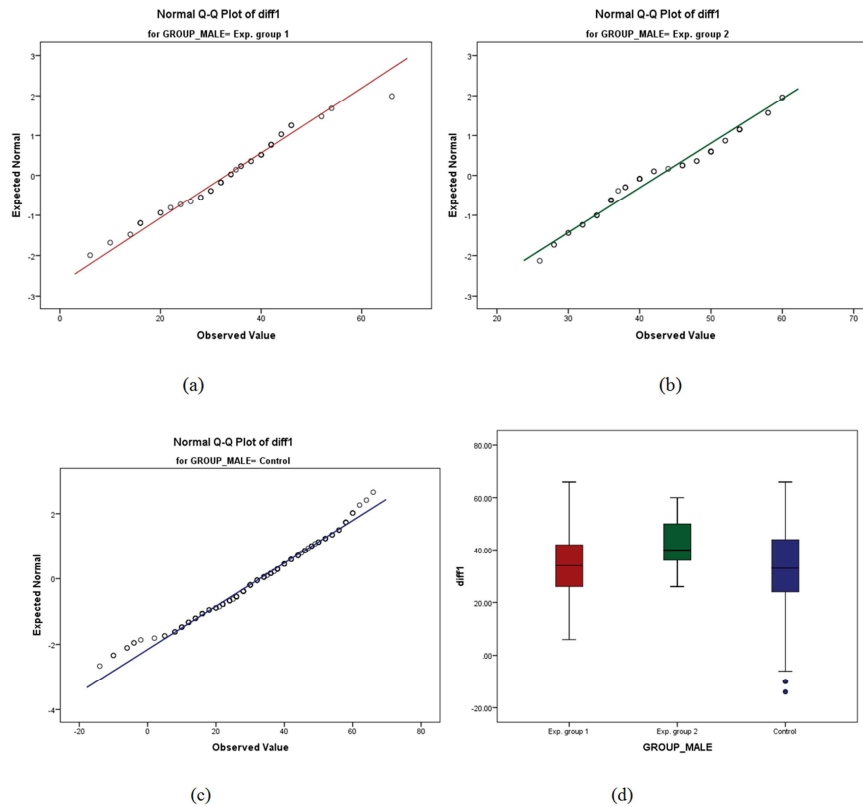


Figure 2. Normal Q-Q plot for experimental group I (a) Experimental group II (b) Control group (c) and box plot of the three group for male students (d).

