Activity-based teaching strategy for mathematics teaching and learning in the Present time: A study

Dr. Srabani Panda Acharya

Assistant Professor, Gandhi Centenary B.T. College, Habra, West Bengal, India.
Email Id: acharya.srabani@gmail.com

Abstract:

In the present time, technology can be found everywhere, including in classrooms. The integration of technology within the teaching and learning of any subject, specifically teaching Mathematics, has become a very critical issue.

It is a well-known fact that many school students have a phobia of Mathematics. Several publications addressed the issue and proposed different ideas to overcome the phobia with the help of technology or strategies. But a large number of schools (government or government-aided schools in west Bengal, India) do not have the requisite minimum infrastructure to fulfill the technical requirements in each classroom. Therefore, it is quite challenging for teachers to achieve mastery of learning in the classrooms with the help of technology. Therefore, reviewing the non-technical activity-based strategies again in the present scenario becomes essential.

The present paper will explore different strategies for supplementing school infrastructural limitations.

The paper will try to propose activity-based strategies for achieving mastery learning in Mathematics classrooms. The strategies will be applied to some school students to study the effect on them.

Key words: *mastery learning, mathematical modeling, discovery approach, self-learning, Cooperative learning, activity-based learning*

Introduction:

"As are the crests on the heads of the peacock, as are the gems on heads of the snakes so is the 'Ganit' at the top of the science known as Vedanga."-Vedanga Jyotish.

Mathematics is the most basic and essential subject for academic and social development. It provides the framework and language in which much of science is formulated. It provides precisions, and clarity and enables other scientists to establish laws and deduce consequences.

Teachers do not consistently use any kind of practical teaching aid with students during math instruction to promote math retention and achievement. Recently the use of technology in the classroom has grown up rapidly. A positive correlation between the use of technology and activity work in mathematics instruction will enhance students learning experience in their classroom.

According to (Stoblein, 2009), (Azuka 2012), (Pokhrel, T. R. 2018), some learners (less attentive) do not use their brains during class lectures. They use their ears and hand only. On the other hand, during well-planned activity-based learning, the students participate actively and enthusiastically. (Pokhrel, T. R. 2018) also observed that the activity-

based learning pedagogy is not only helpful for Mathematics teaching but also helps in the all-around development of the students.

Key concepts of Activity-Based Learning:

Activity-Based Learning:

As the name suggests, Activity-Based learning is a process whereby learners are actively engaged in the learning process, rather than passively absorbing lectures. It is based on the belief that learning should be based on performing some hands-on experiments and activities instead of a listing job. Students will be able to relate abstract ideas and theories with their observations. Activity-based learning involves reading, writing, discussion, practical activities, and engagement in problem-solving, analysis of problems, synthesis, and evaluation of the results. Active learning is also defined as a strategy that involves students in doing things and thinking about the concepts they are doing" (Bonwell & Eison, 1991). "If a child can get the opportunity to explore the learning environment by themselves with an optimum learning environment, learning becomes joyful and long-lasting" (Wikipedia, 2012; Pokhrel 2018). Active learning can also be defined as a method where the teacher will act as a facilitator and learners will carry out the learning process by their high involvement in practical activities and discussions. This approach develops Creativity and imagination among the students (Pokhrel, 2018). Self-initiated learning involving the whole person- feeling as well as intellect – is the most pervasive and lasting type of learning (Okwudishu, 2011).

According to (Meyers and Jones in Kathleen 1996) Active learning "derives from two basic assumptions: (1) that learning is by nature and active endeavor aid (2) that different people learn in different ways".

(Bonwel and Eison 1991) states that the characteristics of Active Learning are as follow:

a) Students can involve themself in activity-based learning than in listening

b) The focus   is more on developing student's skills with less emphasis on transmitting information,

c) Students are encouraged to perform higher-order thinking (analysis, synthesis, evolution) and to explore their own attitudes and values. Students are engaged in activities like reading, discussing, and writing.

