

Effect of Mathematical Laboratory Pedagogy (MLP) on Student Achievement in Teaching and Learning of Mathematics in Enugu State Nigeria

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Abstract

Original Research Article

The effect of mathematics laboratory pedagogy in teaching and learning of mathematics was studied. The research shows a significant difference between the mean scores and gender of students taught using the Mathematics Laboratory Pedagogy (MLP) and those taught in the usual classroom setting. The study also shows significant difference between the mean interest scores and retention capacity of students taught using the mathematics laboratory pedagogy and those taught using the conventional methods. Null hypotheses were formulated and Analysis of Covariance (ANCOVA) was employed for the study. Results show that in a learning environment where there are concrete tools for learning mathematics in the laboratory students understand and perform better than in the absence of mathematics laboratory. The research also indicates that students retain mathematics knowledge and concepts and develop higher interest in learning when exposed to the mathematical laboratory setting.

Keywords: mathematics, laboratory, pedagogy.

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INTRODUCTION

Mathematics is defined as the study of numbers, shapes and space using reason and usually a special system of symbols and rules for organizing them (Cambridge, dictionary). Encyclopedia Britannica [1] defined mathematics as the science of structure, order, and relation that was evolved from practices of counting, measuring and describing the shapes of objects. Mathematics is an inevitable tool in natural sciences, engineering, medicine, sports, finance, etc.

Mathematics laboratory is a unique room or place, with relevant and up-to-date equipment known as instructional materials, designed for the teaching and learning of mathematics and other scientific or research works, whereby a trained and professionally qualified person (mathematics teacher) readily interacts with learners (students) on specified set of instructions. Adenegan [2].

Mathematical laboratory pedagogy considers how knowledge and skills are exchanged by the use of simple concrete objects or equipment in learning mathematics in the laboratory. It considers the interaction between these laboratory equipments and reasoning mathematical laboratory pedagogy inquiries into the “comprehension strength” of students in

mathematical concepts with respect to practical of ideas.

This study “effect of mathematical laboratory pedagogy student’s achievement in teaching and learning of mathematics” was conducted as a result of dwindling interest of students in mathematics. Many students in Nigeria (using Enugu State as a case study) show displeasure towards the learning of mathematics. Many view mathematics as a dull, oppressive and pain-inducing subject because of the “abstract” nature of the concepts of measurement, numbering and shapes which are not properly taught in schools. This phobia for mathematics could be as a result of many factors [3], obtained that mathematics is one of the most poorly taught, widely hated and abysmally understood subjects in secondary schools. The West African Examination Council (WAEC) Chief examiner reports (2005, 2006, 2007, 2008) constantly showed lack of skill in answering questions in general mathematics. The report shows that candidates avoided questions in 3-dimensional problem in their working. Obidiwe [4], pointed out that the poor academic achievement in mathematics are caused by lack of well-equipped laboratory, lack of qualified teachers, limited time table hours, poor observation, poor knowledge or mathematics basics.

These studies reflect the need for students to be exposed to the practical meaning and interpretation of mathematical concepts as against the normal idea of solving a question and arriving at a value as an answer. The importance of laboratory in teaching and learning of mathematics cannot be over-emphasized. Adenegan [5,6], stated that mathematics laboratory permits students to learn abstract concepts through concrete experiences and thus increases their understanding of those ideas. It enables students to personally experience the joy of discovering principles and relationships thereby cultivating favourable attitude towards mathematics. The main purpose of the study was to determine the effect of mathematics laboratory pedagogy (MLP) in teaching and learning of mathematics in Enugu State, Nigeria. Specifically this study intended to:

- Determine the mean achievement scores of students taught mathematics using mathematics laboratory pedagogy (MLP) and those taught using the conventional methods.
- Determine the mean achievement scores of male and female students taught mathematics using mathematics laboratory pedagogy(MLP) and these taught using the conventional methods
- Determine the mean interest scores of students taught mathematics using Mathematics Laboratory Pedagogy (MLP).

- Determine the effect of mathematics laboratory pedagogy (MLP) in the teaching and learning mathematics in school.

METHODOLOGY

The following Null Hypotheses were formulated for the study.

H0₁: There is no significant difference between the mean scores of students taught mathematics using mathematical laboratory pedagogy (MLP) and those taught with conventional methods.

H0₂: There is no significant difference between the mean achievement scores of male and female students taught mathematics using mathematics laboratory pedagogy (MLP).

