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Interactive Effect of Socio-Demographic Variables and Instructional Simulation Strategy On Ekiti State Secondary School Students' Academic Performance in Chemistry

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Abstract:

The study investigated interactive effect of socio-demographic variables and instructional simulation strategy on Ekiti State Secondary School students' academic performance in Chemistry. The study examined the influence of gender and location on the academic performance of students exposed to instructional simulation strategy and conventional method. This study adopted quasi – experimental pre-test and post-test two group design. The sample consisted of 169 SS II students in four public secondary schools in Ekiti State. Chemistry Performance Test (CPT) was used for data collection as it consisted of two sections A and B. The instrument was validated before administration on students. The study was carried out in three stages namely pre-treatment, treatment and post-treatment stages. The data collected for this study were analysed using descriptive and inferential statistics. The research questions were answered using means and standard deviation. All the hypotheses were tested using two-way Analysis of Variance at 0.05 level of significance. The findings of the study revealed that gender and location of students did not influence their performance in Chemistry when exposed to instructional simulation strategy and conventional method. Instructional simulation strategy is not gender biased and potent in all locations. It was recommended that teachers irrespective of the gender and location of students should make use of instructional simulation strategy in teaching Chemistry.

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Introduction

Simulations are tools that facilitate learning through representation and practice in a repeatable, focused environment. It helps students to identify and understand factors which control the system and or predict the future behaviour of a system. It can bring into the classroom, aspects of the world or universe that are too expensive, dangerous, abstract, difficult or too slow or too fast in occurrence to be comprehended. The use of simulations in the teaching and learning of Chemistry could help the understanding of abstract and difficult concepts by allowing students to develop their own understanding. Umoke and Nwafor (2014) observed that the use of simulations to teach science gives positive results over time and permits the learner to manipulate variables or parameters and then observe the consequences of their actions. Chemical bonding and natural occurrences such as earthquakes, radioactivity, predators/prey relationships which occur too rapidly to be observed, can be illustrated through simulation. Therefore, simulation may make learning more concrete and meaningful.

Instructional simulations combine visual and interactive learning experiences, promotes application of knowledge, and provides a simplified representation of real world systems (Eskrootchi & Oskrochi, 2010). Instructional simulation is used with the aid of computer to simplify real life situation (simulation) and this will aid to manage the class, support reluctant learners, stimulate gifted children and ease administration. Simulation employs selected aspects of a real-life situation.

Instructional simulation includes instructional elements that help a learner to explore, navigate or obtain more information about that system or environment that cannot generally be acquired from mere experimentation. Simulation means imitation of situation or process. Simulation is otherwise known as 'the act of pretending or deception'. Simulation involves the use of model- a simplified version of reality which reduces the complexity of a real-life situation, taking from reality only those essential features of the learning objectives (Awodun, 2010).

The sources of gender differences in educational outcomes appear to have been a subject of considerable study and debate. There has been an increasing interest in both academic and policy discussions about ways to improve the educational performance of students, more specifically girls, in developing countries. One reason for such debates has been the increase in society's fundamental interest in fairness and equal opportunity. It appears that male and female teachers have unique biases with respect to how they engage boys and girls in the classroom. For example, cognitive process theories suggest that teachers may subtly communicate that they have different academic expectations of boys and girls.

There is a great deal of public interest in the effect of gender on students' performance in Chemistry achievement. Biologically, males are different from females in their physical structure, features and heredity traits. Heredity traits are physical characteristics that living things inherit from their parents. Boys seem to be more aware of what it means to be masculine than girls. There are conflicting opinions on gender related issues in science achievement. Some researchers pointed out that gender plays no significant role in student academic performance in chemistry while others hold contrary opinion. The general beliefs that males achieve better than females in Chemistry is apparently a myth.

School location simply describes the settlement or area in which a school is situated. This settlement could either be urban or rural. Student achievement may be influenced by the area in which the students live or where the school is situated. Olasesan and Akaje (2018) asserted

that the reasons for variation in achievement can be as a result of geographic location of school, resources, availability of technology and quality of teachers. The school location (rural or urban) seems to affect male and female students' performance in Chemistry. Olueh (2016) surveyed the works of different researchers on school location, attitude and achievement and found out that there were significant differences between students' performance and attitude in urban and rural schools. Also, Olasesan and Akaje (2018) asserted that school location, rural and urban setting is an important factor significantly capable of influencing the students' academic performance in school subjects such as Chemistry. On the contrary, Adebule and Aborisade (2013) and Bosede (2010) expressed that there was no significant difference in students' performance to science from rural and urban school location.