[Morable in Okwudishu (2011)] defined the following benefits of Activity based learning:

a) it reinforces the overall learning processes,

b) develops skills like collaborative learning, improves learners' self-esteem, stimulates participatory learning,

c) allows to build creative problem-solving skills, and improves the concept of discovery learning.

Studies by (Iqbal et. al, 2022) have revealed that activity-based teaching is more beneficial than traditional teaching and obtain higher grades through activity-based methods.

Cooperative Learning or Small Group Learning:

Cooperative learning or small group learning is one of the best practices that may be adopted to ensure the active participation of the learners in the learning process. Cooperative learning is a practical-oriented learning strategy in which students participate proactively in their learning process (Yemi et. al, 2018). It creates an environment that helps to engage students who might not be engaged in their own learning in meaningful ways. When a small group of students is assigned a mathematical task, it enables all students to contribute to the learning process. Group work encourages academic discussions within the group which improves the understanding of each student. This makes learning, more engaging, meaningful, active and effective and a deeper process. Several studies have established the strong positive effect of cooperative learning on mathematics learning (Yemi et.al, 2018).

Discovery Approach of Learning:

In the discovery approach, the learners are guided by their teacher to discover mathematical concepts, facts and formulae through organized activities and observations. (Herdian et. Al 2017) defined "discovery or invention" as a designed activity that allows students to discover mathematical concepts and principles through their intellectual processes. According to (Kamaluddin, et.al, 2019), in the past few decades, the learning paradigm has been shifted from teacher-centric to learner-centric

Example of discovery learning: "Sum of internal angles of a triangle is 180 degrees."

The teacher will ask the students to draw a triangle, measure the three internal angles and add them together. The students would discover that the sum of the angles is 180 degrees.
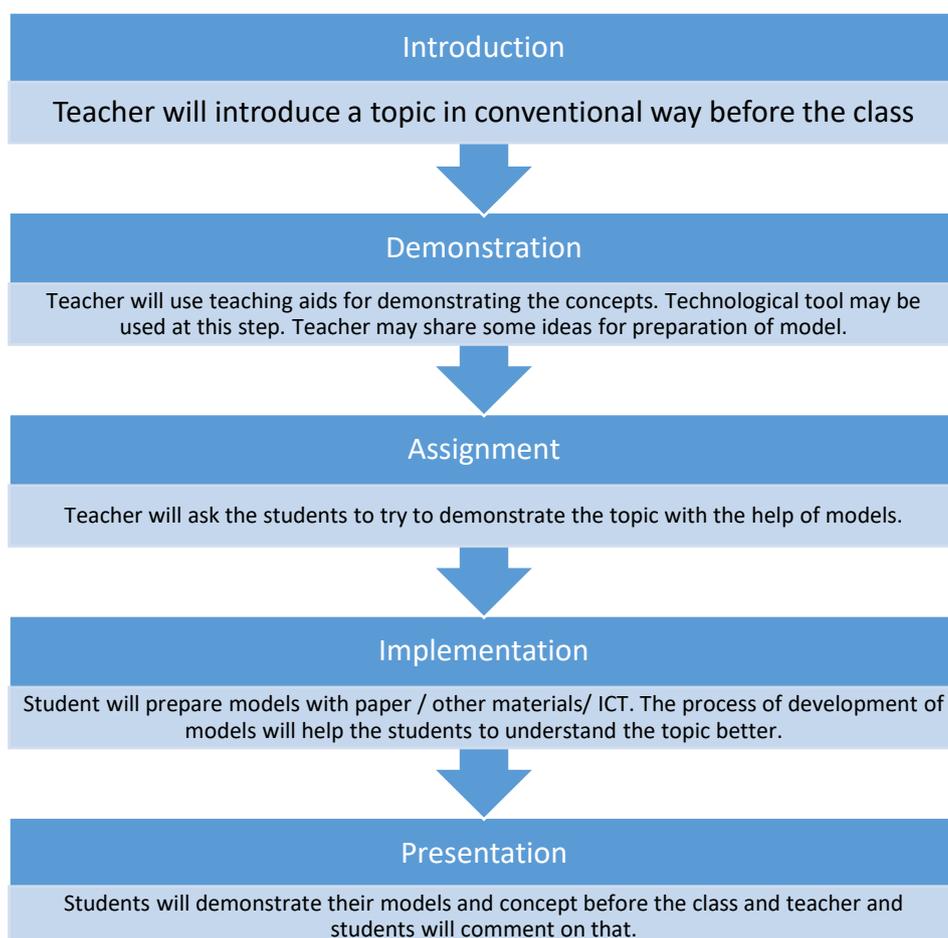
Self-Learning:

