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Use of Environmental Resources: Innovative Teaching For Enhancing Pupils' Academic Performance In Basic Science In Cross River State, Nigeria

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ABSTRACT

The study examined the efficacy of using environmental resources in teaching Matter and its properties amongst Basic Science pupils in Cross River State, Nigeria. The environmental resources used for teaching Matter included camphor balls, stones, water, palm oil, vegetable oil, yam, cassava, milk, chalk particles, sugar, garri, table, stool, spoon, perfume, rotten egg, egg in a bottle, kerosene, balloon, and a piece of magnet. Two null hypotheses were formulated to guide the investigation. The design adopted was a quasi- experimental design where the experimental group was taught the concept of Mater and its properties with innovative approach of making students interact with environmental resources that are locally sourced while the control subjects were taught the same topic without these environmental materials. The treatment lasted for two months. The reliability of the instrument used for obtaining data (Basic Science Performance Test (BSPT) was established using Richard-Kudarson formula (KR-21). The reliability yielded a coefficient of 0.86. The data obtained were analyzed using the independent t-test analysis technique. Results revealed that the experimental class which was allowed to interact with environmental resources as they were taught Matter and its properties, performed significantly better than the control group taught without this interaction. On this basis recommendations were made in support of teaching basic science with environmental resources, which will help to enhance the efficiency of learning the subject among pupils in primary schools. Primary School science teachers should adopt the use of environmental resources which abound within the learners' environment to promote performance of pupils in Basic Science.

Keyords: Enhancing, Academic performance, Basic Science and Environmental resources.

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1. INTRODUCTION

Basic education is the first level of education in Nigeria, which is divided into three parts – the lower basic, middle basic and the upper basic. The lower and middle basic components of the Nigerian basic education make up Primary education, which is defined as the education given in an institution for children aged 6-11 years plus. These aspects of the Nigerian basic education constitute the bedrock upon, which the entire education system is built (Labo-Popoola; Bello & Atanda, 2009). The importance of this level of education can be seen in the sense that all beneficiaries of the other levels of education, by necessity, have to pass through it. Thus, the success and failure of the entire education system are determined by this basic level (Oni, 2008). Therefore, Basic Science, being one of the subjects taught at this level of education, serves as the foundation for science learning for all other levels. This makes the effectiveness of science learning at this level very important.

Despite the fact that science learning at this level is critical to the learning of science at all other levels of education in Nigeria, we see performance of pupils in the subject consistently poor. In Cross River State, for instance, Basic Science at the common entrance examination is one of the most poorly performed subjects. This poor academic performance of pupils in Basic Science has been partly attributed to teachers' mode of presentation of science instruction in the classroom (Udogu, 2010 & Asiyai, 2006). Also, Neji and Nya (2014) observed that the extent of utilization of learning resources in teaching Basic Science in primary schools is lower than expectation. This results to inadequate opportunities for learners to actively engage in the learning process.

Primary school pupils progress through primary education in Nigeria without adequate opportunities to handle laboratory materials, either because those materials are not available or are inadequate. Thus, the pupils see science as an abstract subject that does not have anything to do with their daily living. In corroboration with this, Iqwe (2015) posits that learners should be presented with opportunities to learn science in a friendly environment by using resources within the environment that are familiar to the learners, which promote achievement and retention of Science concepts. There is therefore need for science teachers to adopt innovative teaching approaches through the use of alternative methods and provide pupils with opportunities to interact with learning materials from their environment.

Primary school pupils progress through primary education without adequate opportunities to handle laboratory materials resulting in poor learning outcome in science. Corroborating this assertion, Iqwe (2015) posits that learners should be presented with opportunities to learn science in a friendly environment by using resources within the environment that are familiar to the learners, which promote achievement and retention of Science concepts. Environmental resources are simply materials found in our environment that could be effectively used for teaching science especially at the basic level of education. Edgar – Dale's (1969) theory of learning by experience, emphasized the learning process where pupils remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see, 70% of what they say and 90% of what they say and interact with. The significance of this study depends on the extent to which the use of/and interaction with environmental resource(s) influences pupils' academic performance in Basic Science.

