Activity Based Learning (ABL): How it can be a recipe for success in mathematics?

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Abstract:

Education for all and its quality is a matter of concern especially in India. India has worked on the implementation of compulsory school attendance for many years. Mathematics is a part of our general education and all children have to study mathematics till class 10th. But most of the students take mathematics as a very boring and difficult subject to understand. They have a phobia of mathematics. In most of the schools, teachers' teaching style is only lecture method. Generally, the teachers believe that mathematics is about knowing solutions to problems and not about being able to understand the concept and about being able to think of ways of solving problems. The emphasis is always being on the solution rather than on thinking of a technique to reach the solution. Therefore, teaching gets restricted only to sharing solutions with students from either the textbooks or guide books, which promotes memorization in mathematics. Mathematics classroom tends to become uninteresting for students. This calls for a teacher to change his/her pedagogy. For most teachers, to make mathematics an interesting and enjoyable subject is quite tedious job because of their own fear of mathematics. 'Activity based mathematics teaching' and 'child centered' teaching are just technical terms to them but they don't actually implement these techniques in their teaching. Also most of the schools don't have access to material required in activity based learning which again becomes a barrier for the teachers to use creative techniques. In this paper focus would be on the need, benefits and problems in the implementation of the activity based learning in the light of review of related literature. Suggestion are given to make activity based learning a recipe for success in mathematics.

Key words: *Success in mathematics, Teaching style, Activity based learning.*

I. INTRODUCTION

History of mathematics in India is hundreds of years old. Earlier mathematics education in schools is restricted to cramming of formulas and methods to solve a problem but with time, mathematics education revolutionized different techniques and become an essential part of universalization of school education (USE) in India. Mathematics is an integral part of our education system till class 10th. India has worked on the implementation of compulsory school attendance for many years through many schemes like universalization of school education (USE), right to education (RTE) and mid-day meal programme etc. Right to Education (RTE) recognizes the importance that children learn through activities, discoveries and exploration in a child-centered and child-friendly manner.

Problems of primary mathematics should follow the trend from concrete to abstract. In fact that itself is the principle of effective learning. Activity based learning (ABL) having hands-on activities, manipulative materials, mathematical games, puzzles and stories involving number are useful to enable children to make the relations and to build upon their mathematical understandings. The National Policy of Education (1986) states that "mathematics should be visualized as the vehicle to train a child to think, reason, analyze and articulate logically.[1]

The following guiding principles[2] are adapted from the different publications of NCTM (National Council of Teachers of Mathematics):

- A curriculum is more than a collection of activities: It must be coherent, focused on important mathematics, and well articulated across the grades.
- Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge. Learning mathematics with understanding is essential.
- If a voluntary national mathematics curriculum is developed, the topics studied in that curriculum must be taught and learned in an equitable manner in a setting that ensures that problem solving, reasoning, connections, communication and conceptual understanding are all developed simultaneously along with procedural fluency.

II. OBJECTIVES OF THE PAPER

- To define the activity based learning (ABL).
- To recognize the need and benefits of activity based learning (ABL).
- To study the problems in the implementation of the activity based learning (ABL).
- To suggest the ways and means for success of activity based learning (ABL).

III. ACTIVITY BASED LEARNING (ABL)

Activity based learning (ABL) is a learning technique in

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which learner interacts with the subject matter through some activity. Here learner understands the problem by being active participant rather than being a passive listener. It also requires that teacher acts as a facilitator and present the content in more concrete form so that learners may be able to relate their knowledge to their daily lives.

Activity based learning (ABL) as an instructional strategy means that the teachers make use of some activities to involve the students while delivering the lesson. The activities vary widely, from hands-on material to real experiences, from using simplest activity to a complex project. Teacher can use the activity at any stage of the lesson as per requirement. Consequently, we define activity based learning (ABL) as teaching technique in which teachers engage students in the learning process and make them active participant for their effective learning of the mathematical concepts.