Self-learning is a learning approach where the learners make effort to identify their own learning needs, set learning goals, find the necessary resources, and evaluate their knowledge. Self-learning allows the learners to handle the new challenges and trends in teaching and Learning mathematics independently (Chaurasia, 2020)

In this process, the teacher act as a facilitator and Self-learning materials can be used as scaffolding.

Proposed Strategy for better learning:

The author proposed an easily implementable strategy, considering activity-based learning approaches and existing strategies, to achieve the goals of Mathematics learning within the conventional classroom environment.

Introduction
Teacher will introduce a topic in conventional way before the class

Demonstration
Teacher will use teaching aids for demonstrating the concepts. Technological tool may be used at this step. Teacher may share some ideas for preparation of model.

Assignment
Teacher will ask the students to try to demonstrate the topic with the help of models.

Implementation
Student will prepare models with paper / other materials/ ICT. The process of development of models will help the students to understand the topic better.

Presentation
Students will demonstrate their models and concept before the class and teacher and students will comment on that.

OPEN ACCESS | **Original Research Article**

Results and Discussion:

The proposed strategy had been applied to the 320 students of Class VI-X in 8 Government aided schools in West Bengal, India. The students were introduced to some Mathematical topics of their syllabi with models (sample examples are given below).

The students were categorised into three types depending on their Mathematical skills and ability

a) Above Average: they can solve exercises without or with little support. The confidence level is high.

b) Average: they can solve exercises with support but can solve similar problems. The confidence level is medium.

c) Below Average: they are afraid of Mathematics. The confidence level is low

The trainee teachers taught in the classes for at least 3 months and introduced at least 10 different topics for a particular class/section.

After completion of the training, it was found that all categories of students accepted the strategy. They enjoyed.

Category a) and b) found it effective for understanding the concepts

with broader dimensions. Category c) found it helpful to understand the problems. Their confidence was increased towards the topic as they could visualise and feel the concept by their own.

Sample Model Ideas:

Topics from Arithmetic, Geometry, Mensuration and Trigonometry are considered for the purpose.

1) Arithmetic Topic: Time and Distance

Normally in these types of problems students face difficulty to understand the length of different things. If they are asked to make models of specific lengths and to demonstrate the physical interpretation of displacement of any object and relation with time they will be able to understand the concepts.

2) Trigonometry: Height and Distance

Students can prepare models of different objects and physically measure the angles, heights and distances to solve the problem.

3) Geometry Topic: Triangle→Sum of inner angles is 180°.

Figure-1 :: Sum of inner angles of a triangle is 180°

Description: Make a triangle with hard paper. Cut the corners of the triangle. Put the pivot points together. It will form three consecutive angles on a straight line. So the sum of the inner angles is 180^{0}.

4) Mensuration: Cylinder

Take a piece of rectangular paper. Measure its length and breadth. Roll the paper to form a cylinder. So the perimeter is the area of the paper.

Conclusion:

The use of Technology in the classroom is the demand of the time. But it is not an alternative to traditional lecture

OPEN ACCESS   **Original Research Article**

based teaching. It will assist the lecture-based teaching activities. But activity-based strategies will make the learning more involving and joyful.

