EFFECTS OF INSTRUCTIONAL STRATEGIES ON STUDENTS' PERFORMANCE IN POLLUTION IN BASIC SCIENCE IN PORT HARCOURT

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Abstract
This study investigated the effects of instructional strategies on students' performance in pollution in Basic Science in Port Harcourt, Rivers State. The pre-test, post-test control group quasi-experimental design was employed. The target population consisted of all 820 Junior Secondary Schools (JSS 1) one students from sixteen (16) state owned co-educational secondary schools in Port Harcourt Local Government Area. A simple random sampling technique was adopted and used to select 220 students from four co-educational junior secondary schools. Three research questions and three hypotheses guided the study. The instrument used for data collection was Basic Science Performance Test (BSPT). To determine the reliability of the instrument, it was trial tested using Kuder -Richardson 20 (K.R-20) and a reliability co-efficient of 0.81was obtained. Mean and standard deviation were used to answer the research questions while t-test was used to test all the hypotheses at 0.05 significant level. The results of the study showed that students taught using demonstration strategy performed better than those taught with Traditional method as it enhanced students' performance in Basic Science better than Demonstration Strategy and Traditional method. Conclusion from these findings led to the recommendations that Basic Science teachers should be encouraged to adopt the use of Concept Mapping and Demonstration Strategies in Basic Science to promote students' performance**.**

Key words: Concept Mapping strategy, Demonstration strategy, Basic Science performance and Pollution.

Introduction

Basic Science is a very important subject in the Nigerian science Education programme, it prepares students at the junior secondary school level for the study of core science subjects at the senior secondary school level which in turn brings about students interest in science oriented courses at the tertiary institution.The science related courses include Engineering, Medicine, Pharmacy, Environmental Biology, Micro Biology, Medical Laboratory Science, Optometry, Dentistry, Anatomy, Physiology et cetera. It is also pertinent to note that Science and Technology play important role in nation building and development. The contemporary world is even driven by Science and Technology, the two are also interrelated. Science is the study of natural world by collecting data through a systematic process called the scientific method, and Technology is where we apply science to create device that can solve problems and do tasks. It is also believed that science probes into questions like the 'why' and Technology probes into

the 'How' aspect and Basic Science as the bedrock of those Science subjects can help students develop the scientific attitudes that are experienced in Science and Technology. Technology is literally the application of science.

It is at this point that Ewesor and Itie (2015) noted that Basic Science and Technology (which was introduced in 2014) is the pillar or foundation upon which the bulk of the present technological breakthrough is built. That is, it should be an opportunity for teachers to make their students appreciate the fact of the subject as a means of achieving technological development and economic survival. Furthermore, Basic Science and Technology education is the way in which children/learners in primary and junior secondary schools try to learn and understand their environment, observe and explore the world around them. Children also learn scientific skills such as observing and referencing when playing with substances like water, mud, insects et cetera.

The urge to improve on the understanding of some Basic Science concepts through effective instructional strategies has increased the awareness or the importance of learners' centeredness in teaching. Learners must be assisted to learn and understand concepts very well. Non- performance maybe related to the type of teaching approach applied in the concept of teaching.

In order to improve academic performance in the students when teaching Basic Science, it is imperative for the teacher to give proper and adequate attention especially in the choice of strategies/methods appropriate for the inculcation of knowledge, ideas and skills in students to facilitate a better understanding of the subject matter (Adah & Ameh, 2002). There are many strategies/methods a teacher can use in the course of instruction. However, no single strategy can be termed as the best but a combination of one or more strategies may serve the purpose at any given point in time.

