

GENDER DIFFERENCE IN INTEREST LEVEL,
ACHIEVEMENT AND RETENTION OF SCIENCE
STUDENT'S EXPOSED TO CONCEPTS OF HABITAT,
PETRO-CHEMICAL AND CRUDE OIL THROUGH OUTDOOR
SCIENCE ACTIVITY TEACHING STRATEGY

**GULEE, SULEIMAN DOGONYARO (Ph.D); PETER, JOSEPHINE
DOGARA; AND BARNABAS, HANNATU**

*Department of Integrated Science, Kaduna State College of Education, Gidan
Waya, Pmb 1024 Kafanchan, Kaduna State*

ABSTRACT

This study investigated gender differences on interest level, achievement and retention of science students' exposed to concepts of habitat, petro-chemical and crude oil through Outdoor Science Activity Teaching Strategy (OSATS). Quasi-experimental, non-equivalent, non- randomized pre-test post-test control group design was used for the study. A sample of 246 Basic Science students (JSS II) involving 125 males and 121 females were taught the concepts of habitat, petro-chemical and crude oil using OSATS. The instruments used for the data collection were: Basic Science Achievement Test (BSAT) and Basic Science Interest Inventory (BSII) developed by the researcher with the reliability

Introduction:

Basic science is not only the pre-requisite for further studies in science but very essential for basic training in scientific skills required for human survival, sustainable development and societal transformation. Despite the importance attached to Basic science, there has been low achievement in the subject. This is evidently seen in academic performance of Basic Science students in Basic Education Certificate Examination (BECE) in Nigeria Schools which has been very poor over the

coefficient(r) of 0.92 and 0.73 respectively. And was determined using Kuder Richardson formula 20 and Cronbach alpha respectively. The data generated was analyzed using mean and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test hypotheses at 0.05 level of significant. The study revealed that male and female science students taught concepts of habitat, petro-chemical and crude oil using OSATS did not significantly differ in interest level, achievement score and retention score. Based on the findings the study recommended adequate training of teachers on the use of OSATS for student's acquisition of appropriate skills and knowledge in Basic science.

KEYWORDS: Gender difference, Achievement, Interest, Retention,

Years (Chief Examiner Reports, 2015,2016,2017,2018).In Kaduna State particularly the result of Basic science showed that the average failure rate from 2015-2017 ranged from 48.28% -51.72% (Ministry of Education, Kaduna State,2018).This implies that the academic performance in Basic Science has not been impressive in Nigeria secondary Schools.

Research findings also showed that large number of students seems to learn very little of Basic Science in Secondary Schools. They tends to learn Basic Science by rote and they found science to be difficult, boring and not interesting to them (Salau, 2007).Number of factors have been identified from various studies to be responsible for the poor academic performance and poor level of interest in Basic Science. These include the methods or strategies used to teach Basic Science among other factors (Damole, 2011 and Wakili, 2018).The researcher's observation shows that, the poor achievement of students in Basic science is mostly noticed along the gender line. Simply means that the poor achievement of science students is further worsened by gender imbalance leading to the problem which now constitutes a major research focus across the globe (Wakili, 2018; Basey, Joshua & Asim, 2015).

Similarly, Atouigba, Vershima, Okwu and Ijenkeli (As cited in Okoro & Unamba, 2017) postulate that there has been global concern about gender differences in students' achievement and interest in science and mathematics. According to Okoro and Unamba (2017) poor academic performance and low interest in science by the majority of students is fundamentally linked to application of ineffective teaching methods by the science teachers to impart knowledge and skills to learners. Most Basic science teachers are glued to the use of traditional approach of teaching which is not student-centered and does not allow the students to express themselves. Basic science teachers need to adopt innovative strategies, which are student-centered in order to develop student's interest in the subject and advance their academic performance. One among the innovative teaching strategies is Outdoor Science Activity Teaching Strategy (OSATS).