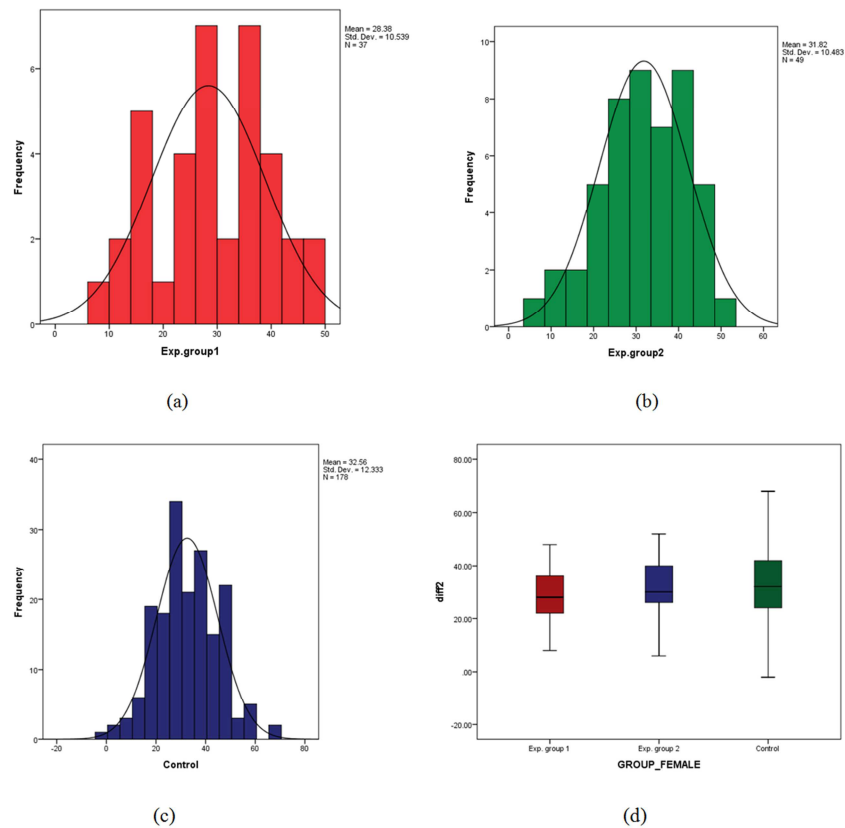


Figure 3. Normal histogram plot for an experimental group I (a) Experimental group II (b) Control group (c) and box plot of the three groups for female students (d).

The descriptive analysis of the male students' performance in basic science presented in (Table 3 and Figure 4) indicated that; the experimental group two (students taught basic science through inductive teaching method) with ($M=78.68$, $S. D=9.653$) performed better than the experiment group one (students taught basic science through deductive teaching method) with ($M=77.57$, $S. D=6.908$) and the control group (student taught using combined teaching methods) with ($M=68.27$, $S. D=12.086$). The students taught basic science through inductive teaching method had a high achievement of 42.8, while the students taught basic science through deductive and combined methods had a lower mean achievement of 33.1 and 32.8 respectively, this result implies that; the most effective and preferred teaching method for the male students is the inductive teaching method.

Research Questions 2: Which of the two teaching methods is the most effective and preferred for teaching female students' basic science in junior secondary school three (JSS

III)?

The result presented in (Table 4 and Figure 4) shows the descriptive analysis of the female students' performance in basic science. The result indicates that; the experimental group II (students taught basic science through inductive teaching method) with ($M=64.94$, $S. D=10.879$), performed better than the experiment group I (students taught basic science through deductive teaching method) with ($M=64.76$, $S. D=10.059$), and the control group (student taught using combined teaching methods) with ($M=64.87$, $S. D=10.326$). The female students taught basic science through inductive teaching method had the high achievement of 33.8, while female students taught basic science through deductive and combined methods had a lower mean achievement of 28.4 and 32.6 respectively, this result implies that; the most effective preferred way for the female students is the inductive teaching method.

Table 3. Mean and standard deviation of pre-BSPT and post-BSPT mean scores of JSS III Male students taught using deductive, inductive and combined method.

Male group	Type of test					Mean Diff.	
	Pretest			Post-test			
	N	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Exp. group I (deductive)	42	44.50	10.908	77.57	6.908	33.0714	12.27012
Exp. group II (inductive)	59	35.92	9.653	78.68	9.653	42.7627	8.94685
Control (Combined)	254	35.50	12.086	68.27	12.086	32.7677	15.20444
Total	355	36.63	12.062	71.10	12.062	34.4648	14.47561

Table 4. Mean and standard deviation of pre-BSPT and post-BSPT mean scores of JSS III female students taught using deductive, inductive and combined method.

Female group	Type of test					Mean Diff.	
	Pretest			Post-test			
	N	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Exp. group I (deductive)	37	36.38	8.190	64.76	10.059	28.3784	10.5392
Exp. group II (inductive)	49	31.12	7.070	64.94	10.879	33.8163	10.48347
Control (Combined)	178	32.31	7.582	64.87	10.284	32.5618	12.33291
Total	264	33.03	7.676	64.87	10.326	31.8371	11.81801