Therefore, the present study investigates interactive effect of socio-demographic variables and instructional simulation strategy on Ekiti State Secondary School students' academic performance in Chemistry. Specifically, the study examined:

i. the performance of male and female students in Chemistry exposed to instructional simulation strategy and conventional method;
ii. the performance of urban and rural students in Chemistry exposed to instructional simulation strategy and conventional method;
iii. the influence of gender on the academic performance of students exposed to instructional simulation strategy and conventional method; and
iv. the influence of location on the academic performance of students exposed to instructional simulation strategy and conventional method.

Research Question

1. What are the performances of male and female students in Chemistry exposed to instructional simulation strategy and conventional method in Ekiti State?
2. What are the performances of urban and rural students in Chemistry exposed to instructional simulation strategy and conventional method in Ekiti State?

Research Hypotheses

The following null hypotheses were postulated for this study.

1. There is no significant influence of gender on the academic performance of students exposed to instructional simulation strategy and conventional method.
2. There is no significant influence of location on the academic performance of students exposed to instructional simulation strategy and conventional method.

Methodology

This study adopted quasi – experimental pre-test and post-test two group design. The targeted population for the study consisted of all the Senior Secondary School (S.S.S.) two Chemistry students in public secondary schools in Ekiti State. The choice of S.S.S. 2 students was considered more appropriate because they had been exposed to some basic science concepts. The sample consisted of 169 SS II students in four public secondary schools in Ekiti State. The sample was selected using multistage sampling procedure. In stage one; one Senatorial District was selected from the three Senatorial Districts in Ekiti State using simple random sampling technique. The next stage involved the selection of two Local Government areas from the selected Senatorial District through simple random sampling technique. In stage three, two public secondary schools will be selected from each of the Local Government areas through stratified random sampling technique so that one urban school and one rural school were selected. In stage four, the S.S.S. 2 class intact size of each of the four schools were used for the study.

Chemistry Performance Test (CPT) was used for data collection as it consisted of two sections A and B. Section A sought for socio-demographic characteristics of the students such as gender, location, among others while Section B consists of 30 objective items adapted from WAEC and NECO past questions. The face and content validity of the instrument was ensured by experts of Tests and Measurement and Chemistry Education. The reliability of Chemistry Performance Test (CPT) was determined through test re-test method. Data collected twice at interval of two weeks from 25 students were tested using Pearson's Product Moment Correlation statistics which yielded reliability coefficient value of 0.819.

The study was carried out in three stages namely pre-treatment, treatment and post-treatment stages. The data collected for this study were analysed using descriptive and inferential statistics. The research questions were answered using means and standard deviation. All the hypotheses were tested using two-way Analysis of Variance at 0.05 level of significance.

Results

Research Question 1: What are the performances of male and female students in Chemistry exposed to instructional simulation strategy and conventional method in Ekiti State?

Table 1: Mean and standard deviation of post-test scores of students exposed to instructional simulation strategy and conventional method based on gender

Strategies	**Gender**	**N**	**Mean**	**S.D**
Instructional simulation strategy	Male	43	84.42	5.33
	Female	35	84.76	5.00
Conventional	Male	47	49.93	4.64
	Female	44	49.92	4.15
Total		**169**		

Table 1 shows the mean post-test scores of students' performance exposed to instructional simulation strategy and conventional method based on their gender. The mean post-test score of male students exposed to instructional simulation strategy is 84.42 while conventional method is 49.93. The mean post-test score of female students exposed to instructional simulation strategy is 84.76 while conventional strategy is 49.92. The table above shows that there was no major gender difference in performance of students exposed to instructional simulation strategy and conventional method. The graphical representation below further shows the students' performance exposed to instructional simulation strategy and conventional method based on gender.