Outdoor Science Activity Strategy (OSATS) is the strategy that is widely applied and can be used to teach both concepts and skills (Knapp, 1999). It is a teaching strategy in which the learners are actively engaged in learning by doing outside the normal classroom or laboratory under the instructional guidance of the teacher. It is also an instructional model that centers learning on solving a particular problem posed by the teacher or answering a central question using outdoor as a classroom as well as instructional materials or resources.

This study is therefore designed to investigate the gender differences on interest level, achievement and retention of science students' exposed to concepts of Habitat, petro-chemical and crude oil through Outdoor Science Activity Teaching Strategy.

Statement of the Problem

Research evidence has shown that a large number of students seem to learn very little of science in Secondary Schools. They tend to learn Basic Science by rote and they find science to be difficult, boring and not interesting (Salau, 2007). And this has eventually led to poor achievement in Basic science. However, a number of factors have been

identified from various studies to be responsible for the low level of interest in Science. These include the methods use in teaching Basic Science among other factors (Damole, 2011 and Wakili, 2018). It is possible students' gender can influence students' achievement, retention and interest when the concepts of habitat, petro-chemical and crude oil are taught using OSATS. Similarly, research reports from Katcha, 2015, Okeke, 2016; Wakili, 2018 & Ahmad, 2014, showed contradictory results on gender influence on science students' interest level, student's academic achievement and retention. This has resulted to the need to verify gender influence on student's interest level, academic achievement and retention when taught the concepts of Habitat, Petro-chemical and crude oil using OSATS.

Purpose of the study

The main purpose of this study was to investigate gender differences on interest level, achievement and retention of science students' exposed to concepts of Habitat, petro-chemical and crude oil through Outdoor Science Activity Teaching Strategy. Specifically it seeks to:

- i. ascertain the difference in mean interest level of male and female students taught the concepts of habitat, petro-chemical and crude oil using OSATS;
- ii. ascertain the difference that exists in Mean achievements scores of male and female students taught the concepts of habitat, petro-chemical and crude oil using OSATS;
- iii. ascertain the difference that exists in Mean retention scores of male and female students taught the concepts of habitat, petro-chemical and crude oil using OSATS.

Research Questions

The following research questions were raised and answered:

1. What is the difference in Mean interest level of male and female students taught the concept of habitat, petro-chemical and crude oil using OSATS?

2. What is the difference in Mean achievement scores of male and female Students taught the concept of habitat, petro-chemical and crude oil using OSATS?
3. What is the difference in Mean retention scores of male and female Students taught the concept of habitat, petro-chemical and crude oil using OSATS?

Hypotheses

The following null hypotheses were formulated and tested at $p \leq 0.05$ level of significance:

- Ho₁:** There is no significant difference in the Mean interest level of male and female students taught the concept of habitat, petro-chemical and crude oil using OSATS.
- Ho₂:** There is no significant difference in the mean achievement scores of male and female students taught the concept of habitat, petro-chemical and crude oil using OSATS.
- Ho₃:** There is no significant difference in the mean retention scores of male and female students taught the concepts of habitat, petro-chemical and crude oil using OSATS.

Research Methodology

The study adopted quasi-experimental non-equivalent pre-test-post-test control group design. This design was appropriate because the researcher didn't randomly assigned subjects to treatment and control condition; rather intact classes were assigned to the groups so as to avoid the disruption of the normal class periods. The design was necessary also because it is appropriate for analyzing gain scores (i.e. the difference between pre-test and post-test scores) in addition to comparing scores between the groups (treatment and control) on the post-test.