H0₃: There is no significant difference in the mean interest scores of students taught mathematics using MLP and those taught with the conventional methods.

H0₄: There is no significant effect on the achievement and retention of students taught school mathematics using mathematics laboratory pedagogy (MLP).

Table-1: Summary of Analysis of Covariance (ANCOVA) for test of significance between the man scores of experimental and control groups and of interaction effect of treatment given to students by gender with respect to the mean scores for MLP and Conventional Methods

Source	Sum of squares	Df	Mean square	F	Sig
Corrected Model	2861.202	4	715.300	212.434	.000
Intercept	226.350	1	226.350	67.223	.000
Pre-test	.103	1	.103	.103	.861
Group	2367.808	1	2367.808	703.204	.000
Group Gender	6.847	1	6.847	2.033	.157
Error	377.123	112	3.367		
Total	2267689.000	117			
Corrected total	3238.325	116			

* Significant at sig of F < 0.05

The data presented in table 1 shows F-Calculated value for test of significance between the mean scores of experimental and control groups and the interaction effect of treatment given to students by their gender with respect to their mean scores in the Mathematics Laboratory Pedagogy (MLP). The F-Value for groups is 703.204 with significance F at .000, which is less the 0.05. The null-hypothesis one (H0₁) is therefore rejected at .05 level of significance. Hence there is significant difference between the mean scores of students taught school Mathematics using MLP and those taught with Conventional Method.

With the F-value for interaction effect (Group Gender) at 2.033 with significance of f at .157 which is greater than .05, the interaction effect of the treatment and students' gender has no significant difference.

The F value for gender is 8.412 with the significant level of F at .04, which is less than .05. hence, the null hypothesis two (H0₂) is rejected at $\alpha = .05$. This result implies that there is significant difference between the man scores of the male and female students taught with Mathematics Laboratory Pedagogy (MLP).

Table-2: Summary of ANCOVA for Test of significance between the Mean Scores of Experimental and Control Groups Taught School Mathematics with Mathematics Laboratory Pedagogy in test for interest of the gender.

Source	Sum of squares	Df	Mean square	F	Sig
Corrected Model	12029.624	2	6014.812	1973.000	.000
Intercept	332.989	1	332.989	109.216	.000
Post-test (Interest)	12.368	1	12.368	4.057	.046
Group	478.702	1	478.702	157.009	.000
Error	347.573	114	3.049		
Total	100008.000	117			
Corrected total	12377.197	116			

* Significant at sig of F < 0.05

From the data in table 2, F value for Posttest interest is 4.057 with the significant of F at 0.046 which is less than the α -level of 0.05, the null hypothesis three (H_{03}) is rejected. This implies that there is significant difference in the interest of students taught mathematics using Mathematics Laboratory Pedagogy and those taught with the Conventional Method.

Moreso, the null-hypothesis four (H_{04}) was rejected following the observation from data in table 2. F value for group is 157.009 with significant of F at .000, which is less than .05. With this result, there is significant difference between the mean scores of students taught school mathematics (algebra) – using MLP and those taught with the conventional methods. This result implies that MLP is an effective and efficacious method of teaching and learning school mathematics.

Recommendations

The study strongly recommends that:

- Mathematics laboratory be established in secondary schools in the study area for better understanding of mathematics,.
- Qualified teachers of mathematics be recruited in order to impart the knowledge of mathematics in the right direction.
- Abandoned or “out of use” mathematics laboratories be renovated, equipped and properly refurbished to raise students’ interest in mathematics.
- Adequate measures be taken on areas of supervision of mathematics teaching, curriculum development and systematic presentation of mathematics topics
- Mathematics classes should not be overpopulated to enable the teacher/teachers carry out a proper check on the performance of students.
- Mathematics laboratories in the area under study should have the modern day mathematics tools and instructional material to meet up with the demand of external examination bodies.

CONCLUSION

The study; effect of Mathematical Laboratory Pedagogy (MLP) on students’ achievement in teaching and learning of mathematics in Enugu State Nigeria,

highlights a pressing need of today’s students of mathematics in Enugu State, Nigeria. The phobia of mathematics, its causes, solutions and the need to use mathematics laboratory in teaching mathematics were examined. The hypotheses questions developed and analyzed showed that mathematics laboratory is an important tool or approach to enhancing students understanding of mathematics concepts. The use of mathematics laboratory for teaching raises the interest of students and makes teaching easy. It is expected that the research will go a long way in addressing the flaws of teaching and learning mathematics in Enugu State.

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