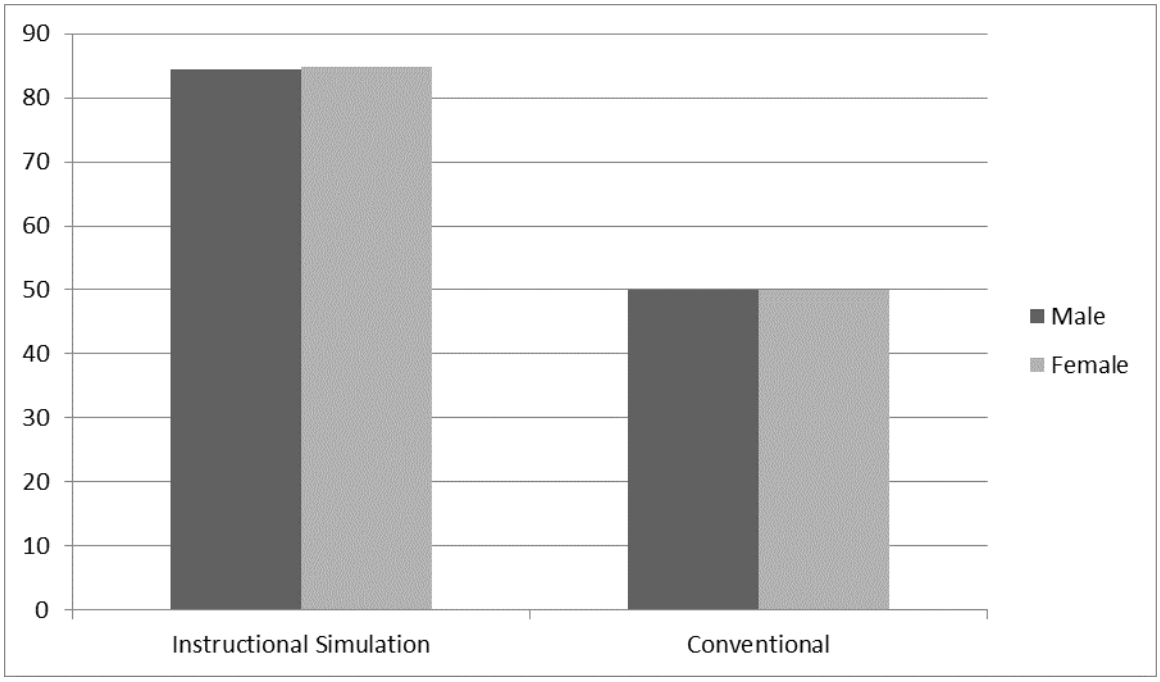

Figure i: Performance of students in Chemistry exposed to instructional simulation strategy and conventional method based on gender

Research Question 2: What are the performances of urban and rural students in Chemistry exposed to instructional simulation strategy and conventional method in Ekiti State?

Table 2: Mean and standard deviation of post-test scores of students exposed to instructional simulation strategy and conventional method based on location

Strategies	**Gender**	**N**	**Mean**	**S.D**
Instructional simulation strategy	Urban	46	83.70	5.72
	Rural	32	85.83	3.97
Conventional	Urban	51	50.65	4.76
	Rural	40	49.17	3.83
Total		**169**		

Table 2 shows the mean post-test scores of students' performance exposed to instructional simulation strategy and conventional method based on their location. The mean post-test score of urban students exposed to instructional simulation strategy is 83.70 while conventional method is 50.65. The mean post-test score of female students exposed to instructional simulation strategy is 85.83 while conventional strategy is 49.17. The graphical representation below further shows the students' performance exposed to instructional simulation strategy and conventional method based on location.

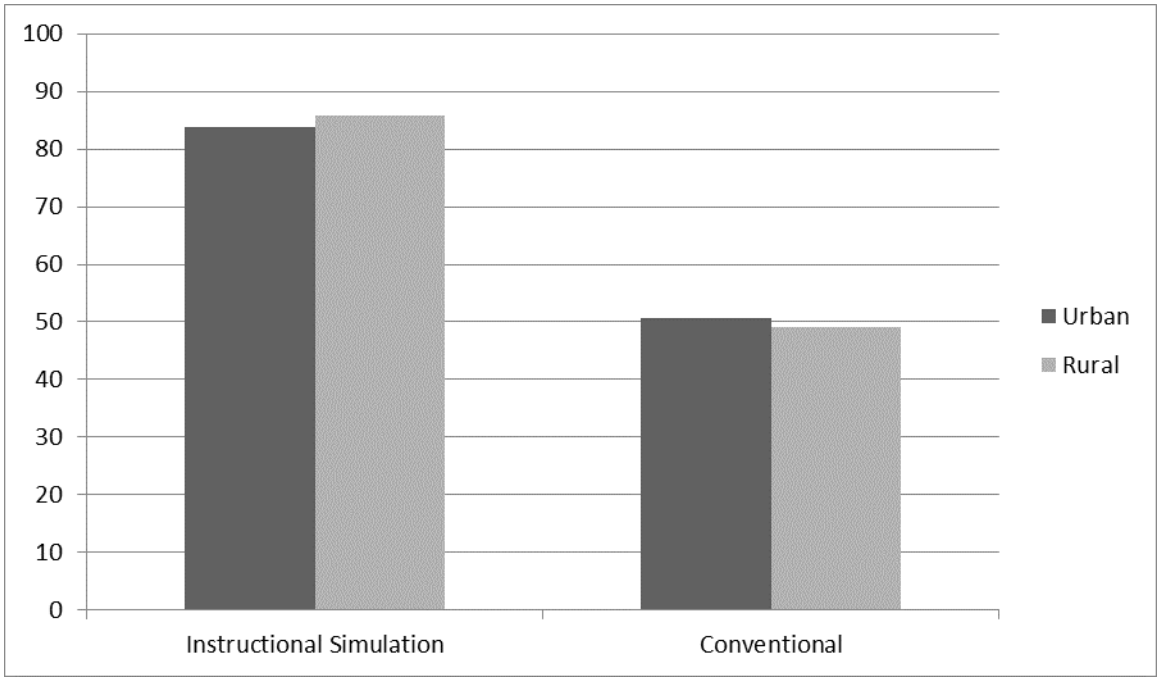

Figure ii: Performance of students in Chemistry exposed to instructional simulation strategy and conventional method based on location

Testing of Hypotheses

Hypothesis 1: There is no significant influence of gender on the academic performance of students exposed to instructional simulation strategy and conventional method.