The Population of the study comprised of 7,264 Junior Secondary School Two (JSS II) Basic Science Students of 33 Secondary Schools of Kafanchan Zone, Kaduna State, and Second Term 2018/2019 Academic Session. The male students were 3,383 and female were 3,881. The sample size of 246

Junior Secondary Two (JSS II) Basic Science Students was used for the study (125 males and 121 females) in the four sampled schools. Stratified Sampling technique was used to select the four sampled schools. The instruments used for data collection were Basic science Achievement Test (BSAT) and Basic Science Interest Inventory (BSII). The Basic Science Achievement Test (BSAT) was used for collection of pre-test achievement scores, post-test achievement scores and retention test scores. The Basic Science Interest Inventory (BSII) was used for collection of pre-test, posttest data on interest level. BSAT was made up of two Sections; Section A and Section B. Section A contain personal data while Section B contained Multiple Choice Objectives test item. The BSAT was 40 items, 4-Option Multiple Choice Objective tests based on the content of the study which were the concepts of Habitat, Petrochemical and Crude oil while the BSII was made up of two Sections: Section A contains Personal information and Section B contains Items and instruction for ticking the chosen response for each item. The BSII formed 30 item Interest Inventory developed by the researcher. It has 4-point scale response. The responses are Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD). The instruments were validated by the two experts in measurement and evaluation and two experts in science education. To determine the reliability of the instruments: BSAT and BSII were pilot tested using randomly selected school that was not part of the main sample of the study but within the study population. The reliability coefficient of BSAT was determined using Kuder Richardson's formula 20 (K-R20) procedures while BSII was also determining using Cronbach alpha procedures. The reliability coefficients for the BSAT and BSII obtained were 0.92 and 0.73 respectively.

Prior to the commencement of the teaching in sampled schools, BSAT and BSII were administered as Pre-test to the Experimental and Control groups. One hour was allowed for the test. Responses of students in the two groups were scored by the researcher to determine their equivalent. Two double lessons of eighty (80) minutes per week were used to teach both Experimental and Control groups in concept of habitat, petro-chemical and

crude oil in Basic Science content for a period of five (5) weeks. The Experimental group received treatment using OSATS instructional model which was withheld for Control group. However, the Control group was taught the same topics using Conventional Method of teaching (CMT). The BSAT and BSII were used to collect Post-test scores. The Post-test was administered to both the Experimental and Control groups at the end of the treatment. One hour was allowed for the test. The test items of BSAT and BSII administered as Pre-test was rescheduled and administered as Posttest and Retention test. Two weeks after the Post-test, Retention test (Post-posttest) was administered by the teachers. One hour was also allowed for the test. The tests were also marked, scored and collated by the teachers. The generated data were analyzed using Mean and Standard Deviation to answer research question while Analysis of Covariance (ANCOVA) was used to test hypotheses at 0.05 level of significance.

Results

Research Question One: What is the difference in Mean Interest Scores of Male and Female Students taught the concepts of habitat, petro-chemical and crude oil using OSATS?

Table 1: Mean and Standard Deviation of Students Interest Level by gender

Group	N	Pre-test		Post-test		Mean Gain	Total Mean	Mean Difference
		X	SD	X	SD			
Male	79	14.42	3.38	25.56	3.08	11.14	39.98	1.9
Female	77	13.81	2.89	24.22	4.90	10.41	38.08	
Total	156							

Table 1 shows a Mean Interest Pre-test Score of 14.42 with a Standard Deviation of 3.38 for Male Students taught Basic Science using Outdoor Science Activity Strategy and a Mean Interest Pre-test Score of 13.81 with a Standard Deviation of 2.89 for Female Students taught using Outdoor

Science Activity Teaching Strategy. The Post-test shows a Mean Interest Score of 25.56 with a Standard Deviation of 3.08 for Male Students taught using Outdoor Science Activity Strategy and a Mean Interest Score of 24.22 with a Standard Deviation of 4.90 for Female Students taught using Outdoor Science Activity Teaching Strategy. This indicates that the Mean Interest Score of Male and Female Students' taught Basic Science using Outdoor Science Activity Teaching Strategy was slightly different. This means that the Mean Interest Scores of Male and Female Students were not influenced by Students' gender. The difference in Mean Interest Scores of Male and Students taught using Outdoor Science Activity Teaching Strategy was 1.9.

Research Question Two: What is the difference in Mean Achievement Scores of Male and Female Students taught the concepts of habitat, petro-chemical and crude oil using Outdoor Science Activity Teaching Strategy?

