TEACHING MATHEMATICS THROUGH ACTIVITIES

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INTRODUCTION:

Education is the basic part of everyone’s life and it is required for holistic development of individual. Education imparts knowledge, skills and shapes values and attitudes. It is vital for the progress of a civil society.

Mathematics is important in everyday life, science and technology, medicine, economy in public decision-making etc. According to (Singh, 2007), "Mathematics is crucial not only for success in school, but in being an informed citizen, being productive in one’s chosen carrier, and in personal fulfillment. In today’s technology driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations. The study of mathematics equips students with knowledge, and habits of mind that are essential for successful and rewarding participation in such a society."
According to researcher, All people thought that Mathematics is a very difficult subject to understand and they have a phobia of Mathematics and they thought that Mathematics is a boring subject. In most of the school, teacher teaching style is only lecture method and students are bored to learn Mathematics. If teacher teacher apply different methods then students took interest in Mathematics.

Kasat (1991) found that low intelligence, poor numerical abilities, poor comprehension and recall ability, no interest in mathematics and poor study habits were the causes of large failure in mathematics. Achievement in mathematics is law. Therefore, Activity approach plays an important role in teaching learning process. Activity is some physical action on the part of the child which acts as a precipitator or aid for mental development.
Activity based approach makes learning interesting and it will be helpful for the students to remember content for a longtime as every student is involved in teaching learning process “Mathematics learning should be imparted through activities from the very beginning of school education. i.e., form 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.” (NCERT, 2000)
NATURE AND STRUCTURE OF MATHEMATICS:

Mathematics relies on both logic and creativity, and it is pursued both for a variety of practical purposes and for its intrinsic interest. “Mathematics is a word of symbols and their interrelation. It is also known as science which is related to measurements, calculation, discovering relationship.

Mathematics is systematized, organized and exact branch of science. It has its own language and characteristics. It is numerical and calculation part of man’s life and knowledge. 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)
Mathematics is a mother of all sciences. Science is a systematic study of knowledge. The structure of mathematics is nothing but structure of science. The structure of science can be compared to the framework of a building consists of a foundation, vertical pillars and horizontal beams. The foundation of the framework is comparable to broad generalization and principles of science. (Kumar, 1993)

The facts are comparable to building materials. i.e., stone, bricks, concrete etc. In the analogy, the vertical pillars and the horizontal beams of science are subject to the attention on the basis of empirical tests. It should be noted that this analogy of a building under construction is to facilitate understanding of science. (ICFAI, 2004)
CONCEPT OF ACTIVITY BASED APPROACH:

The teaching-learning process is the heart of education. According to Khanzode (1995), “previously teaching meant nothing more than giving information and imparting knowledge. It was regarded as a bi-polar process. Teacher and subject being its two poles. Child was all together ignored. But now teaching has become tri-polar process of teaching-learning. Teacher, student and subjects are the three poles.” Thus in teaching learning process teacher, learner as well as subject all these three components are very important.”

Weaknesses of students in Mathematics can be major factor, which cause the gap between the expected achievement and actual achievement in mathematics.
Chel (1990) found that underachievement was caused due to lack of understanding of mathematics concepts of earlier stages. Thus, weaknesses of students in mathematics at lower stage also hinder their progress in learning mathematics at higher stage of mathematics.

According to Dhand (1995), “a learning centre or activity centre is one way of organizing instruction so that students can direct their own learning. It is most conveniently a designated area of the classroom or part of the school where students work independently or in small groups. Students work on activities purported to achieve certain objectives.” It is conducive to individualized learning. Learning becomes more meaningful and challenging when each student competes only with himself or herself. Students explore, estimate, experiment, question and hypothesize through learning center activities.
According to researcher, the Activity Based Approach is unique and effective to attract school children. The teachers who are involved in implementing this method have developed activities for each learning unit which facilitated readiness for learning. The aim of activity-based approach is for learners to construct process of self-learning and problem solving and transfer of information and skills. This method has brought out the potential of the learners in classroom situations.
NEED OF ACTIVITY BASED APPROACH:

According to Dhand (1995), “child-centered educational aids to foster self-learning and allows a child to study according to his/her aptitude and skill. Activities in each milestone include games, rhymes, drawing and songs to teach a letter or a word, or understand a concept.”

Need of Activity Based Approach:

- Encourages independence and team learning
- Provides a wide variety of manipulative open-ended and creative activities
- Provides students experience and active participation in the exploration of their environment
- Make students advance at their own rate –the rate that is with their abilities, interest and motivations
- Encourages self-reliance and development of initiative in an atmosphere of trust
Encourages children to follow many of their own interests and desires to learn

- Problem-solving, critical and creative thinking and deep understanding are emphasized

- Learners are encouraged to explore the new knowledge independently
OBJECTIVES OF THE STUDY:

- To study the effectiveness of activity based approach for teaching mathematics.
- To study the difficulties faced by students in understanding and performing Activities.
- To study the opinion of students about activity based approach.

