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Effects of Instructional Simulation On Students' Academic Performance in Chemistry in Ekiti State Secondary Schools

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Abstract:

The study examined the effects of instructional simulation strategy on students' academic performance in Chemistry in Ekiti State secondary schools. This study adopted quasi – experimental pre-test and post-test two group design (one experimental group and one control group). 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 sample consisted of 169 SS II students available in the classes that were selected from four public secondary schools in Ekiti State. The sample was selected using multistage sampling procedure. Two instruments were used for this study. These are Chemistry Performance Test (CPT) and Instructional Simulation Package (ISP). The face and content validity of the instrument was ensured by experts of Tests and Measurement and Chemistry Education. The reliability of the instrument (CPT) was determined through test re-test method which yielded reliability coefficient value of 0.819. The study was carried out in three stages namely pre-treatment stage, treatment stage and post-treatment. The data collected for this study were analyzed using descriptive and inferential statistics. All the hypotheses were tested at 0.05 level of significance. The findings of the study revealed that there was no significant difference in the pre-test mean scores of students exposed to instructional simulation and conventional strategies but there was significant difference in the post-test mean scores of students exposed to instructional

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simulation and conventional strategies. The use of instructional simulation strategy enhanced better performance of students in Chemistry than the conventional method. It was recommended among others that the use of instructional simulation strategy should be encouraged in Chemistry class in secondary schools so as to enhance better academic performance of students in Chemistry.

Keywords: Instructional Simulation, Students, Performance, Chemistry,

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Introduction

In Nigeria, National Policy had emphasized science teaching and learning in on Education (FRN, 2013). In order to instill the necessary skills, scientific knowledge, proficiencies and attitudes in various developmental strategies such as World Declaration on Education for All (EFA) are set rolling in Nigeria educational system. Other strategies like the NEEDS (National Economic Empowerment goals) of MDGS (Millennium Development Goals) are established in order to meet these goals. Nigeria started to update the existing curriculum to take care of the needs of the nation which was wishful to be among the first 20 economy in the world by the year 2020. Chemistry education grew to be the best avenue to curb the global challenges the Nigerian Nation is battling with. Adesoji and Olatunbosun (2008) stated that it was because of the recognition given to chemistry in individual and nation development that it was turned to a core-subject among other sciences and science- related courses in Nigerian education system.

Chemistry is the scientific study of the inter-connectedness of chemical substances that make up atoms or the subatomic particles; protons, electrons and neutrons. It is a vital part of the science curriculum both at the senior secondary school as well as higher institutions. At the secondary school level, it is often called "General Chemistry" which is an introduction to a wide variety of fundamental concepts that enables students to acquire tools and basic skills useful at the advanced level. One of the objectives of science education is to develop students' interest towards science and technology. The development of any nation today depends greatly on its technological and scientific advancement. Chemistry, in particular is central to many of the scientific areas of human's efforts; therefore, teaching of chemistry should be given serious attention.

As a single subject, Chemistry is offered at the senior secondary school level, from senior secondary one (S.S 1) to senior secondary three (S.S 3) classes. The senior secondary school students had done Basic Science which is to equip them for doing Chemistry at senior secondary level. The role of Chemistry in the scientific root development of a country cannot be over stretched without excluding Nigeria. Yet with the increasing importance of Chemistry to the unfolding world, the performance of Nigerian students in the subject at the secondary school remains a dismal failure. However, it is disappointing to note that the students' performance in Chemistry at internal and external examination has remained considerably poor despite the relative importance of Chemistry (Saage, 2009).

Due to the complex nature of Chemistry as a subject, students seem to have difficulties in learning and understanding basic concepts in Chemistry and their alternative conceptions which seem to be part of the causes of poor academic performance in Chemistry. Recently, West African Examination Council (WAEC) and National Examination Councils (NECO) results show that more than 60% of the Chemistry students perform below average in Nigeria (Asogwa, Muhammed, Asogwa & Ofoegbu, 2016).

Many students find chemistry to be a hindrance in attaining their aims and objectives. Students wishing to read medicine or other science related subjects cannot do so unless they have credit grade in chemistry. It is therefore necessary to properly groom the students right from the secondary level to enable them improve their academic achievement in chemistry. Chemistry, being a science subject has two aspects; the theoretical aspect and the practical

aspect. Students are allowed to face both internal and external examination. The poor performance of students in Chemistry in Nigeria has become an matter of great concern to stakeholders in the educational sector in recent times. However, a lot of reasons have been tendered for this downward trend. These include teaching strategies, inadequate qualified Chemistry teachers, fear of Chemistry shortage of facilities, equipment and instructional materials for effective teaching, use of out-dated teaching methods, large students to teacher ratio and to mention but a few. The poor performance of students in Chemistry as posited by Saage (2009) is attached to a number of factors which include inadequate facilities, teachers' diligence to work, method of teaching, student's lack of interest while some may be related to the state of science education enterprise in Nigerian schools.

