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EDITORIAL

STEM Journal of Anambra STAN (STEMJAS) is a publication of **Science Teachers Association of Nigeria, Anambra State Chapter.** STEMJAS is developed to disseminate information on Science, Technology, Engineering and Mathematics (STEM) to teachers, teacher-trainers, researchers and other interested persons. Articles that are of relevance to STEM education are published in this journal.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Ebele C. Okigbo

Editor-in-Chief

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EVALUATING THE IMPACT OF LABORATORY FACILITIES AND STUDENTS ACADEMIC ACHIEVEMENT IN MATHEMATICS IN ANAMBRA STATE

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Abstract

The study ascertained the impact of laboratory facilities on senior secondary school studies academic achievement in mathematics. A descriptive survey research design was adopted for the study. The population consisted of 4000 SS1 students the seven public secondary schools in Onitsha North Local Government Area indicated by post Primary School Commission (PPSSC, 2024). A simple random sampling technique was adopted to select seven (7) out of 25 secondary schools. The instrument for data collection was a structured questionnaire constructed by the researcher and distributed to only the selected sample population of the study. One research question guided the study and one research hypotheses was tested at 0.05 level of significance. Mean scores of 2.50 and above was accepted, while 2.49 and below was rejected for the study z-test was also used to test hypothesis at 0.05 level of significant. The findings revealed that the impact of laboratory facilities in teaching mathematics helps to improve students' achievement in mathematics. Based on the findings, the researcher recommended among others that the mathematics teachers should be mandated to use mathematics laboratory during instructions.

Keywords: Laboratory Facilities, Academic Achievement

Introduction

Mathematics is the foundation of science and technology, the functional role of mathematics to science and technology is multifaceted and multifarious that no area of science, technology and business enterprises escapes its application (Okigbo & Osuafor, 2018). Mathematics is the mirror of civilization in all the countries of painstaking, calculations and to most basic discipline for any person who would be truly educated in any scope and in many other endeavors (Ukeje, 1986). According to Nwoke and Nnaji (2011), mathematics is the study of quantity, structure, space and changes. It developed through the use of obstruction and logical reasoning from country, calculations measurements and the study of shapes and motions of physical objects. It involves thinking logically and reasonably so as to understand how Formula is derived and their applications. The study of mathematics had been and will continue to be tremendously important to humanity for its ability to explain natural phenomena and everyday occurrences' as well as its central role in the world's technological development. In the same vein, Nwamaradi (2014) defined mathematics as a language of nature developed to aid precise and logical thinking about mathematics.

Moore (2015) asserted that mathematics is the logical language for expressing ideas, shapes, quantities, sizes, order, change and dynamism in the system and far explaining the complexities of modern society in the business, economics, academic engineering and medical settings. This might be the reason for the Federal Republic of Nigeria (2014) in the National policy on education accorded prominence to mathematics at both primary and secondary school as it is taught least from (4) times in a week and at all levels. Mathematics comprises of numbers and numerations, algebra, geometry, probability, statistics and probability among others. Despites all the application of and usefulness of mathematics in life, students achievement it is not encouraging. According to WAEC chief examiners' report (WAEC 2011-2016) students fail woefully- questions in mathematics especially in geometry. Since geometry is practically oriented, the use of mathematics laboratory facilities can be of huge benefit to the students' achievement in mathematics.

Mathematics laboratory is a place where students can explore mathematical objects, shapes and symbols to learn and verify mathematical facts and theorems through a variety of activities using different materials. These activities may be carried out by both the teacher and the students to explore, learn, stimulate interest and develop favorable attitude towards mathematics (Sreedhard, 2018). Nwoke & Nnaji (2011) asserted that the use of mathematics laboratory facilities is more effective than that normal conventional method of teaching mathematics with respect to the student's achievement. Mathematics laboratory facilities further seen to enhance student's ability to carry-out their project and other activities this provides active sensory mathematics experience (Ukpebor, 2011). Hence, it should be a focal point of all mathematics work in school Obienyem in Leghara et al (2013) opined that the nature of mathematics and its contents demand effective engagement and participation of the students in mathematics class or activities, when their developmental level is taking into consideration, this opportunity to learn mathematics actively through practical investigation of laws, formula and principles can be achieved with a well-established mathematics laboratory.