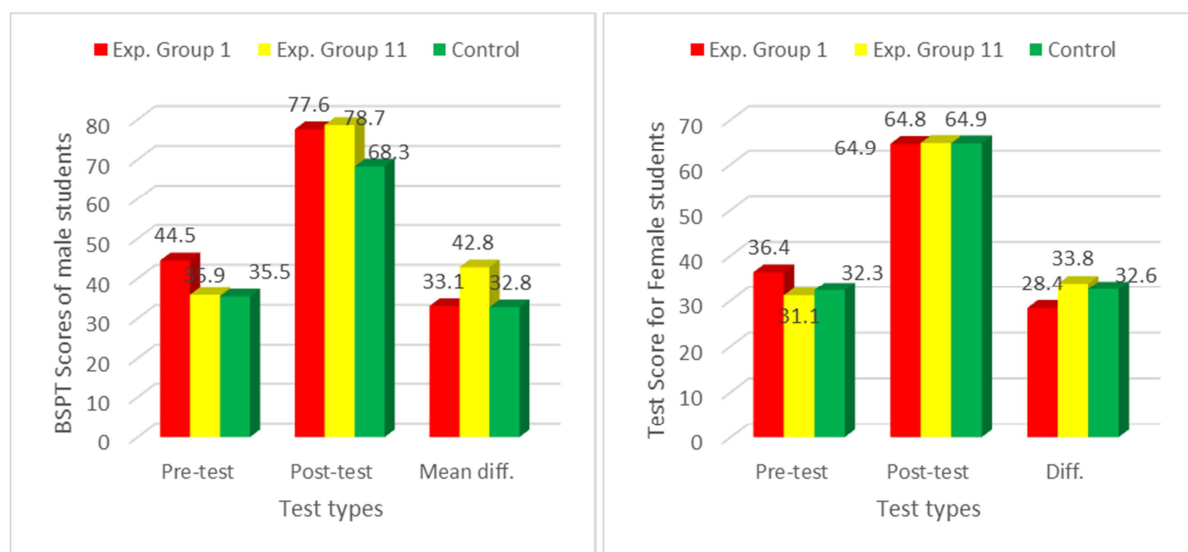


Figure 4. Mean Pretest, Posttest and difference in inductive, deductive and combined teaching methods for male and female student.

3.3. Inferential Statistics Result

Hypothesis 1: Inductive Teaching Method (ITM) and Deductive Teaching Method (DTM) has no significant effect on JSS III male students' performance in basic science.

The Analysis of Covariance (ANCOVA) result for the male students shows the main effect of inductive and deductive teaching method on their performance in basic science after the effects of the pretest score have been accounted for. The Analysis of Covariance (ANCOVA) result on male students' performance in basic science after being taught with inductive and deductive methods was; $F(2, 351) = 25.911$ and $p = 0.000$ (Table 5). The null hypothesis (H_0) which stated that; inductive teaching method (ITM) and deductive teaching method (DTM) has no significant main effect on JSS III male students' performance in basic science is rejected in favour of the alternative hypothesis (H_1). There was a significant difference in the mean posttest score performance of the male student [$F(2, 351) = 25.911$, $p = 0.000$] between experimental group one, experimental group two

and the control group while adjusting for pretest score. The size of the effect of the inductive and deductive teaching methods is given by the partial Eta Squared value of .129, which implies that the effect is small because its value falls between (0.1 – 0.2). This result also indicates that 12.9% of the male students' performance variance was explained by the experimental group I, II and control group. The Parameters estimate that the result of ($\beta = 0.111$, $p = 0.005$) revealed that the inductive and deductive teaching methods statistically significantly affect the students' performance in basic science (Table 6). The result implies that; a unit increase inductive and deductive teaching methods will lead to 0.111 increase the male students' performance in basic science. The pairwise comparison of male students' performance in basic science using adjustment for multiple comparisons (Bonferroni) presented in (Table 7) shows that; there is a significant difference between experiment group I and control group ($p = 0.000$) and between experiment group II and control group ($p = 0.00$).

Table 5. Summary of male student's ANCOVA result of the difference in posttest BSPT mean achievement of Experimental group I, II and Control groups.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7582.569 ^a	3	2527.523	20.200	.000	.147
Intercept	96769.651	1	96769.651	773.382	.000	.688
PRETEST	397.982	1	397.982	3.181	.075	.009
POSTEST_MALE	6484.119	2	3242.060	25.911	.000	.129
Error	43918.981	351	125.125			
Total	1846030.000	355				
Corrected Total	51501.549	354				

R Squared=.147 (Adjusted R Squared=.140)

Table 6. Parameter estimate of male students' mean achievement in the basic science of Experimental group I, II and Control groups.

