

A Study On Effectiveness Of Math Laboratory Activities For Enhancing The Performance Of Students In Mathematics

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Abstract—Mathematics is important in everyday life, science and technology, medicine, economy in public decision-making, practically in every walk of life. Hence it is imperative to develop interest and curiosity for the subject among the students. The math laboratory provides an opportunity for the students to discover mathematics through doing. The following study focusses on the Mathematics laboratory activities to have better clarity of basic concepts in Mathematics. It was found that the activities helped in understanding the concepts and created interest among students for learning Mathematics.

Keywords—*Mathematics Laboratory, Performance of Students, Learning Mathematics*

Introduction

Mathematics is systematized, organized and exact branch of science. It has its own language and characteristics. It is a science of logical reasoning and numerical problems. It deals with quantitative facts and relationship as well as problems involving space and form.” (Sidhu, 2005)

Many of the activities present a problem or a challenge, with the possibility of generating further challenges and problems. The activities help students to visualize, manipulate and reason. They provide opportunity to make conjectures and test them, and to generalize observed patterns.

The Mathematics laboratory is a place where anybody can experiment and explore patterns and ideas. It is a place where one can find a collection of games, puzzles, and other teaching and learning material. The materials are meant to be used both by the students on their own and with their teacher to explore the world of mathematics, to discover, to learn and to develop an interest in mathematics.

Activity method is a technique adopted by a teacher to emphasize his or her method of teaching through activity in which the students participate rigorously and bring about efficient learning experiences. It is a child-centred approach. It is a method in which the child is actively involved in participating mentally and physically. Learning by doing is the focus in this method. Pine G (1989) mentions that in an activity-based teaching, learners

willingly with enthusiasm internalize and implement concepts relevant to their needs.

In the 1996, Lurdes Lopez did action research study to observe mathematical abilities of students and to inquire whether teaching students problem-solving strategies in mathematics would affect students mathematical thinking and their ability to understand and solve word problems. In particular, the researcher studied at risk students who obtained direct instruction and were imparted with mathematical strategies. Through the use of problem-solving notebooks, math journals and interviews, researcher collected data on students' mathematical comprehension and problem-solving abilities.

Two researchers, Eda Vula & Rajmonda Kurshumlia, one of them was a third-grade teacher and other was a professor of mathematics education, who studied and investigated the impact of explicit mathematical vocabulary instruction and practical formative assessment feedback on third grade students' abilities to solve word problems in mathematics. Authors worked together to observe, reflect, plan, and implement as part of a collaborative action research project. Once the first research cycle was completed, the researchers evaluated the interventions. Analysis of the qualitative data (interviews with students, observation and journal entries) and quantitative (surveys and exams) showed a significant improvement of students' word-problem solving abilities. Developing mathematical vocabulary enabled them to understand mathematical terms and requirements while providing feedback on problems assessment led to the improvement of the 'gap' in the process of problem solving.

Thus, the studies focussed on overcoming the problems of students in the subject of mathematics.

Students today just learn the formulae's byheart without understanding how these were derived. This leads to lot of confusion among the students when applying it to a new situation. Hence the researcher to take up the following action research study to find out whether Mathematics Laboratory activities can help in better understanding and concept clarity. Also, during practice teaching in B.Ed. programme, researcher found that students had problem to grasp new concept due to lack of basic knowledge of math.

Therefore, researcher thought of doing action research on revising basic concepts of mathematics using math lab activities for std VIII.

Need

The information processing theory in psychology views learners as active investigators of their environment. The theory states that people innately strive to make sense of the world around them through experience and active problem solving by students through their own investigation and analysis. It enhances creativity, provides varied experiences to the students to facilitate the acquisition of knowledge, skills and values, builds the student's self-confidence and develops skills for working as a team, and thereby enhances the social skills

Activity based approach makes learning interesting and it will be helpful for the students to remember content for a long time as every student is involved in teaching learning process.

As per (NCERT, 2000) "Mathematics learning should be imparted through activities from the very beginning of school education, the primary stage itself. These activities may involve the use of concrete materials, models, charts, patterns, pictures, posters, games, puzzles, and experiments. The importance of using learning aids needs to be stressed. This may be done by involving students and teachers by mobilizing community resources to this end."

Majority of the students never tried to understand the concept; they just learn the formula's byheart only for the exam purpose. Therefore, they have difficulty to apply that basic knowledge in further topics.

The activities were conducted for basic concepts of mathematics, as students were weak with their basic knowledge of mathematics.

Statement

A study on effectiveness of Math laboratory activities for enhancing the performance of standard eighth students in Mathematics.

Variables of the study

Dependent variables

Performance of students in Mathematics

Independent variables

Math Laboratory Activities

Operational Definitions

Performance of students in Mathematics: For the present study, performance of students in Mathematics is defined as the scores obtained in the pre and post test administered by the researcher.

Math Laboratory Activities: For the present study, Math laboratory activities is defined as the activities that are conducted in the Mathematics Laboratory in the school for the topics prescribed in Mathematics syllabus.

