



Gender Differences on Upper Basic Students' Interest and Performance in Basic Science Using the Asei-Pdsi Teaching Approach in Bauchi Metropolis

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Abstract

The study investigated gender differences on students' interest and performance in Basic science using ASEI-PDSI (Activity, Student-centred, Experiment, Improvisation – Plan, Do, See and Improve) teaching approach. The design of the study was quasi-experimental research design. Simple random sampling was employed to select 82 students from two intact classes. Basic Science Performance Test (BSPT) and Basic Science Interest Rating Scale (BSIRS) were the instruments for data collection. The reliability of BSPT and BSIRS was determined using Kuder-Richardson 20 (K-R20) and Cronbach Alpha and the reliability coefficient 0.81 and 0.75 was obtained respectively. Mean and standard deviation were used to answer the research questions while, the hypotheses were tested at 0.05 level of significance using ANCOVA. The findings of the study revealed that, there was no significant gender difference in the interest and performance. The study recommended that, the application of ASEI-PDSI can bridge the gender gap in students' interest and performance.

Keywords: Interest, Performance, ASEI-PDSI Teaching Approach

Introduction

Gender is the physical, biological, mental, and behavioural qualities and differences which males and females (masculine and feminine) in a population are known for. Gender differences in students' interest and performance have been one of the greatest challenges confronting the teaching and learning of science subjects. This problem has drawn the attention of researchers, education policy-makers and made it necessary for science educators and educational psychologists to come up with effective instructional strategies that are learner-friendly, can arouse the interest of the students toward learning, and put an end to the existing difference. Ojo (2015) reported that Universal Basic Education UBE aims at closing the difference that exists among students as a result of gender, through making education at the basic level a gender-friendly education as a way of reducing poverty, promoting and social, economic development. According to Abubakar (2015) science education reform emphasizes the elimination of gender differences in students' performance and call for science teachers to work effectively in putting an end to the difference in learning science subjects such as Basic science.

Basic science is the first form of pure science students come across at the upper basic (junior

secondary I-III) level of education in Nigeria. Basic science is a requirement and foundation for studying science-related subjects (Biology, Physics and Chemistry) at senior secondary level of education and its curriculum is pure science. Agu and Samuel (2018 a) concluded that efficient teaching and learning of Basic science at upper basic level will inevitably result in students' success in studying science-oriented subjects at the senior secondary level of education. In view of this, Basic science is given special attention in the basic education curriculum.

With all the roles Basic science play in grooming future scientifically literates in Nigeria, Kabutu, Oloyede and Bandele (2015), Samuel (2018) and Ukoh and Adejimi (2018) revealed that the teaching and learning of Basic science is not producing intended results, most of the Basic science teachers applied conventional teaching methods while teaching. These conventional teaching methods of teaching do not provide the students with the opportunity to actively participate and apply their creative mind during the teaching and learning processes and resulting to difference in performance and interest among male and female students. Similarly, studies by Oludipe and Oludipe (2018), Bash et al., (2020) revealed that the conventional teaching methods used as a means of teaching Basic



science in our classrooms could interact with gender to influence students' performance.

Gender difference in the learning of Science, Technology, Engineering and Mathematics (STEM) subjects is causing a serious setback to Nigeria's quest for development in the field of science and technology because in Nigeria these subjects are mostly seen as male-centered. Huang et al., (2020) maintain that females are left behind in the field of STEM which leads to male dominance in Nigeria's science and technology endeavors. The male dominance according to Umar and Samuel (2018) resulted from the superiority influence that the male gender has over their female counterparts due to sociocultural practices of Nigerians especially in Northern region of the country, this resulted in gender stereotypes even in our science classrooms which might directly affect their interest toward studying sciences. This is testified by Godpower-Echie and Ihenko (2017) work that deals with gender differences on students' interest and achievement in Integrated science (now Basic science) and reported that there is a significant gender gap in students' interest in Basic science, male students show high interest toward learning Basic science compared to their female counterparts. Oluyemo et al., (2020) reported that male students show high interest in studying Mathematics than female counterparts. In the same vein, Jonathan, Ehud and Chukwudi (2017) maintain that male students have high interest in studying Basic technology than their female counterparts. In view of the findings of these studies, it is revealed that female students show lower interest in learning STEM subjects. Oluyemo et al., (2020) concluded that students' academic performance or achievement is significantly influenced by their level of interest in learning. This implies that the importance of interest on students' academic performance cannot be overemphasized.