Impact of Mathematics Laboratory

Mathematics laboratory provides the learning opportunity not only from the teacher but also provides from the peers. It helps the teacher to deliver the class working together with their students in a creative way. To support learning from the classroom experience, the work in a mathematics laboratory is

organized around a learning cycle with four phases: learning together, co-planning a lesson, enacting the lesson together, and debriefing together (McDonald, Kazemi, & Kavanagh, 2013). In this learning cycle, the students learn in group, plan the lesson together, act and perform instructional activity that provides the practical means for focusing student and teacher learning together and at last they also debriefing together. Mathematics laboratory is a practical oriented classroom or place where materials useful for the effective teaching and learning of mathematics are kept. Throughout these classroom presentations, teachers experiment together with new teaching practices and learn together about students' mathematical thinking. As stated by Fernandez (2002), teachers spend time together in classrooms. However, in a mathematics laboratory teacher's work together to experiment with instruction during both planning and the classroom enactment by collectively discussing instructional decisions in the moment (Gibbons, Kazemi, Hintz & Hartmann, 2017). Thus, mathematics laboratory helps the teacher to modify their role as the facilitator that might play in supporting them to collectively learn in and from practice. Hence, the mathematics laboratory may have impact on teacher's role, teaching strategy, students' assessment technique and classroom instruction. Some impacts of mathematics laboratory are as follows:

a. It shifts the teacher as a learner in the classrooms, which enables the teacher to see their learners in new ways.

b. It focusses on instructional activities that support teacher and make them feel more prepared for implementing in their own classroom and to develop a sense of alignment with their colleagues.

c. Mathematics laboratory may influence the students and teacher on activity-based learning rather than the traditional teacher centered method.

d. It makes the teacher as a supportive role play or as a facilitator and makes the students as a major part of the learning process.

e. Learning may be easier and permanent due to activity-based learning and more time consuming

f. The teaching activity plans are collectively created and possessed by the participating teachers.

g. It helps to create positive attitude towards learning mathematics in both students and teacher.

h. It helps the students to develop to work in group, collaborate with each other and socialization.

i. It helps to develop problems solving skills and encourage the students to promote creativity.

j. It helps the students to motivate for learning, developing cooperation and coordination skills among them.

In regards to this, the teaching and learning of mathematics concepts like geometry should be by practical, exploration and experiment using mathematics laboratory facilities. This will make students organize their true potentials, talents, cultivate habit of hand on work, ethical standard to learning of mathematics (Ogunkunle, 2017). In mathematics, laboratory facilities should be used in demonstrating abstract concepts using concrete materials and this is capable of enhancing student's interest in mathematics (Onwuka & Iweka 2010). The using of mathematics laboratory facilities provides opportunity for concretizing some of the abstract concepts in mathematics. Then, the researcher therefore deems it necessary to evaluate the impact of laboratory facilities on senior secondary school student's academic achievement in mathematics in Onitsha North L.G.A. of Anambra State.

Statement of the Problem

Many students always complain of the difficult nature of mathematics, most of them stress that they easily forget mathematical concepts learnt especially the formula and notation students usually express difficulty in understanding and retaining concepts being taught in the class. Also, students always perform poorly in mathematics Researchers confirmed that, how well students understand depends on the teaching methods used by the mathematics teachers (Awofola & Nneji, 2012; Usman & Nwabueze, 2012). Many researchers also identified those laboratory facilities as being effective for improving learning and achievement. The study therefore chooses to investigate the impact of laboratory facilities on senior secondary school student's academic achievement in mathematics in Onitsha North Local Government Area.

Purpose of the Study

The purpose of the study was to investigate the impact of laboratory facilities on senior secondary school students' academic achievement in mathematics. Specifically, the study sought to find out:

1. The extent to which academic achievement of senior secondary school students in mathematics is enhanced when taught using laboratory facilities.

Research Questions

One research question guided this study;

1. To what extent does academic achievement of senior secondary school students in mathematics enhanced when taught using laboratory facilities?

Hypothesis

One null hypothesis was formulated and tested at 0.05 level of significant.

1. There is no significant difference between the mean achievement of senior secondary school students in mathematics taught with laboratory facilities and those taught without laboratory facilities.

Method

This chapter deals with design of the study, Area of the study, Population of the study, Sample and Sampling Technique, Instrument of Data Collection, Validation of the Instrument, Reliability of the Instrument, Method of Data Collection and Method of Data Analysis. The design of the study is a descriptive survey research which entails the ways of findings out "The impact of laboratory facilities on senior secondary school students' academic achievement in mathematics in Onitsha North L.G.A. of Anambra State. Anene (2013) describes survey research as a form of descriptive research that is aim at collecting sample from population in order to determine the distribution, incidences and interactive and of educational and sociological phenomena. The study was carried out in Onitsha North Local Government Area of Anambra State of Nigeria; it has Onitsha as its only city and a total of 25 secondary schools. The population of the study was 4,000 SS1 students from the 25 secondary schools in the area of study. A sample random sampling technique was adopted to select seven (7) out of 25 secondary schools. From the selected secondary schools, 40 students and the students were the selected school and used for sample of the study which around two 280 students consist of 143 male and 137 female students were used for the study, the instrument for data collection was a structured questionnaire, prepared by the researcher with the help of the project supervisor. The questionnaire was in two (2) parts. Part 1 contains

personal data while part 2 is the question that should be answered by the respondents and it is of three (3) sections with 20 items. To ensure the validity of the instrument some copies of the questionnaire were given to the project supervisor, one expert from department of mathematics education and two (2) other experts in the department of educational measurement and evaluation for criticisms. They were given the research topic, research questions and hypothesis. They were required to check for both face and content validity and to check for ambiguity of the statement. The researcher visited the schools involved administer the questionnaire developed for the study. All the copies of the questionnaire were administered on the respondents and collected back on the spot to ensure maximum return rate associated with the questionnaire. Their corrections were properly affected and used in the final draft of the questionnaire. The data collected were corrected using the Pearson product moment correlation co-efficient. The score yielded reliability coefficient of 0.93. This estimate was considered high enough for adopting the instrument for the study.