Objectives

1) To study the effectiveness of Math Laboratory activities on the performance of standard eighth students in Mathematics for the following topics

- i. Circumference of circle
- ii. Quadrilateral
- iii. Fraction

Hypothesis

1) There is no significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for circumference of circle.

2) There is no significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for Quadrilateral.

3) There is no significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for Fraction.

Sample

For the present study the sample consisted of standard eighth students of English multipurpose school affiliated to SSC board situated at Matunga, Mumbai. Total 43 students participated in this experimental study & their age ranged from 13 to 14 years.

Methodology

The method used was experimental method to measure the effectiveness of math lab activities and for enhancing the students understanding and performance in basic concepts of Mathematics. Experimental Action-Research is that type of investigation which employs the technique of experimentation for arriving at inferences and for drawing conclusions. The researcher planned group activities as well as individual activities. Altogether there were 3 activities. A pre-test was conducted before every activity and after the activity post-test was conducted to check whether the activity was effective or not.

Planning and Implementation

ACTIVITY: Topic- Circumference of Circle.

Learning outcomes:

- To enable the pupil to derive the value of pi and the formula for circumference.
- To apply the formula of circumference to solve new problems based on circumference.

Nature of the activity: Group Activity

Entry level behaviour: Pupils were introduced to Circumference of a circle in standard VII.

Procedure:

Pupils were divided into 3 groups and was provided with 3 different circular objects. They were asked to measure the circumference and diameter and then divide circumference by diameter, through which constant value of pi was obtained and using this, the formula for circumference was derived.

Discussion:

The students before activity knew the value of pi but were not knowing how this value is derived and why it is 3.14 and 22/7. But after the activity they were clear with the concept. Also, they got to know how the formula of circumference of circle is derived, the students were eager to know when to use $2\pi r$ or πd while solving the problems based on it. The activity helped them to understand the concept, they enjoyed the activity and found it easy to solve the sums based on it.

ACTIVITY 2: Topic- Quadrilateral

Learning outcomes:

- To enable the pupil to understand the property of quadrilateral.
- To apply the property of quadrilateral to solve the problems based on the same.

Nature of the activity: Individual Activity

Entry level behaviour: Pupils were introduced to quadrilateral in standard VI.

Procedure:

Pupils were given a quadrilateral shape individually, and then they were asked to cut that quadrilateral into four more quadrilaterals such that each contains one angle of the given quadrilateral. Later, pupils were asked to arrange those cut-outs in such a way that they form a circle. As circle has angle 360° , on arranging the cut-outs in circle the property of quadrilateral is derived.

Discussion:

During the activity, almost everyone knew the property of quadrilateral, but they lacked understanding of derivation of property of quadrilateral. However, they all were interested to know the logic behind it, and everyone individually participated in the activity. Later, they solved the examples given and verified the same through activity.

ACTIVITY 3: Topic- Fractions

Objectives learning outcomes:

To enable the pupil for finding LCM of the given number.

To enable the pupil to apply the concept of LCM to solve sums based on Fractions

Nature of the activity: Group Activity

Entry level behaviour: Pupils were introduced to quadrilateral in standard V-VII.

Procedure:

Researcher provided each group with a sheet of 100 numbers. Pupils were asked to mark the multiples of given numbers using different colour for each number. Through which the least common multiple concept was taught. Researcher showed how to use prime factorization to find LCM of two numbers.

Discussion:

Students found calculating LCM a difficult task and therefore, in pre-test they directly cross multiplied the denominator of the given fraction which was easy at first but again during simplifying it to simplest form it was difficult. After the activity, the students were clear with the method and understood why taking LCM of denominator is important. It was seen that students were fast and accurate while solving sums based on it.

Major Findings:

Figure 1.1

Mean score of pre and post-test for activity 1

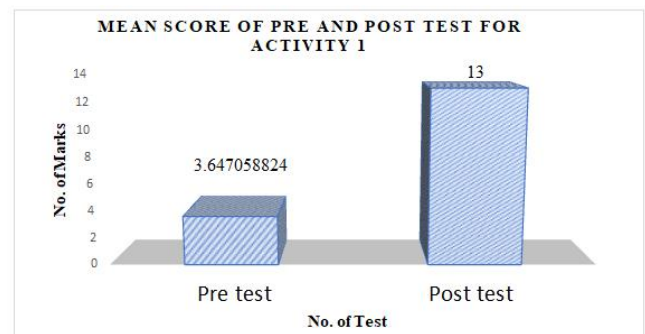


Figure 1.1 shows for activity no. 1 the mean scores for pre-test is 3.64 and the mean scores for post-test scores is 13.

Figure 1.2

Mean score of pre and post-test for activity 2

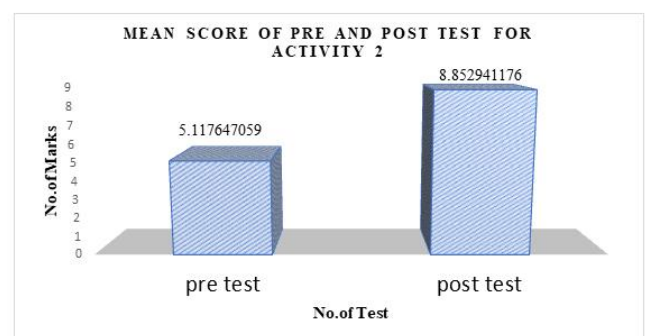


Figure 1.2 shows for activity no. 2 the mean scores for pre-test is 5.11 and the mean scores for post-test scores is 8.85.