Table 3: Two-way Analysis of Variance (ANOVA) for influence of gender on the academic performance of students exposed to instructional simulation strategy and conventional method

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	50159.537[a]	3	16719.846	730.204	.000
Intercept	751129.580	1	751129.580	32803.993	.000
Gender	1.177	1	1.177	.051	.821
Group	49878.767	1	49878.767	2178.349	.000
Gender * Group	1.271	1	1.271	.055	.814
Error	3755.191	165	22.898		
Total	**785990.712**	**169**			
Corrected Total	**53914.728**	**168**			

a. R Squared = .930 (Adjusted R Squared = .929) * P < 0.05

From Table 3, the F-value of 0.055 is not significant because p-value of 0.814 is greater than 0.05 level of significant i.e. P (0.814) >0.05. This led to the non – rejection of the hypothesis. This means that gender has no significant influence on the academic performance of students exposed to instructional simulation strategy and conventional method. The table also shows that there was no gender difference in academic performance of students exposed to instructional simulation strategy and conventional method (F_{cal}= 0.051, P-value= 0.821

>0.000). The instructional simulation strategy is not biased based on the gender of the students.

Hypothesis 2: There is no significant influence of location on the academic performance of students exposed to instructional simulation strategy and conventional method.

Table 4: Two-way Analysis of Variance (ANOVA) for influence of location on the academic performance of students exposed to instructional simulation strategy and conventional method

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	50334.800[a]	3	16778.267	755.018	.000
Intercept	743356.372	1	743356.372	33450.862	.000
Location	4.333	1	4.333	.195	.659
Group	49787.193	1	49787.193	2240.412	.000
Location * Group	34.570	1	34.570	1.556	.315
Error	3666.686	165	22.222		
Total	**789102.201**	**169**			
Corrected Total	**53901.486**	**168**			

a. R Squared = .932 (Adjusted R Squared = .931) * P < 0.05

From Table 4, the F-value of 1.556 is not significant because p-value of 0.315 is greater than 0.05 level of significant i.e. P (0.315) >0.05. This led to the non – rejection of the hypothesis. This means that location has no significant influence on the academic performance of students exposed to instructional simulation strategy and conventional method. The table also shows that there was no location difference in academic performance of students exposed to instructional simulation strategy and conventional method (F_{cal}= 0.195, P-value= 0.659 >0.000). The instructional simulation strategy is not biased based on the location of the students.

Discussion

The finding of this study revealed that gender had no significant influence on the academic performance of students exposed to instructional simulation strategy and conventional method. Gender of the students has no influence on the academic performance of the students who were exposed to Chemistry through instructional simulation strategy and conventional method. The finding also revealed that there was no significant difference between the academic performance of male and female students exposed to instructional simulation strategy and conventional method. By implication, instructional simulation strategy and conventional method are not gender biased. Asogwa et al (2016) and Yearwood (2015), on the effect of instructional simulation technique on students' academic performance and attitude found that instructional simulation technique was more effective in comparison to other teaching techniques of teaching and not gender biased. The finding of this study is quite interesting in the sense that there was no interaction and no cause to separate biology instruction along gender lines. The finding is also in line with that of Asogwa et al (2016), Nduati (2015) and Umoke and Nwafor (2014). These studies reveal no interaction between method and gender on students mean achievement scores.

It was also revealed that location had no significant influence on the academic performance of students exposed to instructional simulation strategy and conventional method. Location of the students has no influence on the academic performance of the students who were exposed to Chemistry through instructional simulation strategy and conventional method. The finding also revealed that there was no significant difference between the academic performance of urban and rural students exposed to instructional simulation strategy and conventional method. By implication, instructional simulation strategy and conventional method are not location biased. This finding is in line with the earlier findings of Yusuf (2010). His revelations are that in simulated classrooms the students are actively involved in the experiential learning and there was no difference in performance of students based on their location.

Conclusion

Based on the findings of this study, it could be concluded that, gender and location of students did not influence their performance in Chemistry when exposed to instructional simulation strategy and conventional method. Instructional simulation strategy is not gender biased and potent in all locations.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. Teachers irrespective of the gender and location of students should make use of instructional simulation strategy in teaching Chemistry.
2. Chemistry teachers should manage the time allocated well in order to accommodate the use of instructional simulation strategy.

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