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Research Article

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Effect of Activity-Based Learning Strategies on Junior Secondary School Basic Science Students Academic Performance

G.A Wokocha, Ogologo Gift Allen

Department of Integrated Science, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Nigeria

Abstract This study investigated the effect of activity-based learning strategies on Secondary School basic science students' academic performance in Rivers State. Quasi experimental pre-test post-test research design was adopted for the work. The study sample consists of 200 Junior Secondary School Basic science (JS2) students drawn from a population of 926 Basic science students using random sampling technique. Three schools were assigned to the experimental group while one class was used as the control. A 20 item multiple choice achievement test question on Osmosis and diffusion titled (BSAT) was used to gather data from the students. The reliability of the instrument (BSAT) was obtained using Kudder-Richardson formula 21 (KR21) with a value of 0.82. Three research questions and three null hypothesis guided the study, Research questions were analysed using mean and standard deviation while the hypotheses were tested using ANCOVA at 0.05 level of significance. Major findings of this study shows that students taught using activity based learning strategies (cooperative, practical work and discovery methods) performed significantly better than their counterparts taught using demonstration method. Based on the findings of this work, it was recommended among others. That the use of activity-based learning strategies in the teaching and learning of basic science should be made compulsory for all Basic science teachers. Also government should support in show commitment and providing an enabling environment and the required facilities in Secondary Schools so as to make students-centered learning activities a reality.

Keywords Activity-based learning, strategies

Introduction

Science Education is a basic component of the general education needed by every individual in today's world, where science plays a major role in influencing present societies and shaping future ones due to its relevance in our day to day activities. The manpower demands in technological development are such that teaching science subjects in any nation should encourage and raise science able students to not only offer science courses, Basic science inclusive but also pursue career in the sciences.

More so, it is various developmental advantages of science and technology that gave rise to the efforts being made by many developed nations of the world to develop the teaching and learning of science at all level of academic pursuit. And of course, it is an obvious truth that there can never be any meaningful technological advancement and achievement in any country where its populace is not scientifically literate and oriented, especially in Basic science which forms the basis of science. The need for science and technology cannot be overemphasized as it serves human needs for the survival of mankind. It helps to solve societal problems which include environmental pollution, the likes of air pollution, water pollution, land pollution, etc., maintenance of personal hygiene, generation of power, effective and efficient exploration and maintenance of natural resources. Importance to note is the fact that science in form of Basic science is the basis of all technological advancement

and is the foundation of national power and production; its advancement is obviously the key to economic and social well-being as well as military superiority of any country in the world.

Basic science as a science subject have been looking for recognition in terms of having science students who can say with all sense of pride that "I Love Basic science and not only saying it, but can also pass their Basic science subject with excellent grades both at internal and external examinations. And for this singular reason, most science oriented organizations, like Science Teachers Associations of Nigeria, (STAN), Nigeria Educational Research and Development Council, (NERDC), etc. and some other government parastatals have for long been searching for various means of making Basic science subject easier, more interesting and attractive to students by developing and modifying curriculum content, working on students' attitudes, introducing new and more interesting teaching methods so as to see if in any way these could aid understanding of the subject in question and hence increase the rate of passing it.

Basic science like any other science oriented subject can be taught and learnt by various teaching methods, some by listening and some other methods are by doing. The selection of the most suitable teaching strategy is a basic condition for a successful teaching/learning process. Teaching of science requires more understanding and conceptual linkage of various scientific representation (Anis, 2016). The teaching/learning techniques must have necessary provision for students' active engagement with explanatory ideas, theories and evidence so as to enable the connection of scientific concepts to real purposes and practices in the world they live. Important to note is the fact that the most recommended strategies for teaching science are problem solving, enquiry-based teaching, laboratory-based activities and project-based teaching/learning approaches. But unfortunately, teachers teach classes the same way they were taught, typically using demonstration methods (Mazur, 2015). This unfortunately leaves the learners to the fate of depending on rote learning without having an in depth understanding of scientific phenomenon, concepts and theories.

They equally tend to foster peer tutoring and encourage students to study on their own. They also encourage collaborative learning, critical thinking, creativity and effective communication. They are students centered by nature. Usually during activity based instructions, students have the opportunity to read, discuss, write, practice, analyze, synthesize and evaluate. The major theoretical perspectives related to these instructional methods are the constructivist, cognitive and motivational learning theories.

Students must be actively involved (hands on) in their learning process through the activity based learning strategies which include cooperative learning, discovery learning, effective practice and demonstration learning strategies. For this work, the researcher wishes to ascertain the effect of these strategies mentioned above to the academic achievement in Basic science in Rivers state.