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	64.317	2.324	27.680	.000	59.747	68.887	.686
PRETEST	.111	.062	1.783	.005	-.011	.234	.009

a. This parameter is set to zero because it is redundant.

Table 7. Pairwise Comparison of male students' mean achievement in the basic science of Experimental group I, II and Control groups.

(I) GROUP_MALE	(J) GROUP_MALE	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Exp. group 1	Exp. group 2	-2.062	2.321	1.000	-7.645	3.521
	Control	8.302*	1.946	.000	3.621	12.983
Exp. group 2	Exp. group 1	2.062	2.321	1.000	-3.521	7.645
	Control	10.364*	1.617	.000	6.475	14.253
Control	Exp. group 1	-8.302*	1.946	.000	-12.983	-3.621
	Exp. group 2	-10.364*	1.617	.000	-14.253	-6.475

Hypothesis 2: Inductive teaching method (ITM) and Deductive teaching method (DTM) have no significant effect on JSS III female students' performance in Basic science.

The Analysis of Covariance (ANCOVA) result for the female students presented in (Table 8), shows the effect of the inductive and deductive teaching method on their performance in basic science after the effects of the pretest score have been accounted for. The result was $F(2, 260) = 0.154$ and $p = 0.857$. The null hypothesis (H_0) which stated that; inductive teaching method (ITM) and deductive

teaching method (DTM) has no significant main effect on JSS III female students' performance in basic science is retained. There was no significant difference in the mean posttest score performance of the female student [$F(2, 260) = 0.154$, $p = 0.857$] between experimental group one, experimental group two and the control group while adjusting for pretest score. The size of the effect of the inductive and deductive methods is given by the partial Eta Squared value of .001, which implies that the effect is very small because the value falls between (0.1 – 0.2). This result

also indicates that 0.1% of the variance in the female students' performance is explained by the control group, experimental group one (I) and two (II). The coefficient results presented under the parameter estimates in (Table 9) shows that inductive and deductive teaching methods

positively and insignificantly affect the students' performance in basic science ($\beta=0.228$, $p=0.067$). The result implies that; a unit increase in inductive and deductive teaching methods will lead to 0.228 increases in the students' performance in basic science.

Table 8. Summary of female student's ANCOVA result of the difference in posttest BSPT mean achievement of Experimental group I, II and Control groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	780.019 ^a	3	260.006	2.480	.062	.028
Intercept	39436.488	1	39436.488	376.104	.000	.591
PRETEST2	779.314	1	779.314	7.432	.007	.028
GROUP_FEMALE	32.322	2	16.161	.154	.857	.001
Error	27262.341	260	104.855			
Total	1138897.000	264				
Corrected Total	28042.360	263				

a. R Squared=.028 (Adjusted R Squared=.017)

Table 9. Parameter estimate of female students' mean achievement in the basic science of Experimental group I, II and Control groups.

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	57.504	2.809	20.471	.000	51.973	63.035	.617
PRETEST2	.228	.084	2.726	.067	.063	.393	.028

a. This parameter is set to zero because it is redundant.

4. Discussion, Conclusion and Recommendation

In this study, the effect of inductive and deductive teaching methods on junior secondary students' performance in basic science among junior secondary school students in Abuja, Nigeria, was investigated. A sample size of six hundred and twenty (620) students comprising of three hundred and fifty-five (355) male students and two hundred and sixty-five (265) were involved in the study. The data for the study was collected through with the Basic Science Performance Test (BSPT). The preliminary test result revealed that; the data collected is assumed to be normally distributed, with few outliers and the variance across the groups considered approximately equal.

According to the results obtained from this study, the experimental group two (II) (students taught basic science through inductive teaching method) performed better than the experiment group one (I) (students taught basic science through deductive teaching method) and the control group (student acquainted with the combined teaching methods). The students taught basic science through inductive teaching method had a higher mean achievement, while the students taught basic science through deductive and combined methods had a lower mean achievement which implies that; the most effective and preferred teaching method is the inductive teaching method. The result obtained from the study is supported by previous studies that examined the effectiveness of inductive and deductive teaching and learning methods; this study reported that inductive teaching increases students' performance and that learning improves if inductive teaching is done before presenting general theories [10, 12, 14]. Another study on the application of inductive

and deductive teaching technique also concluded that learning is enhanced if teachers use methods that cause students to experience economic concepts before they begin to lecture over the general idea associated with that concept [15, 28].