Literatures on science teaching emphasize the need for science teachers to adopt innovative teaching approaches through the use of inquiry based learning, problem-solving approach, concept mapping, experimental approach and other alternative methods to reduce teacher authority in the classrooms where students are not provided with opportunities to interact with learning materials. Science teachers are required to go beyond the subject area and explore different ways knowledge could be imparted to the understanding and assimilation of the learners to enhance optimum performance. Often, teachers do so by selecting teaching styles or strategies that match learners' background, aspiration, intelligence, age, available resources and the concept under consideration (Onwioduokit, 2013). Generally, science teaching and learning require hands – on or activity-based approaches and use of instructional resources to ensure clarity and understanding of concepts. Gbmanja (1991) observed that, learning is more productive and effective if the pupils are engaged and resources are maximized appropriately. A bare and uninteresting environment offers little or no opportunity for learning to take place.

Nnaka and Anakwe (2006) and Ihuarulam (2008) reported that the poor achievement in science subjects has been partly attributed to teacher dominated teaching approaches resulting in inadequate opportunities to learn, especially in poorly equipped science laboratories where learners are not provided with opportunities to interact with science materials. Consequently, learners progress through the system without the relevant basic skills and knowledge in science which often reflect in their performance. Achievement has to do with attainment of the set objectives in instruction. Udogu (2010) affirms that academic achievement is the attainment of a set of objectives measured from the score obtained through a test. Thus the success of science teaching and learning is dependent on the learner's ability to achieve and recall prescribed concepts meaningfully.

In numerous ways environment can be considered the laboratory for teaching science. Within its widest nature so many physical, chemical, biotic and abiotic reactions are constantly occurring on daily basis. An effective science teacher should look into the environment and explore resources in teaching Basic science to ensure meaningful learning. Active learning by engagement offers a paradigm for pupils' to learn differently from the conventional approach (lecture method). Snodgross (2001) asserted that learners who go to school to study science at the secondary institution and had contact with the learning outcome of science in the environment, are stimulated and motivated to learn science as a means of finding answers to many questions in the environment. The science of environment was put forward by Johnson (2007) to create innovative and constructivist science resources that make the teaching of science unique and easier for teachers and more fun for pupils.

The environment contains a lot of science experiments and activities and enterprise in science education and can challenge pupils to learn actively (Home experiments 2014). Eshiet (1996) sees the environment as a place stocked with quality materials and probably the safest science laboratory in the world. Experimenting using environmental resources serves a motivational strategy for students to learn science. Dahar and Faize (2011) carried out a study on the effect of availability and use of instructional material on academic performance of students in Punjab (Pakistan). 20 students and 10 teachers from each school were randomly selected as sample for the study. The study used the value added approach. A questionnaire for teachers and result sheet were the instruments of the study. Pearson Product Moment Correlation was used to find out the relationship and Stepwise Regression Analysis with linear function was used to find out the differential impact (causal relationship). The study found that there was low availability and efficiency in the use of instructional materials, which was responsible for poor academic performance.

In line with this result, Onasanya and Omosewo, (2011) investigated the effect of improvisation and standard materials on students' achievement and obtained some quality results. The research design employed was quasi experimental research design of the pretest-posttest non randomized control design. There was a significant difference between the students taught with standard instructional materials and those taught with improvised instructional materials. The mean scores of pretest $t=4.09$, $df=14$, $p=0.05$. There was no significant difference between the post test scores of the experimental group and control group. This means that improved instructional materials in the compassion of the male mean scores of experimental and control group were the same entry level with regard to academic year entry $t=2.23$, $df\ 7$, $p=0.05$. Students learn better with instructional materials as to bring better understanding of the topic under consideration.