Table 2: Mean and Standard Deviation of Achievement Scores by Gender

Group	N	Pre-test		Post-test		Mean Gain	Total Mean	Mean Difference
		\bar{X}	SD	\bar{X}	SD			
Male	79	26.72	3.31	31.66	1.79	4.94	58.38	
								0.23
Female	77	26.93	3.57	31.22	3.00	4.29	58.16	
Total	156							

Table 2 shows a Mean Achievement Pre-test score of 26.72 with a Standard Deviation of 3.31 for Male Students taught using Outdoor Science Activity Teaching Strategy and a Mean Achievement Pre-test Score of 26.93 with a Standard Deviation of 3.57 for Female Students taught using Outdoor Science Activity Teaching Strategy. The Post-test shows a Mean Achievement Score of 31.66 with a Standard Deviation of 1.79 for Male Students taught using Outdoor Science Activity Teaching Strategy and a Mean Achievement score of 31.22 with a Standard Deviation of 3.00 for

Female Students taught using Outdoor Science Activity Teaching Strategy. This indicates that the Mean Achievement Scores of Male and Female Students' taught Basic Science using Outdoor Science Activity Teaching Strategy were slightly different. This implies that the Mean achievement score of male and female students taught with OSATS is not influenced by gender. Thus, the difference in Mean Achievement Scores of Male and Female Students taught using Outdoor Science Activity Teaching Strategy was 0.23.

Research Question Three: What is the difference in Mean Retention Scores of Male and Female Students taught the concepts of habitat, petro-chemical and crude oil using Outdoor Science Activity Teaching Strategy?

Table 3: Mean and Standard Deviation Retention Scores of Students by Gender

Group	N	Pre-test		Post-test		Mean Gain	Total Mean	Mean Difference
		X	SD	X	SD			
Male	79	26.59	2.97	30.38	2.67	3.79	56.97	
								0.26
Female	77	26.53	3.02	30.18	2.63	3.65	56.71	
Total	156							

Table 3 shows a Mean Retention Pre-test Score of 26.59 with a Standard Deviation of 2.97 for Male Students taught Basic Science using Outdoor Science Activity Teaching Strategy and a Mean Retention Pre-test Score of 26.53 with a Standard Deviation of 3.02 for Female Students taught using Outdoor Science Activity Teaching Strategy. The Post-test shows a Mean Retention Score of 30.38 with a Standard Deviation of 2.67 for Male Students taught using Outdoor Science Activity Teaching Strategy and a Mean Retention Score of 30.18 with a Standard Deviation of 2.63 for Female Students taught using Outdoor Science Activity Strategy. This indicates that the Mean Retention Scores of Male and Female Students' taught Basic Science using Outdoor Science Activity Teaching Strategy

were slightly difference. The difference in Mean Retention Scores of Male and Female Students taught using Outdoor Science Activity Teaching Strategy was 0.26. This implies that gender has no influenced on mean retention scores of students taught with OSATS.

Hypothesis Testing

Ho₁: There is no significant difference in the Mean Interest level of Male and Female Students taught the concepts of habitat, petro-chemical and crude oil using OSATS.

Table 4: Summary of Analysis of Covariance of Student Mean Interest Scores by Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	65.307 ^a	2	32.654	2.057	.130	.017
Intercept	5231.462	1	5231.462	329.500	.000	.576
Pretest	24.805	1	24.805	1.562	.213	.006
Gender	35.589	1	35.589	2.242	.136	.009
Error	3858.107	243	15.877			
Total	146196.000	246				
Corrected Total	3923.415	245				

a. R Squared = .017 (Adjusted R Squared = .009)

Table 4 shows the Analysis of Covariance carried out to determine whether Male and Female Students taught Basic Science using OSATS differed significantly in their Interest level in Basic Science. This test resulted to F-value 2.242 which is not significant at .136 which is above 0.05 ($p > .05$). The Null hypothesis as formulated was not rejected. This implies that there was no significant difference in the Mean Interest level of Male and Female Students taught Basic Science using OSATS.