Results

Research Question 1: To what extent does academic achievement of senior secondary school students in mathematics enhanced when taught using laboratory facilities?

Table 1: Mean ratings and standard derivation of the respondents on extent achievement of senior secondary school students in mathematics is enhanced when taught using laboratory facilities.

N=280

S/N	ITEMS						Mean	SD	REMARK
1.	Laboratory facilities increases students' zeal and participation mathematics therefore increasing their achievement in mathematics	94	93	38	55	280	2.81	1.10	High extent
2	Laboratory facilities remove abstract nature of mathematics and makes learning from thereby making students to comprehend and increase their performance	120	88	26	45	280	3.02	0.95	High extent
3	Laboratory facilities enable the students apply mathematics to real life problem thereby relating school mathematics to situations thereby increases the academic achievement.	47	163	42	27	280	2.81	0.70	High extent
4	A laboratory facility enriches and encourages spirit of	17	141	95	27	280	2.53	0.75	High extent

	research among the students in mathematics therefore their academic achievement will be enhanced.								
5	Laboratory facilities makes students to be independent develop thinking through learning by discovering making them to understand and perform greatly.	102	119	57	2	280	3.15	0.76	High extent
6	Laboratory facilities give students confidence to explore and tryout Laboratory facilities gives students their performance. Mathematical problem which increases their performance.	87	139	27	27	280	3.02	0.89	High extent
7	Laboratory facilities provides students with opportunity to understand and discover the beauty, importance and relevance of mathematics	113	53	70	44	280	2.84	1.12	High extent
	Total						**2.88**	**0.88**	**High Extent**

H0$_1$: There is no significant difference between the mean achievement of senior secondary school students in mathematics taught with laboratory facilities and those taught without laboratory facilities.

Table 2: Z-test on

Group	Mean	SD	N	Df	Z Cal.	Z crit.	Decision
Male	2.96	0.85	143	278	1.42	1.96	NS
Female	2.81	0.92	137				

Where **NS means Not significant**

The calculated value of z (1.42) is less than the critical value of Z (1.96) at 0.05 levels of significance and 278 degrees of freedom. Since Z cal< Z crit, we accept the null hypothesis as stated earlier i.e no significant difference in the mean response of male and female students on the academic achievement on mathematics when taught with laboratory facilities.

Discussions

Results in Table 1 shows that the extent of academic achievement of SS1 students in mathematics is enhanced to a high extent when taught using laboratory facilities, it was revealed that laboratory method used when teaching mathematics helps to increase the academic achievement of SS1 students through increasing the students zeal and participation in mathematics, removing abstract nature of mathematics and makes learning fun, enabling the students apply mathematics to real life problem, thereby relating school mathematics to situations, giving students confidence to explore and try out mathematical problem

etc. And this was in line with David (2014) when he inquired why mathematics teachers and students felt they need to carry out experiments in their classes. Both teachers and students responses included: helping students understand and learn better, enhancing their interest in classes, improving manual skills, help to discover knowledge on their own improves observation skills, enhancing their problem-solving skills, ensuring students learn through experience.

Laboratory facilities increases students' academic achievement in mathematics to a high extent through making students to be independent and develop thinking through learning by discovering giving students confidence to explore and try out mathematical problem, enriching and encouraging spirit of research among the students in mathematics, remove abstract mature of mathematics and makes learning from among others.

Recommendation

Based on the findings the following recommendations were made;

1. Teachers should try to embrace laboratory method of teaching mathematics since this influence the students' academic achievement in mathematics in a positive direction.
2. A good and well-equipped mathematics laboratory should be provided in schools by the government for effective teaching and learning of mathematics.
3. Enough time should be given to laboratory practical in the school timetable since laboratory practical is time consuming but has more positive effect on students.
4. The school management should try as much as possible to replace the worn-out equipment in the mathematics laboratory for mathematics practical. Curriculum planners should introduce in the curriculum how and when to use laboratory method for mathematics.
5. Government and school management should make provision for mathematics teachers who are not qualified in the area of mathematics laboratory to go for seminar or workshop which will help them to be more competent in the teaching of mathematics practical and also update their knowledge.

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