OPERATIONALIZATION OF THE TERMS:

- Activities: For the Activity based approach the students were made to cut the paper fold the paper and then logically think about the concept involved., which are to
- Opinion: Opinion means a view, judgment of appraisal formed in mind of students about the activity based approach.
Effectiveness: effectiveness will be studied in terms of significance of difference between the pre-test mean and post-test mean scores.

**DELIMITATION:**

The present study was delimited to English Medium School of Vadodara city following Gujarat State Board syllabus for standard VII of Baroda City during academic year 2011-12.

**HYPOTHESIS:**

There will be no significance of difference between Pre-test mean Score and Post-test mean scores of students.
METHODOLOGY:

POPULATION:

- All the students of Standard VII of 58 English medium schools of Vadodara City for the academic year 2011-12 following the Gujarat State Board syllabus will constitute the population for the present study.

SAMPLE:

- School: The school was selected conveniently on readiness and co-operation of principal, teacher and students. Daffodils English Medium school situated at Chhani Jakat Naka was the sample of the study.

- Students: There were total 17 students in class VII. The responses through questionnaire and Opinionnaire were collected from 17 students.
DESIGN OF THE STUDY:

- Present study was quantitative in nature. The design of the study was Pre-experimental design.

TOOLS FOR DATA COLLECTION:

- Achievement test: An Achievement test was prepared to know the significance difference between pre-test mean score and post-test mean score.

- Questionnaire: A questionnaire was prepared for students to know students learning difficulties.

- Opinionnaire: An Opinionnaire was prepared for students to know students opinions regarding activity based approach. The Opinionnaire was consisted of close-ended questions.
DATA COLLECTION:

Phase 1: Development of Activities

Activity – I: Verification of Pythagoras Theorem

- Statement: The Square of the hypotenuse of a right angle triangle is equal to the sum of the square of the other two sides.

- Pre requisite knowledge: Area of square, construction of parallel and perpendicular lines

- Material required: chart paper, pen, glue stick, scissor.

Procedure:

- Draw a right angle triangle on a chart paper.

- Extend all the sides of triangle to form squares.
- Draw unit squares in the squares corresponding to two legs of the triangle.
- Cut the unit squares and paste them on square corresponding to the hypotenuse.

Area of square 1 = $a \times a = a^2$
Area of square 2 = $b \times b = b^2$
Area of square 3 = $c^2 = a^2 + b^2$

Pythagoras theorem: $c^2 = a^2 + b^2$
**Activity – II - A:** Verification of Right angle triangle.

- **Pre requisite knowledge:** Area of circle, circumference of circle

- **Material required:** Pencil, simple paper or notebook paper

**Procedure:**

- Draw a circle and fold it directly in half and crease it well.
- Open it and hold the circle at the end of the crease and fold the circle in half again but at this time match up the end points of the crease.
- Again open the circle and fold in one of the outer, curved edges of the circle until it just touches the dot in the middle. Crease it well.
- Again open it and fold the opposite side of circle and fold it so that the curved part just touches the center and the bottom forms a perfect point and that makes the cone.

- Fold the top of the cone down until the curved part touches the centre of the circle. The top corners should make perfect points. Crase well and equilateral or acute triangle is formed.

  Fold new triangle in half by matching up two of the points, crease well. The new crease splits the triangle in half.
Activity – II– B: To find formula for area of circle

- **Objective**: To illustrate the activity of finding the formula for the area of a circle.

- **Pre requisite knowledge**: Area of triangle, concentric circle, circumference of circle, Symmetry

- **Material required**: Chart paper, sketch pen, glue stick, scissor, scale.

  **Procedure**:
  
  - Draw a big circle on a chart paper. Cut it from paper.
  - Fold it subsequently to form quarters, octants etc.
  - Reopen it. Cut all its parts folded.
  - Paste all the parts on a straight line to form parallelogram.
REMEMBER, AREA IS ALWAYS MEASURED IN SQUARE UNITS.
Area of a circle – the number of square units contained inside the circle.

Estimate the number of square units inside the circle.

It is hard to always count the squares so it would be a good idea to use a formula.

Cut a circle up into small sectors

Divide the circle in half.

Cut and open each half.