For this, The Central Board of School Education (CBSE) has published detailed guidelines for mathematical laboratory in schools including hands-on activities to be done with the objective[3] of

- Making teaching and learning of the subject interactive, participatory, fun filling and joyful from primary stage of schooling.
- Strengthening the learning of mathematical concepts through concrete materials and hands-on-experiences.
- Relating classroom learning to real life situations and discourage rote and mechanical learning.

Many psychologists favoured the argument that students' learning is enhanced when they actively participate in the learning process and involve in doing, seeing and interacting by using hands-on approach in mathematics. Piaget and Bruner also appreciate the importance of learning by doing. They argued that direct experience with physical material is necessary for school children for their intellectual development. This indicates that by doing and experiencing activities in mathematics, students develop their intellectual ability as well as mathematical creativity. This mathematical creativity helps the students in problem solving and relates the mathematical idea to real life situation. These abilities stay with students throughout their life but they forget the concepts learnt through hearing with passage of time.

Effective learning takes place when the learner is able to transfer the acquired knowledge to other relevant situations. This can only happen if learners learn through by doing and experiencing the same, which means in learning processes the learner's ability to listen and read are not sufficient evidences to confirm that the learner has acquired adequate knowledge of a concept. The theory of experiential education revolves around the idea that learning is enhanced when students acquire knowledge through active involvement.

Thus, activity based learning (ABL) is a learning process that involves the active participation of learner and interaction with the subject-matter to enhance his/her creative, critical and divergent thinking.

How activity based learning (ABL) takes place in classroom? The commonly used methods:

Teachers can help students developing a positive attitude and make active participant in the learning process by providing lessons which engage children and allow them to solve problems by using hands-on materials, manipulative materials, visualization techniques, and real-world math as well as other strategies like play-way, co-operative learning, collaborative learning, heuristic technique and problem –solving during class.

Hands-on activities and manipulative materials provide experiential learning. Manipulative materials engage students in lessons by being active participants which results in effective learning. Manipulative materials help students learn by allowing them to move from practical and real experiences to difficult mathematical problems. They have both visual and tactile appeal and can be manipulated by learners through hands-on experiences. Any physical object that can be used in teaching to help the students understand the concept better are manipulative materials i.e. blocks, shapes, spinners or even paper which is cut or folded, buttons, macaroni, biscuits etc.

Also the National Council of Teachers of Mathematics (NCTM) has recommended the activity based learning in teaching mathematical concepts at all levels in school. Many private schools mandate or urge for manipulative materials and hands-on activities especially for teaching of mathematics at all levels.

IV. NEED OF ACTIVITY BASED LEARNING (ABL)

The poor methods of teaching mathematics have made the subject difficult for students. This is the reason that most students have negative attitudes and are experiencing difficulties in learning mathematics. Students feel that school mathematics is a boring subject and is not at all useful in everyday life. A reason for this attitude towards mathematics is use of same conventional teaching techniques going back number of years. In primary classes, mathematics learning is considered as rote-learning that is based on memorization. Teachers must be prepared with creative teaching techniques to meet the needs of all the children in the class. Creative techniques which involve the children in physical activities may develop their positive attitudes toward mathematics. This calls for the need to use of effective instructional techniques for teaching mathematics especially in the early school stages. One such learning technique is activity based learning (ABL) technique. Learning mathematics only through rote-learning creates problem in school mathematics. Working with hands-on concrete material including materials such as manipulative materials gives students a different vision in order to solve mathematical problems.

Learning mathematics is not about rote learning rather it is about gaining ability to solve new problems. It also realizes the need of activities in mathematics for problem posing. For most people mathematics education means remembering the formulas and correct solution of the problems and not about being able to understand what the concept means. The emphasis is on the 'solution'. In these cases teaching is limited to textbooks or guide books instead of organizing activities in the classroom.