It is believed that Concept Mapping originated from the philosophy of knowledge called constructivism. Constructivists consider that existing knowledge is utilized as a model for understanding and learning new knowledge.Inspirational Software (2018) defined Concept Mapping as a type of graphic organizer used to help students organize and represent knowledge of a subject. Concept maps begin with a main idea (or concept) and then branch out to show how that main idea can be broken down into specific topics. As students create concept maps, they recite ideas using their own words and help identify incorrect ideas and concepts. Educators are able to see what students do not understand, providing an accurate objective way to evaluate areas in which students do not yet grasp concepts fully. Concept Mapping can bring many advantages to students and educators while learning and teaching science subjects because it helps them to visually present connections between existing and new knowledge. However teachers can use students' concept map as a testing method for evaluating how well a subject is understood by them.

Umar (2013) defined Demonstration method of teaching as a traditional classroom strategy used in technical and training colleges and in teacher education. It focuses on achievement of psychomotor or cognitive objectives. It is noted that Demonstration method is based on some principles such as learning by doing, development of skills by initiation. Chingombe (2013) concurred that demonstration involves teaching pupils how a specific skill is executed.

This method is recommended for teaching a skill because it enables covering of all necessary steps in a process. Thus, Demonstration method gives pupils the opportunity to see and hear the related details being taught. Demonstration method gives pupils the opportunity to become proficient. It is believed that the method leaves nothing to chance.

There are many concepts that exist in Basic Science that need special teaching strategies (like Concept Mapping, and Demonstration instructional strategies) to be applied and one of such concepts is pollution. Pollution is an environmental hazard and having known that our environment is an important resource that provides livelihood and comfort to man. Special attention must be paid to the environment to enable man enjoy the comfort, hence the concept of pollution is considered.

Dictionary.com (2018) defined pollution as the contamination of air, water or soil by substances that are harmful to living organisms. It is believed that pollution can occur naturally, for example through volcanic eruption or as a spilling of oil or disposal of industrial waste. Pollution can also be regarded as unwanted, harmful stuff contaminating an environment.

The teaching of Basic Science requires appropriate instructional strategies, as their proper application is essential for facilitating the achievement of the set objectives. The experience of the teacher and the adoption of appropriate methodology in teaching greatly help in promoting the effectiveness and consequently students' academic performance. Different teaching methods/ strategies such as lecture, discussion, discovery, demonstration et cetera have been applied in teaching the concept of pollution in Basic Science, even though the concept of pollution is supposed to be taken more seriously as a result of black soot which has been predominant in recent times in Port Harcourt and Niger Delta in general. The knowledge of black soot and gas flaring by the students could be conceptualized.

Science educators are concerned about the need to improve students' academic performance so the researchers in this area attest to this concern.(Meheux, 2017; Jubrin & Shehu, 2012; Ajayi, Achor & Agugo, 2017 and Santanu & Abhijit, 2018) found out that concept mapping instructional strategy was better than the conventional traditional method in acquisition of scientific knowledge, though from different subjects. On the other hand, demonstration instructional strategy was also found to be better instructional strategy compared with the conventional lecture method. (Daluba, 2013; Ndioho & Uwazurike, 2015; Achomugu, 2018).

Studies have shown that students' performance in Basic Science is declining. It has been observed that learners performance in Science dwindle as they move up in the academic pursuit to the extent that few students choose science oriented disciplines. Evidence has shown that Concept Mapping, and Demonstration Strategies have been effective in improving learning outcomes of senior secondary schools but there is no clear evidence of the effects on Basic Science in JSS level and in the concept of pollution, hence this study on the effect of Instructional Strategies on Students' Performance and Retention of Pollution in Basic Science in Port Harcourt, Rivers State.

Aim and Objectives of the Study

The study investigated the effect of instructional strategies on students' performance in pollution in Basic Science in Port Harcourt local Government Area of

Rivers State. Specifically, the objectives are to:

1. Determine the mean performance scores of students exposed to Concept Mapping instructional strategy and Traditional method.
2. Ascertain the effect of mean performance scores of students exposed to Demonstration instructional Strategy and Traditional method.
3. Examine the mean difference in performance between students taught using Concept Mapping and those taught using Demonstration instructional Strategies.