Studies by Agu and Samuel (2018-b); Okwara, Adejoh, and Tafi (2019); Edoho et al. (2020) have identified teachers' application of conventional teaching methods as the causes of the gender difference in students' performance in science classrooms. Godpower-Echie and Ihenko (2017); Agu and Samuel (2018-a) call for Basic science teachers to apply teaching and learning strategies that encourage both male and female students' active participation and stimulate their interest in learning which are the determinants of academic performance. UNESCO (2017) concluded that the gender

difference in students' performance and interest in STEM subjects (Basic science inclusive) can be eliminated through the application of an effective instructional strategy that is innovative, learner-friendly, and actively engages and equally arouse students' interest during the instructional processes. Therefore, there is the need to adopt an innovative and learner-friendly instructional strategy that will bridge the performance and interest gaps between male and female students in Basic science. The ASEI-PDSI teaching approach is one of such innovative strategies that aim at remedying the ineffectiveness of conventional teaching methods and equally enhance the students' academic performance and interest irrespective of gender.

The ASEI-PDSI stands for Activity, Student-centered, Experiment, Improvisation- Plan, Do, See and Improve. It is an innovative instructional approach that calls for a paradigm shift from the teaching methods that are knowledge-oriented to teaching approach that is activity-oriented, from the conventional teacher-centered methods to learner-centered teaching approach where the emphasis of teaching and learning activities are on the learner and promotes continuous progress in learning outcomes. According to Winrose, Ayere and Rabari (2019) using ASEI as medium of instruction in science classrooms provide the students with ability for active and constructive participation in the teaching and learning activities and ability to transfer what was learned to the solutions of problems in real life situation. Winrose Ayere and Rabari added that proper Planning, Doing, Seeing and Improvement (PDSI) is required for effective evaluation of set behavioural change on students and answering the questions on how the activity is being conducted when ASEI is used as medium of instruction. Mpewe (2018) reported that ASEI-PDSI approach of teaching and learning encourages independent learning and provides the learners with the opportunity to actively participate and apply their creative mind during teaching and learning processes.

According to Strengthening of Mathematics and Science Education (SMASE, 2012) the improvisation in ASEI aims at encouraging constructive use of the local and available resources that are concrete and familiar to the students to facilitate active participation during the teaching and learning and to carry out simple experiments to arouse student's interest, curiosity and active participation. The active participation of learners in



teaching and learning processes yields capabilities, such as independent-learning, social interaction, healthy competition and self-evaluation among the learners, which might enhance students’ performance and interest. As a result of such learning capabilities contained in ASEI-PDSI teaching approach, Ogwah, Akpa and Ndudirim (2021) reported that Science Teachers Association of Nigeria (STAN) advocated for teaching Basic science using ASEI-PDSI teaching approach.

The objective of the study was to investigate the effects of ASEI-PDSI teaching approach on male and female upper basic students’ interest and performance in Basic science.

Research Questions

The following research questions guided the study

1. What is the difference in the interest mean scores of male and female students taught Basic science using ASEI-PDSI teaching approach?
2. What is the difference in the performance mean scores of male and female students taught Basic science using ASEI-PDSI teaching approach?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

Ho₁: There is no significant difference in the interest mean scores of male and female students taught Basic science using ASEI-PDSI teaching approach.

Ho₂: There is no significant difference in the performance mean scores of male and female students taught Basic science using ASEI-PDSI teaching approach learning strategy.

Methodology

The study employed a pre-test post-test quasi-experimental research design. The design was employed to because the authorities of the school did not allow the researcher to randomize their classes for the purpose of the research. The population consisted of all the 3985 upper basic students from the 30 upper basic schools within Bauchi metropolis, Bauchi State, Nigeria (Source: Bauchi Local Government Education Authority, 2021). The sample of the study was 82 (43 male and 39 female) students from two intact classes selected using simple random sampling technique from the two randomly selected upper basic schools. The students were taught Basic science

using ASEI-PDSI (Activity, Student-centred, Experiment, Improvisation – Plan, Do, See and Improve) teaching approach as a medium of instruction.

Basic Science Interest Rating Scale (BSIRS) and Basic Science Performance Test (BSPT) were the instruments used for data collection. The BSIRS contained 15 items rated using a five-point likert scale with Strongly agree (SA) = 5 points, Agree (A) = 4 points, Undecided (U) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point options. The BSPT consisted of 30 multiple choice objective questions, each question has 4 option response mode of A, B, C, and D, the questions were drawn based on the topics treated during the study, two marks were allocated to correct answer and zero marks to wrong answer. A pre-test was administered using the instruments prior to the treatment to determine the initial interest and performance of the students, after the treatment using the ASEI-PDSI teaching approach the items in pre-test were reshuffled and re-administered to the students as a post-test.

The instruments were validated by 3 experts in science education from University of Jos. The reliability of BSPT and BSIRS was determined using Kuder-Richardson formula 20 (K-R20) and Cronbach Alpha and the reliability coefficient 0.81 and 0.75 was obtained. Data for the study were analyzed using mean and standard deviation to answer the research questions and ANCOVA was used to test the hypotheses at 0.05 level of significance.