Nwosu (2003) investigated the comparative effects of prior and concurrent exposures to related Mathematics principles on achievement and retention in practical Chemistry among senior Secondary three (SS3) students in Abia State. "The research design adopted was Quasi-experimental involving non-equivalent pre-test – post-test control groups. One hundred and forty (140) SS3 Chemistry students drawn from fourteen (14) co-educational secondary schools formed the sample for the study. Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 alpha levels. The results showed a mean of 35.21 for the experimental class taught with concurrent exposure to mathematical principles while the control group taught practical Chemistry without exposure to basic Mathematics had a mean score of 21.63. The un-adjusted mean score for the three levels of treatment were 7.59,-6.61 and 5.99 respectively, and as expressed as deviation from the grand mean. The deviation in prior exposure group was higher than those in concurrent group and control group hence, variation in achievement was attributed to prior exposure strategy to basic Mathematics principles.

The gender dimension of science and technology has become one of the most important and debated issues worldwide. A strong tradition has been established of researches on gender issues in science classroom due to serious justifiable concerns about gross under-representation of girls in science and contribution of women in science and technology related courses (Enukoha, 1995; Abiam & Odok, 2006 & Edu, 2013). Lagoke, Jegede and Oyaebanfi (2009) observed that this under-representation is generally economic and philosophical, relating to equity and equality. In Nigeria, the Science Teachers Association (STAN, 2014) reported that less than 10% out of 100 women of the total enrolment in Nigeria universities for Sciences and Technology based disciplines are taken up by women, only 6% of those who enrolled in WAEC and SSCE are girls and less than 5% of academic disciplines are women.

In a study report for UNESCO by Koirala & Acharya (2005) on Girls in Science and Technology Education: A Study on Access, Participation, and Performance of Girls in Nepal. four objectives were focused on viz. to review curricular and research materials from gender lens, identify stakeholders' perspective towards girls' access to and participation in Science and Technology Education (STE) related subjects, find out the forces that are both conducive as well as obstructive to STE for girls, and work out measures to address the problems. In view of these objectives, documents were reviewed, 55 schools in 11 districts of the country surveyed and data of 80,838 students analyzed quantitatively. This apart, qualitative information obtained from 22 different schools of the districts was processed, classroom dynamics was observed, and case studies were carried out. The data thus obtained from the fields were shared through debriefing sessions in the headquarters of the districts covered by the study. The study came up with five major conclusions, which are: (a) parents expected less from girls' education and so cared less about it (b) teachers failed to link girls' practical experience with theoretical knowledge (c) girls were confined to domestic chores and hence could not give enough time to science subjects (d) girls fear that science subjects are difficult considering it as the boys domain only (e) girls' deeply entrenched inhibition stood in the way despite efforts to the contrary.

However, Hazari and Patvin (2005) affirmed that though females and males may be inherently different or socialized to be different, those differences cannot dictate who participates and succeeds in science. Also, according to a new analysis published by the American Psychological Association (2014) despite the stereotype that boys do better in math and science, girls have made higher grades than boys throughout their school years for nearly a century. The researchers examined 369 samples from 308 studies, reflecting grades of 538,710 boys and 595,332 girls. Seventy percent of the samples consisted of students from the United States. Other countries or regions represented by more than one sample included Norway, Canada, Turkey, Germany, Taiwan, Malaysia, Israel, New Zealand, Australia, Sweden, Slovakia, United Kingdom, Africa and Finland. Countries represented by one sample included Belgium, Czech Republic, Estonia, Mexico, Hong Kong, India, Iran, Jordan, the Netherlands, Portugal, Saudi Arabia, Serbia and Slovenia. As for why girls perform better in school than boys, the authors speculated that social and cultural factors could be among several possible explanations. Parents may assume boys are better at math and science so they might encourage girls to put more effort into their studies, which could lead to the slight advantage girls have in all courses, they wrote.

Gender difference in learning styles is another possible reason for differences in performances in the sciences. Previous research has shown girls tend to study in order to understand the materials, whereas boys emphasize performance, which indicates a focus on the final grades. The author emphasized that mastery of the subject matter generally produces better marks than performance emphasis, so this could account in part for males' lower marks than females. In order to determine the influence of gender on students' academic performance, Mbia (2009) conducted a research on the influence of variables like gender, age and nature of schools on students' academic performance in England. The study comprised performance difference between male and female students in secondary schools using a total of 2,500 subjects. Two research instruments were developed to guide the study finding revealed that boys recorded a higher mean score than girls indicating that boys had better problem solving ability than girls. Gender achievement in science, according to data revealed that primary science pupils do not exhibit any gender difference in achievement; that gender difference begins to appear in the middle grades (Catsambis 1995) and that gender gap in science achievement increases from 9-13 years (Kahle & Meece, 1994). However, the issue is whether there would be influence of the use of environmental resources on academic performance based on gender.