Research Questions

The following research questions guided the study:

1. What is the mean performance scores of students exposed to Concept Mapping instructional Strategy and Traditional method?
2. What is the mean performance scores of students exposed to Demonstration instructional Strategy and Traditional method?
3. What is the mean difference between students taught using Concept Mapping and those taught using Demonstration strategies?

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 scores of students exposed to Concept Mapping instructional strategy and Traditional method.
2. There is no significant difference between the mean performance scores of students exposed to Demonstration instructional strategy and Traditional method.
3. There is no significant difference between students taught using Concept Mapping and those taught using Demonstration instructional strategies.

Methodology

The study employed a quasi-experimental research. Specifically, a non-equivalent pre-test, post-test control group design. A quasi-experimental design was employed because intact classes were used as a group in each school and therefore selection of each subject was not randomized.

However, assignment of groups to different treatment conditions was randomized. The three experimental groups and the control group were given pre-test and post-test. The post-test of the experimental groups were after the treatment.

The population consists of all the 820

JSS 1 students in the sixteen (16) co-educational public secondary school in Port Harcourt Local Government Area of Rivers State. However, JSS 1 students were chosen because it is the class in which environmental pollution is taught in Basic Science. Source: Universal Basic Education Board Port Harcourt, Rivers State (2018). The sample size for this study was 220 JSS 1 students selected from four public junior secondary schools in Port Harcourt Local Government Area. Simple random sampling technique was used to select the four schools for the study. The sample used was an intact class without randomization.

Face and content validity of the instruments tagged Basic Science Performance Test (BSPT)was determined by presenting the instrument to three experts in Science Education. These experts were requested to scrutinize the instruments for content, relevance and appropriateness. Their criticism and remarks were used to improve on the

instrument and lesson plans. In addition, the title of the study, the research questions and hypotheses were also used to ensure the face validity of the instrument. A sample of 20 students who were not part of the study was drawn from an equivalent sample. The instrument Basic Science Performance Test (BSPT) was used for the test of reliability. Kuder Richardson 20 (K.R-20) was used and a reliability coefficient of 0.81 was obtained. The value is high enough to guarantee the use of the instrument for the field work.

Basic Science Performance Test (BSPT) used for the study was designed to test the general knowledge of the topic – pollution. It is made up of 25- multiple choice questions, the students selected from the options A-D. The test was used as both pre-test and post-test to gather data. Four lesson plans were prepared by the researcher. The three lesson plans were written using the Concept Mapping strategy, Simulation and Demonstration strategies respectively and the fourth lesson plan was with the usual traditional method. The experimental and control groups were taught by the researcher with the same contents. The researcher visited the schools to administer the test to the students. The time allotted for the test was 30 minutes.

Three instructional strategies were used for this study. The two strategies are Concept Mapping strategy, and Demonstration strategy, while the third approach was the traditional method. The two strategies were identified in terms of content, basic instructional objectives and mode of evaluation. The difference was in the instructional activities.

Concept Mapping strategy, and Demonstration strategy were used for the treatment, for group 1, and group 2 while the traditional method was used for the control group. Subjects in both experimental groups were given the pre-test in BSPT before the experiment by the researcher. At the end of the treatment based on the three different instructional strategies, the post-test was administered to the students with the help of the subject teachers at the allotted time of 30 minutes. The answer scripts were retrieved, marked and scored by the researcher.The data collected from the three (3) sample schools were used for analysis.

The student's pre-test and post-test scripts in the four groups were marked and scores recorded. The data obtained were subjected to analysis using SPSS(IBM SPSS Statistics version 22). Descriptive statistics was applied in the analysis. Mean and standard deviation were used to answer the research questions, while t-test at 0.05 level of significance was used to test the hypotheses.

Results and Discussion

Research Question One: What is the mean performance score of students exposed to Concept Mapping instructional strategy and Traditional Method?