Figure1.3

Mean score of pre and post-test for activity 3

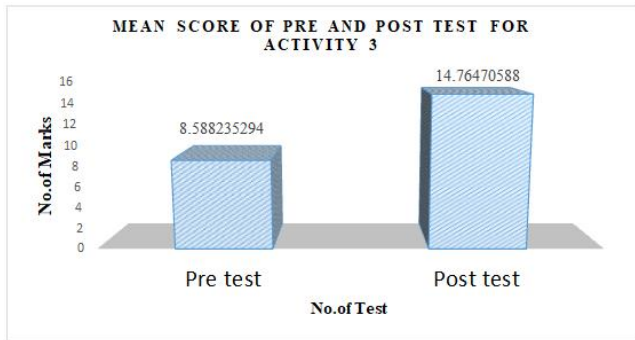


Figure 1.3 shows for activity no. 3 the mean scores for pre-test is 8.58 and the mean scores for post-test scores is 14.76.

Hypothesis Testing:

The statistical technique used to test the hypothesis was Single Group 't' Test.

Testing of the hypothesis 1

There is no significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for circumference of circle.

Table 1.1

Difference in the pre-test and post-test score of activity 1

Single Group	N	Mean	SD	Obtained t-ratio	Tabulated t-ratio	l.o.s
Pre-test	34	3.647	4.18	4.3772	2.75	0.01
Post-test	34	13	4.22			

Interpretation

Table 1.1 shows the obtained 't' is greater than the tabulated 't'. Hence the null hypothesis is rejected. There is a significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for circumference of circle.

Discussion and Conclusion

While conducting post-test of circumference, the researcher noticed that almost everyone was knowing the formula and were confident enough while solving the sums. In the post-test most of the students were able to solve it accurately and correctly, except for those who had learning disability and one who did silly mistakes. Overall; there was remarkable change observed in the performance of the students after explaining the concept through math lab activity.

Testing of the hypothesis 2

There is no significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for Quadrilateral.

Table 1.2

Difference in the pre-test and post-test score of activity 2

Single Group	N	Mean	SD	Obtained t-ratio	Tabulated t-ratio	l.o.s
Pre-test	34	5.117	3.26	6.9506	2.75	0.01
Post-test	34	8.852	2.14			

Interpretation

Table 1.2 shows the obtained 't' is greater than the tabulated 't'. Hence the null hypothesis is rejected. There is a significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for Quadrilateral.

Discussion and Conclusion

In the pre-test pupils were aware of the property of the quadrilateral but did not know the reason behind the property of the quadrilateral. Also, the researcher observed that some of the pupils had difficulty in comprehending word problem in which angles were expressed in ratio form. After post-test it was observed that almost every student was able to solve sums based on property of Quadrilateral and majority of them solved it correctly.

Testing of the hypothesis 3

There is no significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for Fraction.

Table 1.3

Difference in the pre-test and post-test score of activity 3

Single Group	N	Mean	SD	Obtained t-ratio	Tabulated t-ratio	l.o.s
Pre-test	34	8.588	5.26	3.676	2.75	0.01
Post-test	34	14.764	4.64			

Interpretation

Table 1.3 shows the obtained 't' is greater than the tabulated 't'. Hence the null hypothesis is rejected. There is a significant difference in the pre-test and post-test scores on the performance of standard eighth students after the implementation of the activity for Fraction.

Discussion and Conclusion

The post-test mean score is higher than the pre-test score of all the activities. This implies that the intervention programme has helped in increasing the performance of the students in mathematics through Math laboratory activities for standard eighth.

Reflections and Implications of the study:

Through this action research, researcher found that, the Math laboratory activities helped the students to grasp and retain more knowledge than usual method of teaching mathematics. By deriving the properties and formulae in math lab, students were able to understand the concept clearly.

In activity 1, researcher observed that hands on experience helped students to visualise and understand the relationship between circumference and diameter. This activity method will allow students to explore the properties of circle and the connection. Also, it makes easy for students to understand the formula and calculate the circumference of the circle.

In activity 2, it was noticed by researcher that when practically students performed and derived, they acquire more and can apply and solve sums based on it. Therefore, researcher feels learning by doing is the best way to teach the derivation of properties and formulas.

Similarly, in activity 3 students were able to understand what LCM is and how it is calculated. Also, after activity they were able to relate the concept and use it in addition and subtraction of fraction.

Most of the students have the fear for Mathematics subject just because they are not able to understand the abstractness in the concepts. Mathematics Laboratory is a place where the abstract concepts can be presented to the students in a concrete way through the various activities. Hence every school should have a well-established math laboratory where the students are actively engaged in the deriving and understanding the abstract concepts in Mathematics.

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