Information gathered and dissected utilizing inferential insights shows a critical contrast in mean execution of the male understudies in the trial bunch one, trial bunch two and the benchmark group while adapting to pretest score. This outcome likewise demonstrates that 12.9% of the difference in the understudies' presentation was represented by the control group, experimental groups (I) and (II). It was additionally found that the inductive and deductive showing techniques measurably, essentially and emphatically influences the male understudies' presentation in fundamental science. The pairwise correlation of the male understudies' exhibition in essential science shows that; there is a huge contrast between the control group, experimental groups one (I) and (II). The female understudies' outcome uncovered that there was no huge distinction in their mean posttest score execution between trial bunch I, test bunch II and the benchmark group while adapting to pretest score. The size of the impact of the inductive and deductive techniques is small; this shows that the control group clarifies lone 0.1% of the change in the female understudies' exhibition, experimental groups one (I) and two (II). The boundary gauges show that inductive and deductive techniques emphatically and altogether influence fundamental science's understudies' exhibition. The findings corroborated with a study whose review focused at finding favoured styles of Iranian students of French as a Foreign Language (FFL) [24]. Besides, the distinction between sexual orientation-based learning propensities, discover that the decision of acceptance or allowance in language learning and the sex variable follows

various headings. This way, regarding the inductive methodology, it was found that the instructing strategies supported the male respondents. Simultaneously, the technique's extent was also connected with ladies whose inspiration is seen rather observably. Besides, the centrality is relative instead of critical in all the connections concentrated in the examination. Based on this study's findings, the following recommendations were made; teachers of basic science subject should consider applying more inductive teaching techniques during the teaching and learning of basic science in junior secondary schools. Secondly, all the necessary facilities and equipment needed for proper implementation should be provided by the school authorities. Finally, basic science teachers are to concentrate more on female students to improve their subject performance.