Keeping in mind the Indian reality, where few schools have access to expensive and virtual material, our main focus is that every child should learn and enjoy mathematics at

the same time. This simply implies that the mathematics should be taught in accordance to real life situations by using activity based learning (ABL). This technique is the best way to serve child-centered learning. Ultimately, in the teaching-learning process child is more important than everything else. It is certainly true that mathematics is very much connected and useful in everyday life. Therefore, students must be taught in a way that they will be able to relate their mathematical knowledge in the actual life situations. Hoang (2007) examined several instructional practices and leads to the result that frequent use of active learning strategies i.e. students working on mathematics projects and using things from everyday life when solving mathematics problems enables them to apply mathematical concepts and to foster meaningful learning. Several roles of visualization were identified by Makina (2009) and most were found to improve the performance and creative thinking of pupils during their learning of data handling.

India is such a country where maximum number of children drop out of school during the elementary stage, therefore, mathematics curricula cannot be based only on preparation for higher secondary and university education. Even after the fulfillment of goals of universalization of elementary education (UEE) many students may exit school after class VIII. This means activity based learning (ABL) is necessary at every stage of school which help students overcoming the challenges they face on exiting school for their livelihood. It is important to remove the mathematics phobia in students at early stage by creating enjoyable taste for mathematics which is possible only through the active participation of pupils in the learning process.

Teachers' understanding "when and how" a mathematical technique to be used is always more important than making the students to recall the formulas and mechanical procedures. Making mathematics a part of children's everyday life experience through activity based learning is the best way to impart knowledge of mathematics. With this technique children may be able to pose and solve meaningful problems. Logical thinking is the base of mathematics which can be achieved through systematic thinking, interaction and active participation of pupils.

V. BENEFITS OF ACTIVITY BASED LEARNING (ABL)

- Students who are involved in ABL program will retain the concept better and positive transfer of learning takes place when needed due to their physical experience with the material. With this their own learning process becomes the base for problem solving in other situations.
- ABL enhance students' critical thinking rather than memorization of formulas. Through ABL students learn to give stress upon evidence related to problem solving instead of simply rote the ways and methods that teacher has told.
- If teacher taught through conventional methods, students simply receive knowledge by being passive recipients but their actual involvement in the learning process gives them direct experience for better understanding and in-depth knowledge of concept.
- Activity-centered classrooms encourage student creativity in mathematics, promote their independent thinking and help students in problem solving in mathematics which they find difficult in traditional classrooms.
- ABL is an effective technique that enables the learners to learn easily, retain the concept longer and enjoy the learning process.
- ABL helps students in their practical and real knowledge due to experiential learning. In ABL students involve in an activity which enhance understanding of the concept because understandings of mathematical concepts are much more important than the memorization of procedures and rules for effective learning.
- In ABL, students use concrete hands-on materials which allow the students to understand abstract concepts/ideas. Thus these physical objects help the students to solve difficult problems.
- Hands-on materials in ABL assist students in dealing with a topic that can be difficult and confusing in traditional classroom as hands-on materials make teaching fun.
- It is important to relate activities to the surrounding context. Making this connection was thought to increase students' motivation and interest, as well as giving students an opportunity to gain deeper mathematical understanding.
- ABL increases the curiosity to gain the knowledge among students because concrete materials and examples connect mathematics to the everyday life.
- With the technique of activity based learning use of graphical representations of data and formal techniques for drawing linear graphs can be taught which fosters understanding and imagination due to its visual impact.
- Benefits of activity based learning also include better concept learning; better concept retention; reduced anxiety; increased enjoyment of learning; increased independent, critical and creative thinking and decision making based on direct experiences by physical involvement in the activity.

VI. PROBLEMS AND ISSUES IN IMPLEMENTING ACTIVITY BASED LEARNING (ABL)

Mathematics education depends upon the teacher's preparation, his collection of teaching techniques and skill to implement those techniques in their teaching. In an activity-oriented classroom inadequate teacher preparation can be a great problem. Mathematics teaching poses different problems at different stages. At the primary stage, most teachers underestimate the level of mathematics with respect to their own knowledge. So they simply go to the class without preparation and reproduce the old-age techniques in front of students. At the secondary and higher secondary level, some teachers face a different situation. NCERT revise the syllabus within a specific period of time and in the absence of in-service teacher training programmes, they lack in the fundamentals concepts of mathematics.

