10

Mathematics Laboratory: A Link between Concrete and Abstract

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Mathematics occupies an important place in the school curriculum. The study of mathematics not only helps in disciplining the mind but also acts as a catalyst in developing the power of thinking and reasoning, which is the prime goal of every individual. It plays an even greater role in technological and scientific advancements of the present day techno-savvy society.

Despite its acute necessity, the largely deductive and abstract nature of mathematics makes it appear a dull and difficult subject. As a result, most students lose interest in the subject and avoid it. It is necessary to remove this fear for mathematics from the minds of students. They need to be motivated. Their interest in mathematics needs to be aroused and nurtured. This needs to be done right from the elementary stage of learning.

Abstract mathematical concepts evolve from concrete concepts and come through personal experiences. The structure of modern mathematical theories rest on the basic and elementary concepts derived from personal experiences with concrete objects. While analysing a mathematical problem, it can be seen that its comprehension and ultimate solution hinges around the correct perception of objects in the physical situation involved in the problem.

Therefore, the journey towards abstract ideas in mathematics can begin only when something concrete is put in the hands of students. This will equip them with the basic ideas of the concepts in a better way. Thus, mathematics should be learnt by doing rather than simply by reading. This 'doing' of mathematics requires a suitable place for performing mathematical activities. A well-equipped mathematics laboratory is a suitable place for the same.

A laboratory can instantly motivate students and create an environment for mathematics learning.

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It can foster mathematical awareness, skill-building and learning by experiences in different branches of mathematics, such as algebra, geometry, mensuration, trigonometry, calculus, coordinate geometry, mechanics, etc. This is the place where students can learn certain concepts using concrete objects.

They can verify many mathematical facts and properties using models, measurements and other activities. A mathematics laboratory enables a student to verify or discover some geometric properties, using models, measurements, paper cutting, paper folding, etc. It can help the student use different tables and ready reckoners in solving some problems. The students can listen to or view certain audio-video cassettes and CDs related to different mathematical concepts. For example, the importance of different congruence criteria of triangles can be made known to the students of upper primary classes by using different modes of handling concrete objects. One student can be asked to draw a triangle. Then, he/she tells other students about the elements of the triangle drawn. The other students should draw triangles, which are exactly the same as this triangle (i.e., a congruent triangle). The original triangle will not be shown to the other students. Suppose, he/she first tells them only the length of one side of the triangle. Accordingly, the other students will try to draw triangles only with the length of the side told to them. The triangles drawn by the other students may not match with the original one. The first student, then, tells them about the length of other side of the triangle. The game continues till all students are able to draw the triangle similar to the one drawn by the first student. At some point of time, the students realise that either three or two sides and the included angle between them, and so on, need to be given to them to get an exact copy of the original triangle. The students understand the importance of the SSS (side-side-side), SAS (side-angle-side), ASA (angle-side-angle) and RHS (right angle-hypotenuse-side) criteria. To perform this activity, the students can use papers kept in the lab or cut triangles with the help of scissors or cutters. They can also make use of Geo-Gebra software available on the computer in the lab. The lab, then, becomes a discussion room because of discussion on triangles drawn by the students at every stage of this game. Thus, the available material in the lab can be used to play games and do mathematical activities that helps in understanding different concepts through exploration.

The teacher may encourage the students to prepare similar models or charts using material, like thermocol, cardboard, etc., in the laboratory. The laboratory can also act as a forum for teachers to discuss and deliberate on some important mathematical issues and problems of the day. Using the laboratory equipment, the teachers can together device some games or

activities or strategies to improve the understanding of mathematics in students.

A teacher can explain certain concepts using computers and calculators in the lab. Integrated projects that include other subjects, like science, social science, language etc., can be also thought of. Integrated projects help students to see a link of mathematics with other subjects, resulting in a better understanding of mathematics. Mathematics lab may not merely be restricted to mathematics teachers but can be of use to teachers of other subjects as well. They should also come and discuss integrating ideas of their respective subjects with mathematics.

The teachers and the students will be able to consult relevant reference books, journals, etc., in mathematics that are available in the laboratory. The students may be inspired by the works of great mathematicians through their pictures and information about them in the lab. The information about mathematicians (including Indians) may focus mainly on their works and struggles.

The students should be encouraged to use the materials kept in the lab and asked to present their observations about relevant concepts using those materials. A discussion among students about the presentations of their peers should also be encouraged. Arguments and counter-arguments may be encouraged. This will deepen the understanding of mathematics among the students and teachers. Based on these discussions, the students may be encouraged to improve the materials kept in the laboratory that would help in better understanding of the subject.

Thus, a mathematics lab can induce learners to handle concrete mathematical objects in a variety of ways, and gradually, lead them to handle the abstractions in mathematics.