Attach the two figures then see what shape is formed. (figure 2.2)
Area of circle = area of parallelogram
= base * height  (height h = r)
= ($\frac{1}{2}$ circumference of circle) * (radius of circle)
= ($\frac{1}{2}$ * $2\pi$ r) * r

Base = $\frac{1}{2}$ circumference
= $\frac{1}{2}$ ( $2\pi$ r)
= $\pi$ r
Activity – III: To find formula for Area and Volume of Cylinder

- Pre requisite knowledge: Area of Rectangle, circumference
- Material required: simple paper and pencil, scale

Procedure:
- Draw a rectangle
- Measure the length and breadth of rectangle
- Fold it and make the cylinder and then measure the length and breadth of rectangle. i.e height and circumference.
AREA of a CYLINDER.
Imagine that you can open up a cylinder like so:
You can see that the surface is made up of two circles and a rectangle.

The length of the rectangle is the same as the circumference of the circle!
Area of Cylinder = Area of Rectangle

= length*breadth
= circumference*height
= 2Πr*h
= 2Πrh
Find the radius and height of the cylinder.

Volume of Cylinder

= Area of the base * height

= Area of circle * height

= \( \pi r^2 \times h \)
**Activity – IV**: Verify the sum of Interior angles of quadrilateral.

- Pre requisite knowledge: Measurement of angle, value of angle of triangle
- Material required: simple paper and pencil, protector, scale, gule stick

Procedure:
- Draw a two quadrilateral with same size.
- Divide it into two parts.
- Measure the angle of one triangle with the help of protector and another also and add it.
The sum of the angles of each triangle is 180 degrees... We get,

\[180 + 180 = 360\]

So, the sum of the interior angles of a quadrilateral is 360 degrees.
Phase 2: Development of pre-test and post-test:

Phase 3: Administered the Pre-test:

Phase 4: Implementation of the Activity.

Phase 5: Administration of post-test

Phase 6: Administration of Questionnaire and Opinionnaire

- Questionnaire: A questionnaire was prepared for students to know students learning difficulties.

- Opinionnaire: An opinionnaire was prepared for students to know students opinions regarding mathematics activities. The opinionnaire was consisted of close-ended questions.
DATA ANALYSIS:

- Data collected through pre-test and post-test was done by co-related t.
- Content analysis was done for open-ended questions and percentage and frequency were calculated for close-ended questions of Questionnaire.
- Frequency and percentage were calculated for responses of Opinionnaire.
DIFFICULTIES FACED BY STUDENTS:

- In Verification of Pythagoras Theorem students faced the difficulties in dividing squares in unit squares, in getting why squares were divided into unit squares, in cutting those unit square and pasting them into square along hypotenuse.

- In activity area of circle students faced the difficulties in dividing in equal quarters of octants, in getting why circle was divided into cone shapes, in cutting those octants or quarters cone shape and pasting them into parallelogram form.

- In quadrilateral activity students didn’t make out that how they got the sum of quadrilateral from triangle.
In activity area of cylinder students faced the difficulties that they didn’t understand how the length is equal to circumference and in activity volume of cylinder, how the base is equal to the area of circle.
OPINIONS OF THE STUDENT ABOUT ACTIVITY BASED APPROACH:

- All the students’ i.e. 100 enjoyed the Mathematics activities.
- All the students i.e. 100 like Activity based approach for mathematics teaching.
- Out of 17 students 14 students i.e. 82.35 percentages felt that Mathematics becomes easy and attractive through Activity based approach.
- Out of 17 students 11 students i.e. 64.70 percentages felt that learning of Mathematics through activities retains for longer period of time.
- Out of 17 students 13 students i.e. 76.47 percentages felt that Activity based approach helped more in learning Mathematical concepts compared to conventional classroom teaching.
Significance difference between the Mean Scores obtained by single group student’s on achievement test before and after the treatment.

<table>
<thead>
<tr>
<th>Single Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error of Mean</th>
<th>Degree of Freedom</th>
<th>‘t’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>15</td>
<td>9.8</td>
<td>2.45</td>
<td>0.6327</td>
<td>14</td>
<td>3.752</td>
</tr>
<tr>
<td>Post-test</td>
<td>12</td>
<td>12</td>
<td>2.591</td>
<td>0.6691</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Computed t-value is greater than table t-value. So Hypothesis of present study that is “There will be no significant Difference between Pre Test Scores and Post test Scores” is rejected.

So, There is Significant Difference between Pre test Scores and Post test Scores.

MAJOR FINDINGS:

- Slow learners are not able to complete the activity in given time.
- Majority of the students felt that Activity based approach helped more in learning Mathematical concepts compared to conventional classroom teaching.
- Majority of the students felt that learning through Activity based approach retains for a longer period of time.
Teaching of Mathematics thorough activities remove the ‘Maths phobia’ and create the interest in Mathematics.

Students have realized that activities have made Mathematics joyful, interesting and fruitful.

Students felt that activity based learning of Mathematics help in learning of other subjects.

Mathematics activities are effective in teaching of Mathematics.
THANK YOU