The researcher observed that the lecture method (conventional method) is the usual method used by Chemistry teachers in secondary schools. Teachers seem to be contented with this method because they are in charge of content and time. Lecture method is a teaching method in which there is a one-way channel of communication, where the teacher gives an oral presentation of the subject matter content and students listen silently and write notes. This method appears to have not yielded much success and could be contributing to the poor performance of students in Chemistry. Student's insight and assimilation of the subject matter appears to be usually very sluggish.

It has therefore become very important to search for effort that will be used to enhance better academic performance of students in Chemistry. There are many ground-breaking strategies that could be used in other to improve students' academic performance in Chemistry but this research is interested in instructional simulation strategy.

The term simulation is considered to be a representation of the behaviour or characteristics of a system via the use of another outlet, usually a computer programme meant for the purpose (Alabi & Lasisi, 2015). Krulik (2010) stated that simulation can be mimicry, making working replicas or representations of machines for demonstration or analysis of problems but clearly shows real life or hypothetical situations. Simulation allows the learner to manipulate variables or parameters and then view/observe effects of their choices (Krulik, 2010).

Simulations are tools that enable via representation and practice in a repeatable, focused environment. It aids students to know and comprehend features 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 costly, dangerous, abstract, difficult or too slow or too fast in occurrence to be motivated. The utilization of simulations in the teaching and learning of Chemistry could assisr 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 speedily to be observed, can be illustrated through simulation. Therefore, simulation may assist learning process more concrete and meaningful.

The instructional simulation environment gives a platform to apply the knowledge in a given situation and their link lead to the discovery of a new knowledge that will aid cognitive domain improvement and the accumulation of knowledge (Shamai, 2011). Instructional simulation strategy seems to be vital to students' academic performance in Chemistry, which appears to be technologically based compared to other strategies of teaching. Therefore, the present study investigates the effect of instructional simulation on the academic performance of senior secondary school students in Chemistry in Ekiti State. Specifically, the study examined:

i. which of the strategies (instructional simulation or conventional) would be more effective in the teaching of Chemistry;
ii. the difference in the pre-test mean scores of students exposed to instructional simulation strategy and conventional method;
iii. the difference in the post-test mean scores of students exposed to instructional simulation strategy and conventional method;

Research Question

1. Which of the strategy (instructional simulation strategy or conventional method) would be more effective in the teaching of Chemistry?

Research Hypotheses

The following null hypotheses were postulated for this study.

1. There is no significant difference in the pre-test mean scores of students exposed to instructional simulation strategy and conventional method.
2. There is no significant difference in the post-test mean scores of students exposed to instructional simulation strategy and conventional method.
3. There is no significant difference in the pre-test and post-test mean scores of students exposed to instructional simulation strategy and conventional method.

Methodology

This study adopted quasi – experimental pre-test and post-test two group design (one experimental group and one control group). 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 sample consisted of 169 SS II students available in the classes that were selected from four public secondary schools in Ekiti State. The sample was selected using multistage sampling procedure.

Two instruments were used for this study. These are Chemistry Performance Test (CPT) and Instructional Simulation Package (ISP). The Chemistry Performance Test was self-designed and based on two topics namely; Chemical combinations and periodic Table. The instruments were in two sections; Section A consists of bio data of respondents while Section B consists of 30 objective items adapted from WAEC and NECO past questions. The Instructional Simulation Package (ISP) was an adjunct instructional and interactive package. It contained nine lessons structured in units, each unit lasted for 40 minutes. The package was developed by the researcher with the aid of program developer.

The face and content validity of the instrument was ensured by experts of Tests and Measurement and Chemistry Education. The face and content validity were ensured by these professionals to assess the wordings and ambiguity of the test items. The reliability of the

instrument (CPT) was determined through test re-test method. The instrument was administered twice on 25 respondents outside the sampled area within an interval of two weeks. In order to ascertain reliability of the instrument, data collected were tested using Pearson's Product Moment Correlation statistics to determine the reliability of the instrument which yielded reliability coefficient value of 0.819.