The use of environmental resources in teaching basic science concepts help to improve on the conventional method of teaching science by memorization of information and trying to recall during examination. It brings the environment closer to the learners and enhances comprehension of science concepts. Obeikwe and Njelita (2013) posited that teaching science concepts requires activity based approach. This can be realized through exploring environmental resources.

1.1 Objectives Of The Study

The main objective of the study was to investigate the influence of innovative teaching using environmental resources on pupils' academic performance in Basic Science in Cross River State, Nigeria. Specifically, the study sought to determine:

(i) The influence of the use of environmental resources on pupils' academic achievement in Basic Science.
(ii) The influence of the use of environmental resources on pupils' academic performance in Basic Science based on gender.

1.1 Hypotheses

Two null hypotheses were formulated to direct the investigation

- There is no significant influence of the use of environmental resources on pupils' academic performance in Basic Science.
- There is no significant influence of the use of environmental resources on pupils' academic performance in Basic Science based on gender.

2. METHODOLOGY

The study examined the efficacy of using environmental resources in teaching 'Matter and its properties' amongst Basic Science pupils in Cross River State, Nigeria. The environmental resources used for teaching Matter included, camphor balls, stones, water, palm oil, vegetable oil, yam, cassava, milk, chalk particles, sugar, garri, sugar, table, stool, spoon, perfume, rotten egg, egg in a bottle, kerosene, balloon, and a piece of magnet. The research design adopted for this study was the quasi experimental design. The independent variable was environmental resources, moderator variable was gender and the dependent variable was academic performance. Two null hypotheses were formulated to direct the study. A total of one hundred and twenty (120) primary six (6) pupils were randomly selected from five (5) randomly public primary schools pupils in Calabar Education Zone, Cross River State, Nigeria. The sampling technique adopted was purposive where the researcher intentionally and credibly selected the respondents from the selected primary schools in Calabar. The research instrument used to obtain data for analysis was a test comprising thirty (30) objective questions based on matter and its properties. The reliability of the instrument was establishment using Kudar- Richardsen formula – 21 (K-R21).

The experimental group was taught Matter and its properties in each school, using environmental resources. Basic Science Performance Test (BAPT) comprising of 30 questions was the instrument used for data collection. The reliability of the Basic Science Performance Test (BSFT) was established using Richard- Kudarson formula (KR-21). The reliability yielded a coefficient of 0.86. The instrument was administered to primary six pupils in Calabar Education Zone of Cross River State, Nigeria. Analysis of data was done using the independent t-test.

3. ANALYSIS OF DATA

Independent t-test analysis was found to be most appropriate for the analysis of the two hypotheses since the study was looking for influence and also involved two independent groups of respondents. The analysis of data was done hypothesis-by-hypothesis.

Hypothesis 1: There is no significant influence of the use of environmental resources on pupils' academic performance in Basic Science.

Data was analyzed using independent t-test analysis technique. The result of the analysis is presented in Table 1.

Table 1
Independent t-test analysis of the influence of the use of environmental resources on pupils academic performance in basic science N =120).

Variables	N	$\bar{X}$	SD	t
Experimental group	60	19.54	9.62	6.25
Control group	60	12.61	4.71	

P<0.05; df = 118; critical t – 1.96

Table 1 revealed that the experimental group had a higher mean score ($\bar{X}$ = 19.54) while the control subjects had a lower mean score ($\bar{X} = 12.61$) at 0.05 level of significance result, which also revealed that the calculated t – value was 6.25 and the critical t-value was 1.96. This shows a high level of significance. Thus, the hypothesis was rejected. This means that there was a strong influence of the use of environmental resources on pupils' academic performance in basic science.