Aim and Objectives of the Study

The aim of the study is to determine the effect of activity-based strategies on junior secondary students' academic performance and interest in Basic science in Rivers state specifically; the objectives of the study are to:

1. Investigate the effect of cooperative learning strategy on students' academic performance in Basic science
2. Find out the effect of practical work on students' academic performance in Basic science.
3. Determine the effect of discovery learning strategy on students' academic performance in Basic science.

Research Questions

The following research questions guided the study:

1. What is the effect of cooperative learning strategy on students' mean performance score in Basic science?
2. What is the effect of practical work on students 'mean performance score in Basic science?
3. What is the effect of discovery learning strategy on students mean performance score in Basic science?

Hypotheses

The following null-hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant difference between the mean performance score of Basic science students taught with cooperative learning strategy and those taught with the conventional teaching method.
2. There is no significant difference between the mean performance score of Basic science students exposed to practical work and those taught with the normal demonstration method of instruction.
3. There is no significant difference between the mean performance score of Basic science students taught with discovery learning strategy and those taught with conventional demonstration method.

Methodology

The researcher used quasi experimental research design of pre-test, post-test control group design with the aim of investigating the effects of activity-based learning strategy on secondary school Basic science students' performance. The population for this study comprised 926 junior secondary school two (JS2) Basic science students in public junior secondary schools in Rivers state. The study sample consisted of 200 JS2 Basic science students selected from four Secondary Schools in Ogba/Egbema local government area, Rivers state. Random sampling technique was used to select four schools on the basis of the schools that have well equipped Basic science practical laboratories. The researcher used intact class with more than fifty (50) Basic science students per class but the researcher used the data obtained from the first 50 students in each class for the analysis in this research work. Three of these classes were used for the experimental classes, where the activity based methods (Cooperative teaching method, practical teaching method, and the discovery teaching method) were used to teach, while the remaining one intact class was used as the control group, where the demonstration method of teaching was used to teach the students. In all, there was 150 students for the experimental group, and 50 students for the control group. Below are the sample distribution table showing the details of the samples selected. The researcher visited the four sampled schools, consulted and sought the permission of the various schools' authorities, after which he was introduced to the Basic science teachers in each of the schools by the school authority. After familiarizing with the subject teachers, the researcher guided them on how to use the lesson packages prepared and how to effectively handle the lesson. Some of the guidance given to the Basic science teachers (who are the research assistants) include, how to group the students, how to engage the students in a cooperative learning strategy, practical work learning strategy and the discovery learning strategy. After some interaction with the students, a pre-test (BSAT) were administered to both the experimental and control groups before the commencement of the teaching. After two weeks of teaching, the test questions (BSAT) administered as pre-test were shuffled and administered as post-test. Thereafter, the scripts were collected, marked, and recorded while data obtained from the questionnaire collected and recorded was used for analysis. The research questions were analysed using mean and standard deviation. While the hypotheses were tested using analysis of covariance (ANCOVA).

Results and Discussion

Research Questions 1: what is the effect of using cooperative learning strategy on students' mean performance score in Basic science?

Table 1: Mean performance scores, standard deviation, and mean difference for the cooperative and demonstration groups

Test: Achievement		Pre-test		Post-Test		Mean Difference
Method	**N**	**X**	**SD**	**X**	**SD**	**X**
Cooperative Method	50	36.307	41	78.30	12.96	42.00
Demonstration Method	50	35.20	8.86	54.40	7.60	19.20

The table showed the mean difference score of 42.00 for the cooperative method and mean difference score of 19.20 for the demonstration method. This result indicates that cooperative method is more effective and improves students' academic performance in Basic science much more than the demonstration method, particularly in the teaching and learning of Osmosis and Diffusion.

Research Question 2: What is the effect of practical work on Basic science students' mean performance score in basic science?

Table 2: Mean performance scores of students, standard deviation, and mean difference for the practical work and demonstration groups

Test: Achievement		Pre-test		Post-Test		Mean Difference
Method	**N**	**X**	**SD**	**X**	**SD**	**X**
Cooperative Method	50	38.507	70	80.60	11.19	42.10
Demonstration Method	50	35.20	8.86	54.40	7.60	19.20

The table showed the mean difference score of 42.10 for the practical method and mean difference score of 19.20 for the demonstration method. This result indicates that practical method is more effective and improves students' academic performance in Basic science than the demonstration method.

Research Question 3: What is the effect of discovery learning strategy on Basic science students' mean performance score in basic science?

Table 3: Mean performance scores of students, standard deviation, and mean difference for Discovery method and demonstration method.