The proposed strategy has been found relevant in the present time. It is proved that there is no alternative to activity based teaching where students are actively involved in their learning. A large number of resources are available online with different ideas for preparing models on different topics. But teachers are required to transform them into mentors and to encourage their students to do the modelling by themselves.

More research can be done to examine the effectiveness of using different activity based approach through mathematical modelling and the use of ICT to various difficult topics in mathematics and different age groups of cognitively and socially challenged child so that students get more joy in learning Mathematics

References:

1. Adetula, L. O. (2006). National Mathematical Centre manual for the UNESCO/FME workshop for primary school mathematics teachers on the use of NMC/PMK. In *the six geopolitical zones of Nigeria.* Marvelous Mike.

2. Azuka B. F. (2012). Teach yourself senior secondary school mathematics. Abuja: Marvelous Mike Ventures

3. Azuka, B. F. (2013). Activity-Based Learning Strategies in the Mathematics Classrooms. *Journal of Education and Practice, 4*(13), 8-14. https://core.ac.uk/download/pdf/234634479.pdf

4. Bandyopadhyay, S. (2007). *Ganit Sikshan Padhyati*. Rita Book Agencies, Kolkata.

5. Biggs, E. E. (1968). Mathematics laboratories and teachers' centres—the mathematics revolution in Britain. *The Arithmetic Teacher*, *15*(5), 400-408. https://files.eric.ed.gov/fulltext/ED111636.pdf

6. Bonwell, C. C., & Eison, J. A. (1991). Active Learning: Creating Excitement in the Classroom. *ASHE-ERIC Higher Education Reports*. https://files.eric.ed.gov/fulltext/ED336049.pdf

7. Chickering, A.W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate ducation. *AAHE bulletin*, *3*, 7.
   https://www.researchgate.net/publication/228044220_Seven_Principles_of_Good_Practice_in_Undergraduate_ Education

8. Chaurasia. P. (2020). Self-learning: a constructivist approach to enhance teaching- learning of mathematics, *The International Journal of Indian Psychology 8*(4), 384-391.
   a. DOI:10.25215/0804.047

9. Herdiana, et. al. (2017). Effectiveness of discovery learning model on mathematical problem solving, *AIP Conference Proceedings 1868*(1):050028
   a. DOI:10.1063/1.4995155

10. Okwudishu, A.U. (2011). Trainer guide to the use of the manual of best practices and methods of facilitating in basic literacy programme. *A lead paper was presented during a workshop on developing Manual of Best Practices at Enugu, Nigeria.*

11. Pande.P.(2018). *Pedagogy of Mathematics Teaching*, Rita Book Agency

12. Pokhrel, T. R. (2018). Activity Based Mathematics Instruction: Experiences in Addressing the 21st-Century Skills. *Journal of Mathematics Education, 11*(1), 46-61. https://doi.org/10.26711/007577152790020

13. Kathleen, M. (1996). Active learning. Retrieved on March 27, 2008, from http/www.worldcat.org/…/icon-n88-191822

14. Stoblein, M.(2009). Activity-based learning experiences in quantitative research methodology for young scholars,

OPEN ACCESS   **Original Research Article**

Retrieved September 19, 2012 from www.pomsmeetings.org/...../011-0782.pdf

15.   USAID & WINROCK international,(2016). *Room to Learn Teacher Professional Development—Basic Literacy Skills Trainers' Manual,* USA,   https://pdf.usaid.gov/pdf_docs/PA00MBPR.pdf

16.   Yemi, A. E., & Seriki, A. I. (2018). Retained Earnings and Firms' Market Value: Nigeria Experience. *The Business & Management Review,* 9(3), 482-496.

Cite This Article:

Dr. Srabani Panda Acharya, (2022). Activity-Based Teaching Strategy for Mathematics Teaching and Learning in the Present Time: A Study , Aarhat Multidisciplinary International Education Research Journal, XI (IV) July – August, 47-52.