Ho₂: There is no significant difference in the Mean Achievement Scores of Male and Female Students taught the concepts of habitat, petro-chemical and crude oil using OSATS.

Table 5: Summary of Analysis of Covariance (ANCOVA) on Students' Mean Achievement Scores by Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	406.251 ^a	2	203.125	15.547	.000	.113	
Intercept	1721.171	1	1721.171	131.734	.000	.352	
Pretest	376.280	1	376.280	28.799	.000	.106	
Gender	36.695	1	36.695	2.809	.095	.011	
Error	3174.920	243	13.066				
Total	218194.000	246					
Corrected Total	3581.171	245					

a. R Squared = .113 (Adjusted R Squared = .106)

Table 5 shows Analysis of Covariance carried out to determine whether male and female students taught Basic Science using OSATS differed significantly in their Mean Achievement Score. This test resulted to F-value 2.809 which is not significant at .095 ($p > .05$) which is above .05 the hypothesis was formulated. The null hypothesis formulated was retained. Thus, there was no significant difference in the Mean Achievement Scores of Male and Female Students taught using OSATS. This implies that the Mean Achievement Score of Students taught Basic Science using OSATS does not differ significantly with regards to gender of the students.

H₀₃: There is no significant difference in the Mean Retention Scores of Male and Female Students taught the concept of habitat, petro-chemical and crude oil using OSATS.

Table 6: Summary of Analysis of Covariance (ANCOVA) on Students' Mean Retention Scores by Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	733.588 ^a	2	366.794	34.829	.000	.223	
Intercept	1407.618	1	1407.618	133.662	.000	.355	
Pretest	731.499	1	731.499	69.460	.000	.222	

Gender	.969	1	.969	.092	.762	.000
Error	2559.078	243	10.531			
Total	205450.000	246				
Corrected Total	3292.667	245				
a. R Squared = .223 (Adjusted R Squared = .216)						

Table 6 shows result of Analysis of Covariance carried out to determine whether Male and Female Students taught using OSATS differed significantly in their Mean Retention Scores in Basic Science. This test resulted to F-value .092 which is not significant at .762 which is above .05 ($p > .05$) the hypothesis was formulated. The null hypothesis as postulated was not rejected. Thus, there was no significant difference in the Mean Retention Scores of Male and Female Students taught using OSATS. This implies that the Basic Science retention score of students taught Basic Science using OSATS does not differ significantly with regards to gender of the students.

Discussion

The result presented in Table 1 shown answer to research question one and Table 4 shown the Analysis of Covariance test of hypothesis One. The finding revealed that the mean interest score of students taught using OSATS was not influenced by gender. This is an indication that gender has no influence on the mean interest scores of students taught using OSATS. Hence, the interaction effect of OSATS on interest of students and gender was found not to be significant. This implies that the effectiveness of OSATS on students' interest in Basic Science does not depend on gender. Any observed difference in mean interest level is not due to gender perhaps due to other factors. The OSATS here showed to be more effective than CMT in stimulating students' interest in Basic Science regardless of Gender. This finding is in agreement with Jolly (2010) and Baran (2016) that reported no significant effect of gender on students development of interest in science. They also reported that female students showed equal interest with their male counterparts. This finding contradicted Desyet.al (2007)

and Godpower & Ihenko (2017) whose study showed that gender have a significant influence on interest of students towards science. The findings further reported that male have more interest in science than female. Some studies also on gender influence on students' interest in science were with the opinion that boys are more exposed to scientific activities very early in life than boys. More over, they are more encouraged to enter for more related scientific courses like Engineering and Technology while girls for Biology, Home Economics, Commercial courses and other related domestics courses. The finding of this study has shown that, giving equal science and unlimited access to education for females, it would as well develop their interest in science generally. The implication is that the use of OSATS which shows to be gender inclusive strategy has eliminated masculine image of science related differences in students' interest in favor of females in this study. Finally, the researcher tender that since OSATS is a gender friendly instructional strategy which involves social interactive with child's social environment, it facilitates self expression and clarifies thinking which was the main source of their interest.