Table 1: Mean Gain scores on the effect of Concept Mapping and Traditional Method

		Pretest		Posttest		
Group	**n**	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Concept Mapping						
Traditional	39	40.8	13.5	72.3	9.00	31.5
Method	85	37.8	10.73	46.4	11.70	8.56

Table 1 shows that prior to the use of Concept Mapping instructional strategy in teaching of Basic Science, students' mean scores were 40.8 and 37.8 while their standard deviations were 13.5 and 10.7 respectively. After the treatment using Concept Mapping the means were 72.3 and 46.4 with standard deviations of 9.00 and 11.7 respectively. The mean gain of Concept Mapping was 31.5 while that of control group was 8.56. This signifies that the concept mapping group benefited more in the lesson, hence, concept mapping strategy has affected students' performance to a great extent in Basic Science.

Research Question Two: What is the mean performance score of students exposed to Demonstration instructional strategy and Traditional method?

Table 2: Mean Gain scores on the effect of Demonstration and Traditional Method

		Pretest		Posttest		
Group	**n**	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Demonstration	33	41.2	16.6	58.8	16.0	17.6
Traditional Method	85	37.8	10.7	46.4	11.70	8.56

Table 2 shows that with the mean and standard deviation of pre-test and post-test, the mean gain of demonstration method is 17.6 and that of traditional method is 8.56. This shows that students taught with Demonstration strategy gained more than their counterparts who were taught with Traditional method.

Research Question Three: What is the mean difference in performance between students taught usingConcept Mapping and those taught using Demonstration strategy?

Table 3.Mean Gain scores on effect of Concept Mapping and Demonstration

		Pretest		Posttest		
Group	**n**	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Concept Mapping	39	40.8	13.5`	72.3	9.00	31.5
Demonstration	33	41.2	16.6	58.8	16.0	17.6

Table 3: has pre-test mean of 40.8 and 41.2 and standard deviation of 13.5 and 16.6 respectively. The post-test mean being72.3 and 58.8 with standard deviation of 9.00 and 16.00; mean gain of 31.5 and 17.6 for Concept Mapping and Demonstration. This signifies that the students taught with concept mapping benefited more in the lesson, hence, Concept Mapping strategy has affected students' performance more than Demonstration strategy.

Hypotheses

Hypothesis one: There is no significant difference in the mean performance scores of students taught using Concept Mapping instruction strategy and traditional method (control).

Table 4: Summary of t-test on the difference between the mean performance scores of students taught with Concept Mapping and those taught with Traditional Method.

Group	n	Mean	SD	df	t	P-value	Decision
Concept Mapping	39	72.3	9.00				
				122	12.3	0.00	Reject
Traditional Method	85	46.4	11.7				

Table 4 shows that there is a significant difference between the mean performance scores of students taught with Concept Mapping and those taught with traditional method. P-value is 0.00 which is less than 0.05. Therefore Ho_1 is rejected. There is a significant difference in the mean performance scores of students taught using Concept Mapping instruction strategy and traditional methods (control). This shows that Concept Mapping is a significant factor in the students overall performance in Basic Science.

Hypothesis Two: There is no significant difference in the mean performance score of students taught using Demonstration instructional strategy and traditional methods (control).

Table 5:Summary of t-test on the difference between the mean performance scores of students taught with Demonstration Strategy and those taught with Traditional Method.

Group	n	Mean	SD	df	t	P-value	Decision
Demonstration Strategy	33	58.8	16.0				
				116	4.63	0.01	Reject
Traditional Method	85	46.4	11.7				

Table 5 shows that the value of t is 4.63, the p-value is 0.01 which is less than 0.05. We therefore reject the null hypothesis. This implies that there is a significant difference between the mean performance scores of students taught with Demonstration Strategy and those taught with Traditional method.

Hypothesis Three: There is no significant difference in the mean performance scores of students taught using Concept Mapping instructional strategy and Demonstration instructional strategy.

Table 6: Summary of t-test on the difference between the mean performance scores of students taught with Concept Mapping and those taught with Demonstration Strategy.