This compels teachers' to use guide books offering little breadth or depth in the understanding of concept and discourages any learning based on activities and real life experiences. Thus, teachers' inability in linking the subject to real life situations enhances students' difficulty and rote learning.

Some teachers teach in an abstract manner with no participation of children. Many teachers do not see the importance or benefits of using these activities and consider it as wastage of time, efforts and resources. Teachers in hurry to complete the syllabus also resist them to use these techniques. For the students, classrooms largely meant for remembering the definitions of mathematical ideas, axioms, postulates and solutions to problems or theorems and their proofs. Therefore, mathematics classroom tends to become uninteresting for students.

RTE argue that in India the main issue of implementing ABL in school is due to their financial condition. Many schools do not have sufficient resources i.e. hands-on material, mathematical games and manipulative materials. These schools are bound to use textbooks as the only teaching material.

Sometimes teachers teach through activity but the activity does not actually relate to the concept. They simply teach without bothering much. This makes the concept more difficult for students and they start taking these activities simply as fun. Puchner (2008) found that manipulative use hindered instead of helping the student learning. Also not all the topics can be taught through activities but some teachers simply believe in activity-based teaching irrespective of concept or topic. This creates the wrong notions in the students that mathematics is a subject which can be learned through activities only and no other method is suitable to the subject.

VII. HOW ACTIVITY BASED LEARNING (ABL) CAN BE ARECIPE FOR SUCCESS IN MATHEMATCS?

- Mind-set of teachers should change towards these activities. Most of the teachers believe that mathematics is best taught by conventional method i.e. it is best taught by revising the formulas, step-by-step procedures and practicing those procedures to make students efficient in solving mathematical problems. Teachers' attitudes often underestimate the benefits of these activities. Few teachers consider this a waste of resources but major section of teachers use activities solely to gain students' interest and add fun to their lesson. This attitude promotes cramming in mathematics and results in failing to enhance conceptual understanding.
- There should be proper in-service teacher training programmes. Giving importance to in-service teacher training programmes for adequate teacher preparation helps in recognizing the difference between doing mathematics and cramming mathematics, between mathematisation of thinking and memorising formulas, between addressing the higher aims and working towards the narrow aims.
- There should be proper in-service teacher training programmes to increase the teachers' knowledge about activity oriented teaching. Choice of incorrect activity can also create problem. In this situation, teachers fail to make link of mathematical concept with the activity and students get confuse rather than to gain in depth knowledge.
- According to research evidence activity based learning is not a sure-shot strategy for helping students to learn mathematics especially for all the topics at all the levels. Therefore, it is teachers' responsibility to choose the pedagogic techniques best fitted for a particular topic.
- There should be more emphasis on low-cost and no-cost materials so that these can be used by low-income schools, and rural schools. Some additional innovation may be necessary for the rural mathematics kit, since some materials available in urban areas may not be available in villages. Teachers should use hand-made manipulative materials or concrete materials which are easily available i.e. coin, paper, chalk, bangle etc.

VIII. CONCLUSION

Yet, despite of all the efforts, mathematics education has remained the same, focusing on narrow aims. This is the reason why many students respond to school mathematics with boredom and discouragement. They develop the perception that success in mathematics depends on some innate ability which they simply do not have, and feel that, in any case, mathematics will never be useful in their lives. Activity based learning (ABL) is an instructional technique with focus on the active participation of learners by using hands-on materials, manipulative materials, visualization techniques, and real-world math as well as other strategies like play-way, role-play, guided discovery and problem –solving during class instead of making learners a passive listener and a receiver of knowledge. A fear of failure in mathematics among children is due to lack of teachers' preparation and support materials in the teaching of mathematics. Also the mismatched curriculum for both above average as well as below average at the same time, calls the need of activity based learning in mathematics. Although activity based learning is very beneficial to make the subject interesting and experiential for students but there are many problems in implementing the activity based learning. In-service teacher training programmes which help in to keep teachers informed with latest pedagogy, adequate choice of activities, provide or develop cost effective materials for the activities and also change the attitude of teachers etc. are some suggestions for the success of activity based learning.

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X. FOOTNOTES

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