The result presented in Table 2 provides answer to research question two which revealed that there was no significant difference in the mean achievement scores between male and female students taught Basic Science using OSATS. However, Analysis of Covariance in Table 5 indicates that, there is a significant difference in mean retention scores of students taught using OSATS and those taught with CMT. In other words, male and female students did not differ significantly in their mean achievement scores as a result of exposure to OSATS. However, the achievement of the male students was slightly higher than that of their female counterparts, even though it was not significant. This slight difference in the achievement of male students and their female counterparts could be as a result of the nature of instructions delivered to the students, which enabled both the male and female students to be actively involved during the teaching and learning process. Similarly, the difference in the score of male students and their female counterparts could be as a result of the student's disposition to active participation in science activity outside the classroom, both male

and female students had equal opportunity to participate actively. Though the female students made considerably good effort based on their results. The implication of this finding is that OSATS as an instructional strategy is not gender bias, which corroborates with the views of Achor & Amadu (2015) findings that there was no significant difference between the mean achievement scores of boys and girls exposed to OSATS. Ajai & Imoko (2015) findings also shows that male and female students taught using OSAS did not differ significantly in their achievement scores in science, male and female students are capable of competing and collaborating in science. This shows that performance is a function of orientation not gender. Again, Joseph, John, Eric, Yusuf & Olubunmi (2015) study showed that even though the male students had slightly better performances compared to female students, it was not significant. Saidu and Suleiman (2014) findings also showed no significant difference in the academic performance of male and female students in science, thus showing that fieldtrip is gender friendly. Conversely, the findings contradicted the study of Ugwu (2016) which revealed that there was a significant gender influenced on students' achievement in Physics. Teaching strategy like the use of OSATS provides students' interaction with the natural learning environment which invariably provides meaningful learning activities. Meaningful learning activities built on prior knowledge motivate students and foster their interest in their effort to executively control their own cognitive process.

Evident from this study recorded in Table 3, answer research question three revealed that mean retention scores between male and female students taught Basic Science using OSATS and those taught using CTM in the achievement test did not differed. This implies that student's gender does not influence students' retention in Basic Science. Therefore gender influence on the mean retention score of students taught using OSATS was not significant. This finding agrees with the findings of Joseph et.al (2015) and Eze et.al (2016); whose study revealed that there was no significant difference in the mean retention scores of male and female students when taught using outdoor instruction. The reason for non-significance

difference between male and female students could be that, understanding and retention are products of meaningful learning, when teaching is effective and meaningful to the students whether male or female there would be no need of difference in scores. This finding supported by Abimbola in Stanley (2008) who observed that the type of instructional strategy used does not discriminate between male and female. Therefore, the Outdoor Science Activity Teaching Strategy is gender friendly as far as this study is concerned. In addition this finding contradicted Ajai & Imoko (2015), who found significant gender influence on mean retention score in Basic Science when taught using OSATS. The findings also contradicted similar innovative strategy reported by Okeke (2011) revealed that the influence of gender on mean retention score of science students taught using Mind Mapping Strategy was significant.

Conclusions

The study concludes that male and female science student's acquisition of knowledge and skills of the concepts of habitat and petro-chemical and crude oil when taught using OSATS is not significant. This implies that there is no significant gender difference in interest level, achievement and retention when students are taught the concepts of habitat, petro-chemical and crude oil using OSATS.

Recommendation

On the basis of the findings of this study, the following recommendations were made:

1. Basic Science teachers should not introduce gender discrepancies when using OSATS. They should as much as possible eliminate contents, instructional techniques and materials that may bring about gender differences in the teaching and learning Basic science and technology.
2. Since OSATS is found to be an effective teaching strategy for improving students mean Achievement score mean interest score and mean retention score in science regardless of the gender. Basic

Science teachers should adopt it as a teaching strategy in Junior Secondary Schools.

3. The teacher training institutions such as Colleges of Education, Faculty of Education in Universities should include the use of OSATS in the Science method course content fully to ensure the training of the teacher trainee.

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