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Enhancing problem solving ability through constructivism

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ABSTRACT *Problem solving is the framework of pattern with in which creative thinking and reasoning takes place. It is the ability to think and reason on given levels of complexity. People who have learned effective problem solving techniques are able to solve problems at higher levels of complexity than more intelligent people who have not such training. It has been observed that in many cases even those students who score good marks in Mathematics, are not good in their problem solving skills.* There may be different reasons behind it but researcher is focusing on teachers' approach in classroom which is more traditional and one way. Researcher in his paper is trying to focus on the methods of implementing constructivism in enhancing problem solving ability and also the role of teacher in such set up.*

A student of Mathematics or a mathematical problem solver not only requires cognitive abilities to understand and represent a problem situation, to create algorithm to the problem, to process different types of information and to execute the computation but also be able to identify and manage a set of appropriate strategies (techniques, heuristic, shortcuts etc.) to solve the problem.

Children learn best when they:

- make connections between their diverse prior experiences and learning in the school setting
- participate in making decisions
- make choices and contribute to learning experiences
- share their opinions and diverse experiences
- discuss their learning
- learn in a responsive and supportive social environment
- learn through multi-sensory experiences
- participate actively in experiences that engage them emotionally, physically, cognitively and socially

Therefore the teaching practice must focus on monitoring and assessing, planning, interacting and reflecting of child's learning environment. Environment in which child feel free to discuss his problem, try to overcome the difficulties on his own effort. Teacher's role in such environment will be a role of facilitator and classroom will be platform where learning is constructed.

Constructivism- Through constructivism people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences.

In constructivist environment teachers help students to construct knowledge rather than to reproduce a series of facts. The constructivist teacher provides inquiry based learning activities with which students formulate and test their ideas, draw conclusions and inferences, and pool and convey their knowledge in a collaborative learning environment.

Mathematics and problem solving ability: Mathematics plays a vital role in the decision making process via reasoning and logical thinking. Mathematics is basic to a large number of branches of human knowledge. In subject like Mathematics the greatest hurdle for students is fear factor and to remove this fear there is need to develop an ability in them to understand the problem and its nature. After understanding the nature of the problem, a student can try to design his approach and make efforts to get the solution of it. This ability of handling the problem and getting the solution is termed as Problem Solving Ability.

Constructivism as tool for enhancing problem solving ability:

Although there are several varied approaches which are considered to be constructivist, the major principles that are common among most constructivist approaches are summarized below (Airasian and Walsh, 1997; Feng, 1995; Kamii, Manning and Manning, 1991, cited in Bonstetter, 1998; Richardson, 1997; Smerdon, Burkam and Lee, 1999; von Glasersfeld, 1990):

- Learning is the active creation of knowledge structures (schemata) from personal experience and interaction with the environment.
- Knowledge must be constructed by the learner; it cannot be supplied by the teacher. It is acquired through the involvement with content instead of imitation and repetition.
- Meaning is intimately connected with experience. Students come into a classroom with their own experiences and a cognitive structure based on those experiences.

Major principles to facilitate constructivist learning are summarized below (Brooks and Brooks, 1993):

1. Posing problems of emerging relevance to students: This does not mean that students are free to study whatever they want on any given day, but it means that the teacher must plan the lesson so that the topic will be of interest to students.

2. Structuring learning around primary concepts: Much of traditional education breaks the concepts into parts and concentrates on the individual parts. However, constructivist approach suggests that the details should be studied in depth once students see the big picture.

3. Seeking and valuing students' points of view: According to constructivist perspective, in order to tailor the in-

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struction to the students' needs, the teacher should know what students are thinking. For this purpose, the teacher should also allow opportunities for students to express their points of view and to elaborate on them.

4. Adapting curriculum to address students' suppositions: It is crucial that teachers actively learn about their students' thinking and apply this knowledge to their lesson planning. Lesson planning flexibility is crucial for addressing student needs.

5. Assessing student learning in the context of teaching: Despite the proficiency tests, the real purpose of assessment should be to assist the teacher in determining how well the student is mastering the concepts being taught. Students' performance should be monitored continually while the lesson is being taught. If the lesson is not working, the teacher should be prepared to determine the cause of students' lack of comprehension and make adjustments to address the problem.

Teacher as facilitator:
Constructing
Thus in constructivist set up knowledge is constructed and teacher's role is as of facilitator. Teacher while entering the class for teaching any new topic must consider students' previous knowledge. Teacher should encourage the students to learn the new concept by their own efforts.

For example: A teacher in elementary school presents a problem to measure the length of wooden piece. Students are provided with some objects including a piece of rope, inch tape, ruler etc. Freedom is provided by the teacher to the students to measure the piece of wood using any one of the available objects. After combined efforts and experience, students may come to know that the best object to measure the wooden piece is ruler.

Motivating the students to participate
Learning activities require the students' full participation and in constructivist environment teacher should motivate the students to participate in activities so that they can learn by reflecting and talking about their activities.

For example before starting any topic teacher on the basis of previous knowledge of students should organize a group discussion on what and why part of that topic.

Reflective
Learning become effective and long lasting when comes through direct experience. Students lead the way by reflecting on their experiences and the teacher in constructivist classroom creates the situation where the students feel safe questioning and reflecting on their own experiences, either privately or in group discussions.

For example asking students about how the project given to them is made and what they have learned from it, what new knowledge the student has created etc.

Cooperative learning
In constructivist classroom cooperation among students plays a significant role. Because in cooperative learning classroom students learn concept not only from themselves but also from their peers.

Inquiry based learning
Main focus in constructivist classroom is on solving problem. Students use inquiry methods to ask questions, investigate a topic, and use a variety of resources to find solutions and answers. As students explore the topic, they draw conclusions, and, as exploration continues, they revisit those conclusions. Exploration of questions leads to more questions.

Evaluation flexibility
Fear of failure in exam most of the time promotes habit of cramming among students. Also they hesitate in asking questions and clearing their doubts in the class. Thus evaluation technique needs to be change so that fear failure in students can be eliminated. Evaluation should not be based on written exam only but also on activities performed individually and in group, such as group discussion, group task, assignments (both individual and group). As a result of which learning will be more activity oriented and students can construct knowledge themselves. Constructivist evaluation strategies emphasized assessment of the learning process regularly, encouraging students to engage in self-evaluation and peer evaluation.

Conclusion
Thus problem solving ability in students can be developed and enhanced through constructivism which focuses on the following:

1. The learning activities should be student-centered and encourage creative and critical thinking and independent learning.

2. The time allocated to lecturing should be reduced and lecturing should be supported with such activities as discussions, cooperative work and student presentations more.

3. Like lecturing, question and answer techniques should also be made more interactive and evoke higher-order thinking rather than requiring a single and a correct answer. Such techniques as fill-in-the-blanks and dictation should be replaced by the activities which encourage the students to use their higher-order thinking.

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