Test: Achievement		Pre-test		Post-Test		Mean Difference
Method	**N**	**X**	**SD**	**X**	**SD**	**X**
Cooperative Method	50	39.608	56	72.30	14.65	32.70
Demonstration Method	50	35.20	8.86	54.40	7.60	19.20

The table showed the mean difference score of 32.70 for the discovery method and mean difference score of 19.20 for the demonstration method. This result indicates that discovery method is more effective and improves students' academic performance in Basic science than the demonstration method.

Hypothesis 1: There is no significant difference between the mean performance score of Basic science students taught with cooperative learning strategy and those exposed to demonstration method.

Table 4: Summary of ANCOVA of Students' performance in Basic science based on methods.

Source	Type III Sum of Squares	df	Mean square	F	Sig.
Corrected Model	577.846[a]	2		64.299	0.000
Intercept	716.238	1	288.923		0.000
Pre-test	6.636	1		159.396	0.227
Method	560.273	1	716.238	1.477	0.000
Error	435.864	97	6.636		
Total	18623.000	100		124.687	
Corrected Total	1013.710	99	560.273		
			4.493		

From the above table, analysis shows that there is a significant difference in cooperative and demonstration method on students' performance in Basic science. Thus the null hypothesis was rejected (P =0.001 and $F_{1,97}$ = 124.687).

Hypothesis 2: There is no significant difference between the mean performance score of Basic science students taught with practical work method and those taught with demonstration method.

Table 5: Summary of ANCOVA of Students' performance in Basic science based on methods

Source	Type III Sum of Squares	df	Mean square	F	Sig.
Corrected Model	55011.473[a]	2	27505.736	410.626	0.000
Intercept	33.8.472	1	3318.472	49.541	0.000
Pre-test	3482.473	1	3482.473	51.989	000
Method	50040.216	1	50040.216	747.038	0.000
Error	6497.527	97	66.985		
Total	396750.000	100			
Corrected Total	61509.000	99			

The Analysis shows that there is a significant difference in practical work and demonstration method on students' performance in basic science. Thus the null hypothesis was rejected (p = 0.001 and $f_{1,97}$ =747.038).

Hypothesis 3: There is no significant difference between the mean performance score of Basic science students taught with discovery method and those taught with demonstration method.

Table 6: Summary of ANCOVA of Students' performance in Basic science based on methods

Source	Type III Sum of Squares	df	Mean square	F	Sig.
Corrected Model	8323.654[a]	2	4161.827	30.984	0.000
Intercept	15654.064	1	15654.064	116.543	0.000
Pre-test	313.404	1	313.404	2.333	0.130
Method	6781.250	1	6781.250	50.486	0.000
Error	13029.096	97	134.321		
Total	422675.00	100			
Corrected Total	21352.750	99			

The Analysis shows that there is a significant difference in discovery and demonstration method on students' performance in basic science. Thus the null hypothesis was rejected (p=0.001 and $f_{1,97}$ =90.565).

Summary of Results

Based on the analysis of the results presented in this work, the findings are summarized and presented as follows

1. There was a significant difference in cooperative and demonstration method on students' performance in Basic science.
2. There was a significant difference in practical work and demonstration method on students' performance in Basic science.
3. There was a significant difference in discovery and demonstration method on students' performance in Basic science.

Discussion of Results

The effect of Activity-based learning strategy on students' performance in Basic science

The study revealed that teaching Basic science with cooperative method enhanced performance of the students after being exposed to the treatment. The difference in mean scores was significant. This shows that the students taught with cooperative method performed better after being exposed to the treatment. This implies that cooperative method is a good teaching method, and that it can be used to enhance students' performance in Basic science. Cooperative method allowed students an opportunity of engaging in learning activities. In agreement, (Johnson & Miles, 2014) reported that group work arouse students' learning interest, cultivate their exploring ability and creative thinking and improve their team spirit and social and communication skills in learning. (Reul & Batianns, 2003) also opined that group work can help students become more active in their learning.

Conclusion

From the findings of this study the four teaching strategies used in this research work were significantly different in their effects on students' performance in Basic science. Practical work method was once more effective than cooperative method while cooperative method was more effective than discovery method and discovery method was more effective than the demonstration method.

Recommendations

The following recommendations were made from the findings of this study

1. The use of activity based learning strategies (cooperative learning strategy, practical work method, and the discovery teaching method) in the teaching and learning of Basic science should be made compulsory for all Basic science teachers and instructors especially at the secondary school level as its importance cannot be overemphasized as revealed by the findings of this study.
2. Basic science teachers at the secondary school level should as a matter of urgency be given orientation through seminars, workshops and conferences on the importance of applying the activity based learning approach in the teaching and learning of Basic science.

3. Government at all levels should show commitment and support in promoting innovative teaching of Basic science and other science subjects at the secondary school level by providing an enabling environment and the required facilities in secondary schools so as to make students' centered learning activities a reality.

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