Group	N	Mean	SD	Df	t	P-value	Decision
Concept Mapping	39	72.3	9.00				
				70	4.50	0.002	Reject
Demonstration Strategy	33	58.8	16.7				

Table 6: shows that the result is rejected since its p-value is less than 0.05 i.e p-value (= 0.002) < α (= 0.05) and t = 4.5, we therefore reject the null hypothesis. There is significant difference in the mean performance scores of students taught using Concept Mapping instructional strategy and Demonstration strategy. Rejecting the hypothesis means that the students taught with Concept Mapping performed better than those taught with Demonstration Strategy.

method of teaching. In table 5, the result of the t-test showed t = 4.63, and p-value is 0.01, which is less than 0.05, therefore the null hypothesis is rejected. This shows that there is a significant difference in the mean performance of students taught using Demonstration Strategy compared with those taught with Traditional Method.

Discussion of findings

In this study Concept Mapping strategy enhanced performance better than traditional method. This showed that after exposure to the treatment, the students exposed to Concept Mapping Instructional strategy outperformed the students in control group who were passive listeners in their Basic Science classes. There was a significant difference between the mean performance scores of students taught Basic Science using Concept Mapping strategy and those taught using traditional method.

Meheux (2017), Jubrin and Shehu (2012) agreed that the students exposed to Concept Mapping instructional strategy do better than those taught with traditional method though in different subjects (Physics and Biology respectively). Furthermore, Ajayi, Achor and Agugo (2017) investigated on the same Concept Mapping and the students outperformed their counterparts.

The students that were taught with the Demonstration strategy were found to have high performance in the Basic Science Performance Test than their counterparts in the control group that were taught with the conventional traditional

The finding is in agreement with some earlier findings of Daluba (2013) who investigated the effect of Demonstration Method of teaching on students' achievement in Agricultural Science in Secondary School in Kogi East Educational Zone of Kogi State and Ndioho and Uwazurike (2015) who carried out a research on Direct Instruction and Demonstration Method in teaching of Integrated Science in Port Harcourt. Achimugu (2018) also carried out the study on the relative effectiveness of enriched demonstration and lecture strategies in senior secondary schools students' achievement in Chemistry. The students exposed to enriched Demonstration Strategies performed better than those expose to lecture method. These researchers observed that students in the experimental group performed better than those in the control group. The

Demonstration strategy used was activity oriented unlike the traditional method.

On the other hand, the present study revealed that students taught with Concept Mapping performed better than those taught with Demonstration Strategy, which in agreement with the work Santanu and Abhijit (2018) who examined Concept Mapping Teaching Strategy on Physical Science Achievement in relation to intelligence level. The result indicated a significant difference in performance that was in favour of students in the experimental group (Concept Mapping Strategy).

Summary of findings

The major findings of the study were as follows:

1. That Concept Mapping group benefited more than the traditional method in the lesson, hence Concept Mapping Strategy has affected students' performance to a great extent in Basic Science.
2. That students taught with Demonstration Strategy gained more than their counter parts who were taught with traditional method.
3. That students taught with Concept Mapping Strategy was found to have high performance in BSPT than their counterparts in the Demonstration group.

Conclusions

It is concluded that Demonstration Instructional Strategy was better than traditional method. Also those students taught using Concept Mapping Instructional Strategy performed better than those taught using traditional method. Generally, Concept Mapping Instructional Strategy is superior to Demonstration strategy and traditional method as it enhanced students' performance in Basic Science better than Demonstration Strategy and traditional method.

Recommendations

Based on the findings and conclusion of this present study, the following recommendations were made:

1. Teachers should be encouraged and efforts intensified to aggressively adopt the use of Concept Mapping and Demonstration in Basic Science to promote students' performance.
2. The society should be exposed to the research work to enable them avoid exposure to black soot because of the negative effects like acidification of rain, cancer and lung cancer.
3. Curriculum developers should as a matter of priority, be reviewing Basic Science curriculum on a continuous basis with the view to incorporating Concept Mapping, Demonstration and simulation teaching strategy. This will help promote performance of students in junior BECE in Basic Science.

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