Result

Table 1: Interest Mean Scores of Male and Female Students Taught Basic science using ASEI-PDSI teaching approach

Gender	N	Pre-Interest		Post-Interest		M _{Diff}
		M	SD	M	SD	
Male	43	2.70	0.25	4.35	0.12	0.06
Female	39	1.66	0.34	4.29	0.15	

Table 1 show that the pre-interest mean scores and standard deviation of male students was ($n = 43, M = 2.70, SD = 0.25$) and their female counterparts ($n = 39, M = 1.66, SD = 0.34$). After exposure to ASEI-PDSI teaching strategy, the interest mean scores have increased male students ($n = 43, M = 4.35, SD = 0.12$) and their female counterparts ($n = 39, M = 4.29, SD =$

0.15), mean interest difference of 0.06 between male and female students was obtained, the difference was in favour of the male students. The significant of the difference was further determined by testing the hypothesis.

Table 2: Achievement Mean Scores and Standard Deviation of Male and Female Students Taught Basic Science Using ASEI-PDSI teaching approach

Gender	N	Pre-test		Post-test		M_{Diff}
		M	SD	M	SD	
Male	43	29.56	4.04	47.53	4.72	0.73
Female	39	26.27	3.64	48.26	5.32	

Table 2 show the pre-test mean scores and standard deviation of male was ($n = 43, M = 29.56, SD = 4.04$) and their female counterparts ($n = 39, M = 26.27, SD = 3.64$). After exposure to ASEI-PDSI teaching strategy, the performance mean scores have increased male students ($n = 43, M = 47.53, SD = 4.72$) and their female counterparts ($n = 39, M = 48.26, SD = 5.32$), mean performance difference of 0.73 between male and female students was obtained. The difference is in favour of the female gender and the significant of the difference was further determined by testing the hypothesis.

Table 4: Summary of Analysis of Covariance (ANCOVA) of Male and Female Students' Interest Mean Scores in Basic Science

Source	Type III Sum of Squares	Df	Mean Square	F	P	Remark
Corrected Model	.061 ^a	2	.031	1.593	.210	
Intercept	6.941	1	6.941	362.041	.000	
Pre-Interest	.000	1	.000	.012	.013	
Gender	.049	1	.049	2.579	.112	Retained
Error	1.515	79	.019			
Total	1535.004	82				
Corrected Total	1.576	81				

Analysis of Covariance (ANCOVA) result in Table 4 revealed that there was no significant difference in male and female students' interest, $F(1,81) = 2.579, p = 0.112$. Since the (p -value $0.112 > \alpha = 0.05$) hypothesis one was retained. This indicated that when ASEI-PDSI teaching approach was used in teaching

Basic science, gender has no effect on students' interest. This implies that there was no significant gender difference on students' interest in Basic science when ASEI-PDSI teaching approach was used.

Table 5: Summary of Analysis of Covariance (ANCOVA) of Male and Female Students' Performance Scores in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	P	Remark
Corrected Model	242.956 ^a	2	121.478	5.404	.006	
Intercept	1724.944	1	1724.944	76.736	.000	
Pretest	232.309	1	232.309	10.335	.002	
Gender	34.550	1	34.550	1.537	.219	Retained
Error	1775.825	79	22.479			
Total	189988.000	82				
Corrected Total	2018.780	81				

Analysis of Covariance (ANCOVA) result in Table 5 revealed that there was no significant difference in male and female students' performance, $F(1,81) = 1.537, p = 0.219$. Since the (p -value $0.219 > \alpha = 0.05$) hypothesis one was retained. This indicated that when ASEI-PDSI teaching approach was used in teaching

Basic science, gender has no effect on students' performance. This implies that there was no significant gender difference on students' performance in Basic science when ASEI-PDSI teaching approach was used.



Discussion of Findings

The findings of the study revealed that there is no significant difference between male and female students' mean interest scores when taught Basic science using ASEI-PDSI teaching approach as a medium of instruction. This finding is in harmony with that of Ajayi, Agamber and Angura (2017); Omega (2017) and Peter, Gabrael and Johnson (2020) who in separate studies found that gender has no effect on male and female students' interest. The revealed that male and female students have equal level interest when the ASEI-PDSI teaching approach is used as medium of instruction.

The findings also revealed that there is no significant difference between male and female students' performance when taught Basic science using ASEI-PDSI teaching approach as a medium of instruction. This finding is in consonance with that of Awodun (2016); Alam (2017) and Omondi et al. (2018) who found that gender has no effect on male and female students' performance. The indicated performance of male and female students exposed to ASEI-PDSI teaching approach did not differ significantly.

The insignificant gender difference in students' interest and performance was as a result of the ASEI-PDSI teaching approach give room for equal active participation of male and female students during the teaching and learning processes which lead to equality in interest and performance. Taken together, the findings revealed that male and female students are capable of competing in Basic science classroom when ASEI-PDSI teaching approach is used as medium of instruction.

Conclusion

The findings of this study provide supporting evidence that the ASEI-PDSI teaching approach is a gender-friendly instructional approach that can be used to close the existing gender interest and performance gap in Basic science.

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