References

- [1] Chukwuneke and Chikwenze, (2012) Chukwuneke, B. U., & Chikwenze, A. R. (2012). The extent of implementation of universal basic education (UBE) programme in Nigeria: focus on Basic science curriculum. *Journal of Research and Development*, 4 (1): 116-126.
- [2] Ayua, G. A. (2011). Teachers' awareness and level of improvisation of primary science instructional materials in primary schools in Makurdi metropolis. *Benue State University Journal of Education*, 11, (44-50).
- [3] Wuyep, S. N. (2000). Teaching and learning science through activity-based methods at the elementary and junior secondary schools. In S. E. Opara, G. A. Diche, B. N. Tang'an & A. S. Dang (Eds.), *Methodology of Teaching - A handbook for students* (PP). Jos: WAIS Publishing Press.
- [4] Adams, S. O., & Onwadi, R. U. (2020). An empirical comparison of computer-assisted instruction and field trip instructional methods on the teaching of basic science and technology curriculum in Nigeria. *International Journal of Social Sciences & Educational Studies*, 7 (4), 22-35. <https://doi.org/10.23918/ijsses.v7i4p22>.
- [5] Igwe, I. O. (2003). *Methods of teaching science: Principles of science and science teaching in Nigeria: An introduction*. Enugu: Jones Communications.
- [6] Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering*, 123-138. <https://doi.org/10.1002/j.2168-9830.2006.tb00884>.
- [7] Landmark C. (2005). *Using Varied Instructional Techniques: Inductive and Deductive Teaching Approaches*.
- [8] Dameus, A., Tilley, D. S. and Brant, M. (2004). Effectiveness of Inductive and Deductive Teaching Methods in Learning Agricultural Economics: A Case Study. *NACTA Journal*, 48 (3): 7-13.
- [9] Narendra, K. S. and Yadav, A. K. (2017). Inductive and Deductive Methods in Mathematics Teaching. *International Journal of Engineering Research and Application*. ISSN: 2248-9622, Vol. 7, Issue 11, (Part -2) November 2017, pp. 19-22.
- [10] Klauer, K. J. (1996). *Teaching Inductive Reasoning: Some Theory and Three Experimental Studies*, *Learning and Instruction*, 6 (1), 37-57.
- [11] Qasim, G. (2011). "Comparative study of the inductive-deductive method of teaching Mathematics at elementary school level" (Unpublished M. Ed Thesis), D. I. Khan: I. E. R.
- [12] Shafter, C. A. (1989) *Comparison of Inductive and Deductive approaches to teaching French Language*. *Modern language journal*. 73 (4), 1989: 395.
- [13] Odizuru I. (2016). Deductive Versus Inductive Teaching Methods and Learning Outcomes in the French Language in selected schools in the Ogun State of Nigeria. *Journal of Modern European Languages and Literature (JMEL)*. 5: 40-52.
- [14] Jong, O. D. Acampo J. and Verdonk, A. (1995). Problems in Teaching the Topic of Redox Reactions: Actions and Conceptions of Chemistry Teachers. *Journal of Research in Science Teaching*, 32 (10): 1097-1110.
- [15] Nejla. (2000) *Comparison of inductive and deductive content sequence on students, Chemistry achievement, attitudes and academic self-concept* HACETTEPE University.
- [16] Silas, A. I., & Bright, O. (2012). "Comparative Effectiveness of Inductive Inquiry and A transmitter of Knowledge Models on Secondary School Students' Achievement on Circle Geometry and Trigonometry" *Bulletin of Society for Mathematical Services and Standards* ISSN: 2277-8020, Vol. 1 No. 3 (2012), pp. 33-46. www.ijmse.com.
- [17] Hafsah, T. (2014). The Effects of Inductive Teaching Methods in an Electrochemistry Class. *The 2014 WEI International Academic Conference Proceedings*, Bali, Indonesia, 137-148.
- [18] Kroflič, R. (2012). The role of artistic experiences in the comprehensive inductive educational approach. *Pastoral Care in Education*, 30 (3), 263-280. <https://doi.org/10.1080/02643944.2012.671342>.
- [19] Alzu'bi, M. A. (2015). Effectiveness of inductive and deductive methods in teaching grammar. *Advances in Language and Literary Studies*, (6) 2, 187-193. <https://doi.org/10.575/aiac.all.v.6n.2p.187>.
- [20] Çakır, I. & Kafa, S. (2013). English language teachers' preferences in presenting target language grammar. *Journal of Language and Literature Education*, 8, 39-51.
- [21] Paradowski, M. B. (2009). Deductive vs inductive teaching. *Science in* 1, 110-114. Retrieved from <http://sciencebin.wordpress.com/article/deductive-vs-inductive-teaching-2qpvtotrrhys1-23/>.
- [22] Ishola, A. F., Oluwole, Y. G. and Lawal, S. (2019). Assessment of Senior Secondary School English Teachers' Teaching Methods Employed in Teaching Grammar in Ilorin Metropolis. *Al-Hikmah Journal of Arts and Social Sciences Education*, (1): 2.
- [23] Mountone, P. (2004). *How to use examples effectively: Deductive vs Inductive approaches?* University of California, Santa Barbara.
- [24] Rahmatian, R. and Zarekar, F. (2016). Inductive and Deductive Learning by Considering the Role of Gender, A case Study of Iranian French-Learners. *International Educational Studies*, 9 (12): 254-267. <https://doi.org/10.5539/ies.v9n12p254>.

- [25] Mayer, J. D. & Allen, J. L. (2013). A Personality Framework for the Unification of Psychology. *Psychology*. Sage Journal. <https://doi.org/10.1037/a0032934>.
- [26] Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*.
- [27] Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approach*. Sage publications.
- [28] Neubert, G. A., & Binko, J. B. (1991). Using the Inductive Approach to Construct Content Knowledge, *Teacher Educator*, 27 (1), 31-37.