Hypothesis 2: The hypothesis states that there is no significant influence of the use of environmental resources on pupils' academic performance in Basic Science based on gender.

Data was analyzed using the independent t-test analysis technique. The result of the analysis is presented in Table 2.

Table 2
Independent t-test analysis of the difference between male and female pupils academic performance when taught with environmental resources in basic science (₦ =120).

Variables	N	$\bar{X}$	SD	t
Male	60	10.55	4.02	5.70
Female	60	15.60	7.55	

P<0.05; df = 118; critical t = 1.96

Table 2 sought to investigate the difference in the academic performance of male and female students taught with environmental resources in basic science. Result revealed that the experimental female and male students had higher mean scores $\bar{X}$ = 15.60 and $\bar{X}$ = 10.55 respectively). The calculated t-value of 5.70 was significantly higher than the critical t-value of 1.96. The hypothesis was thus, rejected. However, the female pupils indicated a higher mean variance in academic performance when taught with the use of environmental resources, than the males.

4. DISCUSSION OF FINDINGS

Influence of the use of environmental resources on pupils' academic performance in basic science
The findings from the analysis showed that there was a positive influence of learning resources on students' academic achievement in Basic Science. This means that teaching Basic Science through the use of resources locally sourced within the students' environment helps to enhance the effectiveness of learning and learning outcome. The finding agrees with Inyang (1997) that teaching is more effective and maximized when science teachers adopt the use of instructional materials. Stephen, Isaac & Iorkpilgh (2013) confirmed that there is a significant correlation between instructional materials on academic performance of students. The result is a clear indication that the observed low performance of pupils in Basic Science in Calabar Education Zone of Cross River State, Nigeria, may be attributed to non-utilization of instructional resources for the teaching of the subject.

Influence of the use of environmental resources in teaching basic science on male and female pupils.
The result also showed that there is significant difference in performance of pupils between those taught with environmental resources and those taught without, based on gender. A more critical look at the results also showed that females had higher mean variance when taught with environmental resources than their male counterparts. Contrary to this result, Mbia (2009) conducted a research on the influence of variables like gender, age and nature of schools on students' academic performance in England. The finding revealed a variance between boys and girls in performance and showed that boys recorded a higher mean score than girls indicating that boys had better problem solving ability than girls.

However, In line with the result of the present study, a new analysis published by the American Psychological Association (2014), observed that despite the stereotype that boys do better in math and science, girls have made higher grades than boys throughout their school years for nearly a century. Though the general belief is that males perform better in science than girls, Hazari and Patvin (2005) affirmed that even if females and males are inherently different or socialized to be different, those differences cannot dictate who participates and succeeds in science. The researchers assume that the result of the study was as a result of the determination of girls' determination to dispel the notion that they are less able in science than their male counterparts.

5. CONCLUSION

The study showed that the use of innovative teaching using resources from the environment in teaching enhances students' academic performance in Basic Science. This indicates that environmental resources have a positive influence on pupils' performance. It was, thus, concluded that environmental resources simplifies the teaching and learning of Basic Science concepts since there is actual interaction and originality, which brings the science environment closer to the pupils.

6. RECOMMENDATIONS

1. Teachers should adopt the use of environmental (physical) resource in teaching Basic science.
2. Curriculum planner should consciously develop the basic science curriculum to involve the use of environmental resources in teacher activities.
3. The environment contains lots of innovative experiences, activities and materials that science teachers can adopt for effective teaching and learning of science. Improvisation is an important skill every teacher should develop. In the absence of, or inadequacy of laboratory resources for teaching science, teachers should improvise using resources from the environment.
4. The government should organize conferences and workshops where consciousness on the use of environmental resources for teaching science can be created in teachers. Teachers can also be trained and retrained in the effective use of environmental resources for the teaching of basic science.
5. Females are likely to perform well in science too. Thus, the government should sensitize the public through the media on the need for females to participate in science subjects and all enabling environment given to them to enhance their effective learning of the sciences.

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