The study was carried out in three stages namely pre-treatment stage, treatment stage and post-treatment. The data collected for this study were analyzed using descriptive and inferential statistics. The research questions were answered using means and standard deviation. All the hypotheses were tested using t-test, Analysis of Covariance (ANCOVA) and two-way Analysis of Variance. Hypotheses 1 – 2 were tested using t-test while hypothesis 3 was tested using Analysis of Covariance (ANCOVA) and hypotheses 4 – 5 were tested using Two-way Analysis of Variance. All the hypotheses were tested at 0.05 level of significance.

Results

Research Question 1: Which of the strategy (instructional simulation strategy or conventional method) would be more effective in the teaching of Chemistry?

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

Strategies	**Test**	**N**	**Mean**	**S.D**	**Mean Diff.**
Instructional Simulation	Pre Test	78	27.01	2.61	**57.56**
	Post Test		84.57	5.16	
Conventional	Pre Test	91	27.51	2.61	**22.49**
	Post Test		50.00	4.42	
Total		**169**			

From Table 1, it is shown that the mean difference in students' performance in Chemistry between pre-test and post-test scores for instructional simulation strategy is 57.56 and conventional method is 22.49. It appears that the use of instructional simulation strategy and conventional method influences students' performance in Chemistry with instructional simulation strategy being the more effective method in the teaching of Chemistry. The graphical representation below further shows the more effective method in the teaching of Chemistry.

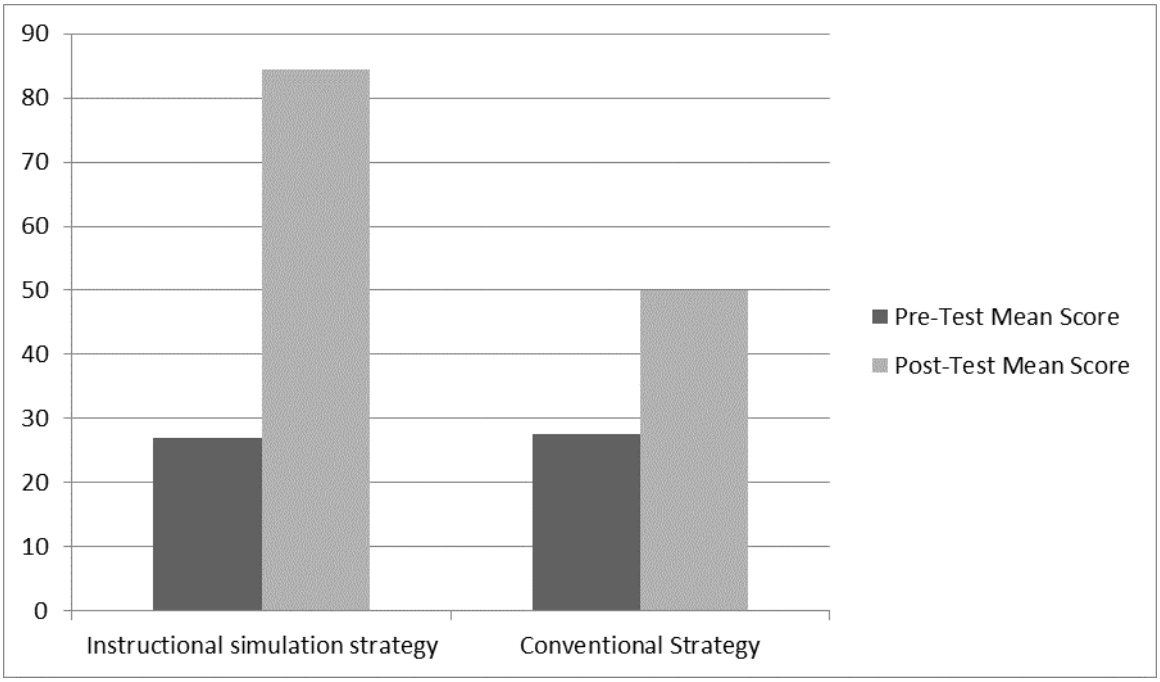

Figure i: Pre-test and Post-test mean scores of students exposed to instructional simulation strategy and conventional method.

Testing of Hypotheses

Hypothesis 1: There is no significant difference in the pre-test mean scores of students exposed to instructional simulation strategy and conventional method.

Table 2: t-test analysis for Pre – test Mean Scores of Students in Experimental and Control Groups

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Instructional Simulation Strategy	78	27.01	2.61	167	1.243	0.216	Not Significant
Conventional	91	27.51	2.61				

P>0.05

Table 2 shows that the t-cal value of 1.243 is not significant because the P value (0.216) > 0.05 at 0.05 level of significance. This implies that null hypothesis is not rejected. Hence, there is no significant difference in the pre-test mean scores of students exposed to instructional simulation strategy and conventional method. The students in both groups were homogeneous at the commencement of the study.

Hypothesis 2: There is no significant difference in the post-test mean scores of students exposed to instructional simulation strategy and conventional method.

Table 3: t-test analysis for Post – test Mean Scores of Students in Experimental and Control Groups

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Instructional Simulation Strategy	78	84.57	5.16	167	46.954	0.000*	Significant
Conventional	91	50.00	4.42				

*P<0.05

Table 3 shows that the t-cal value of 46.954 is significant because the P value (0.000) <0.05 at 0.05 level of significance. This implies that null hypothesis is rejected. Hence, there is significant difference in the post-test mean scores of students exposed to instructional simulation strategy and conventional method. The mean score showed a significant difference of 34.57 in favour of students exposed to instructional simulation strategy.

Hypothesis 3: There is no significant difference in the pre-test and post-test mean scores of students exposed to instructional simulation strategy and conventional method.

Table 4: Analysis of Covariance (ANCOVA) for Pre – test and Post – test Mean Scores of Students under the Groups

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	50290.575[a]	2	25145.287	1124.823*	.000
Intercept	5381.214	1	5381.214	240.718*	.000
Pre-test	91.531	1	91.531	4.094	.045
Groups	50148.171	1	50148.171	2243.275*	.000
Error	3710.912	166	22.355		
Total	789202.201	169			
Corrected Total	54001.486	168			

a. R Squared = .931 (Adjusted R Squared = .930) * P < 0.05

The result presented in table 4 shows that there is a significant difference in the pre – test and post – test mean scores of students in the groups (Instructional Simulation Strategy and Conventional method) as P= 0.000<0.05. There is a strong evidence to reject the null hypothesis which states that there is no significant difference in the pre-test and post-test mean scores of students exposed to instructional simulation strategy and conventional method. This result led to the rejection of the null hypothesis. By implication, there is significant difference in the pre-test and post-test mean scores of students exposed to instructional simulation strategy and conventional method. In order to find out the more probable effective strategy, Multiple Classification Analysis (MCA) was carried out. The result is shown in Table 5.

Table 5: Multiple Classification Analysis (MCA) of students' performance in Chemistry by treatment

Grand Mean = 65.96					
Variable + Category	N	Unadjusted Dev'n	Eta^2	Adjusted for Independent + Covariate	Beta
Experimental (Instructional Simulation Strategy)	78	18.61	.93	6.51	.09
Control	91	-15.96		-6.37	
Multiple R					.965
Multiple R^2					.931

The result in Table 5 shows the Multiple Classification Analysis (MCA) of students' performance in Chemistry by treatment. It reveals that, with a grand mean of 65.96, students exposed to instructional simulation strategy had higher adjusted mean score of 84.57(65.96+18.61) than their counterparts in the control group with control group 50.00(65.96+(-15.96)). This means that instructional simulation strategy was the more effective strategy of teaching Chemistry in Nigeria. There was a very high multiple relationship (R= 0.965) between the two groups and academic performance of students in Chemistry. The two treatment strategies can also account for 93.1% variability in academic performance of the students in Chemistry. It means there is a need for other researchers to find other teaching strategies (other than the two strategies under consideration) that could account for 6.9% of the variability in academic performance of students in Chemistry.

Discussion

The finding of this study revealed that, the performance of students in both experimental and control groups in pre-test were low and do not differ statistically. This finding established the homogeneity of the two groups involved in the study prior to the experiment. In other words, it could be said that the knowledge baseline for the two groups involved in the study are equal. Consequently, any significant difference recorded afterwards would not be ascribed to chance, but to the specific treatment applied.

The findings of this study revealed that there was significant difference in the post-test mean score of students exposed to instructional simulation strategy and conventional method. There was a better improvement in the performance of students resulting from their exposure to instructional simulation strategy. This implies that the introduction of instructional simulation strategy to the experimental group made them to perform better than the control group that was not exposed to treatment. The findings of Awodun and Oyeniyi (2018) show that, instructional simulation strategy application in schools yielded better results than the conventional method. Simulation may, therefore, make learning more concrete and meaningful. Also, the study is in line with the assertion of Kolawole and Ojo (2016), and Olofin and Kolawole (2020) who were of the opinion that the use of conventional method to teach students in school diminishes their interest and performance. Olofin (2020) concluded that good teaching strategies have the potent to improve cognition of students. This also justifies the earlier postulate of this study that instructional simulation strategy could facilitate meaningful learning of Chemistry.

Computer simulations can significantly affect and improve performance of students towards Chemistry and be effectively used as instructional method in Chemistry classroom (Nireti, Morenike &Joyce, 2014). Simulation is used with the aid of computer to simplify real life situation (simulation) and this helped to manage the class, support reluctant learners, stimulate gifted children and ease administration. Computer simulations brings about students' interest and involvement in the learning process, foster retention of information and offers opportunities for affective and behavioral learning (Guy & Lownes-Jackson, 2015).

Conclusion

Based on the findings of this study, it could be concluded that, the two groups (instructional simulation and Conventional method) were homogeneous at the commencement of the experiment. The use of instructional simulation strategy enhanced better performance of students in Chemistry than the conventional method.

Recommendations

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

1. The use of instructional simulation strategy should be encouraged in Chemistry class in secondary schools so as to enhance better academic performance of students in Chemistry.
2. Teachers who specialises in Chemistry should be given adequate orientation through workshops and seminars to update their knowledge in the use of instructional simulation strategy in teaching.

References

Adesoji, F. A., &Olatunbosun, S.M. (2008). Student, teacher and school environment factors as determinants of performance in senior secondary school Chemistry in Oyo State, Nigeria. *The Journal of International Social Research, Turkey.*1(2), 13—34.

Alabi, T. O., & Lasisi, N. (2015).Effects of guided discovery and problem solving on achievement of secondary school students in volumetric analysis in Niger State. *Journal of Science, Technology and Education*, *3*(4), 75-87.

Asogwa, U. D., Muhammed, A., Asogwa, E. N., & Ofoegbu, T. O. (2016).Effect of interactive computer simulation package on senior secondary school students' achievement and retention in genetics concepts. *Asian Journal of Information Technology*, *15*(14), 2313-2321.

Awodun, A.O. & Oyeniyi, A.D. (2018). Effects of Instructional Simulation on Students' Academic Performance in Basic Science in Junior Secondary School in Ekiti State, Nigeria. *International Journal of Research and Analytical Reviews,* 5(2), 23 – 27

Guy, R. S., & Lownes-Jackson, M. (2015). The Use of Computer Simulation to Compare Student Performance in Traditional Versus Distance Learning Environment. *Issues in Informing Science and Information Technology*, 12, 95–109

Federal Republic of Nigeria (2013).*National policy on science and technology*. Lagos: NERDC Press.

Kolawole, E. B. and Ojo, O. (2016). Statistical Analysis of the Effects of Kolawole's Problem Solving (KPS) and Conventional Teaching Methods on the Academic Performance and Retention of Secondary School Students in Mathematics in Ekiti State, Nigeria. *Research Journal of Education,* 2(6), 100-109.

Krulik, R.N. (2010). *A Practical Approach to Problem Solving*. New York: The Macmillan.

Nireti, D., Morenike, O., & Joyce, O. (2014). Effects of Computer Simulation Package, Gender and Perantal Education on Nigerian Secondary School Students' Attitude Towards Biology. In 21st Century Academic Forum Conference (pp. 114–136). Boston, MA U. S. A

Olofin, S.O. (2020). Effect of Kolawole's Problem-Solving Teaching Strategy and Teachers' Characteristics on the Academic Performance of Secondary School Students in Mathematics in Nigeria. *African Scholar Journal of Contemporary Education Research,* 17(8), 33 – 54

Olofin, S.O. and Kolawole, E.B. (2020). Effect of Kolawole's Problem-Solving Teaching Strategy on the Academic Performance of Secondary School Students in Mathematics in Nigeria. *Advances in Social Sciences Research Journal, 7(2)* 68-77. DoI:10.14738/assrj.72.7749.

Saage, O. (2009). Causes of Mass Failures in Mathematics Examination among Students a Commissioned Paper presented at Government Secondary School. Karu Abuja Science Day 1st March.

Shamai, R. (2011). Barriers in Using Technology for Education in Developing Countries, *Computers & Education* 41(1), 49-63.

Umoke, J. C., and Nwafor, C. C. (2014).Effects of Instructional Simulation on Secondary School Students' Achievement in Biology. *Journal of Education and Practice, 5*(19), 101-110.

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