ROLE OF IJSO EXPERIMENTS IN LEARNING PROCESS

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Learning Science through experiments can be an un-forgettable experience.

Experiments play vital role in helping students in understanding concepts of science. Experiments are the answers to our questions, provided by nature. It does not involve any guess work or approximation of reality or even unclear calculation. Once a student understands the basic concepts of science, hands-on experience of the same topics/concepts helps him or her in cementing the understanding.

However, an premature exposure to experiments where multiple principles of nature are at play, may confuse students, Conversely, a delay in exposure to demonstrative experiments results in loss of time, delay in understanding and lack of clarity in the students' thinking. High school is the appropriate level when hands on experiments can have strong impact on basic understanding by the students. For example chemical reactions or chromatography basics, when seen in action give a lot of confidence to the students on the validity of their class room learning.

Experiments can be of two types. Ones that are conducted in science laboratories of school/institutions and the other, what can be done in day-to-day life which students see from very young age, sometimes without realising. The second type of experiments are a part of their daily life experiences and are spread from house-hold kitchen, to running of a vehicle on a road and playground. Students have varying images of these experiments depending on their understanding of principles of science. This exposure can result in students developing instinctive and sometimes ambiguous understanding which can be right or wrong. However, the second type of experiments, performed formally under controlled environment in laboratories can be more informative. Such experiments can be designed in such a way that students learn the basic concepts in action in appropriate ways.

One such example of learning concepts is related to energy and force. When students read about of conversion of chemical energy (battery) into a mechanical force (seen in running motor or related device), they have no real feel for the conversion of the energy into motion. Experiments/demonstrations related to these concepts, and their quantification can help students correct their comprehension of the scientific principles involved.

In our interactions with teachers and students of science it is observed that the understanding of science by students remains superficial until an experiment/demonstration of the same is carried out and followed up with hands-on experience. One example of the potential pitfalls of teaching without experiments is the experiment of lighting a candle in a dish filled with water and placing an inverted glass/cylinder over it. In a short time, the candle extinguishes and water rises in the cylinder/glass. The explanations given in the theory cannot be fully grasped with the experiment just concluded. In reality, this experiment opens a large number of questions in the mind of the child carrying out this experiment, many of which are difficult to respond with justification. If this experiment is only formally discussed on the blackboard the students would accept the statements of the teacher uncritically. However, in the live demonstration students are more likely to come up with questions regarding heat and hot gases, water soluble gases, duration for which the flame burnt etc.

At International Junior Science Olympiad (JSO) competition the role of experimentation has been understood well and hence has become an essential part of the competition with 40 percent weightage being assigned to the experimental component. During our training of JSO students, a large fraction of time is devoted to experimental training. Some new experiments have been designed which train the students to think before actually carrying out the experiments, and learn much more from the experiments, in both terms of concepts and skills.

In the International Junior Science Olympiad several experiments have been designed keeping in mind the teaching component for the students and teachers.

In JSO it has also been our effort not to restrict definitions of science in three different compartments, namely Physics, Chemistry and Biology. At the level of School and High School, the subject should remain as science and it should be taught in a more holistic manner. Even though the reader maybe able to distinguish an experiment as belonging to Physics, Chemistry or Biology, they are not labelled that way.

To achieve this, we are starting a series where experiments appropriate for young learners that can be used for students of class VIII to X will be published at regular intervals for the benefit of school teachers. These experiments will be taken from the archives of the Indian and International Junior Science Olympiads. The series will begin with experiments from 2009 training camp.

The articles may contain any of the following aspects of the experiments. The idea behind planning that experiment, the write-up including the step-wise procedure, the theoretical questions based on that experiments and an analysis of the results obtained by the student(s) of the Olympiad. We will also try to highlight the common conceptual errors committed by students while performing those experiments and indicate to teachers the steps where students are likely to commit errors.

In the write ups that follow, at appropriate stages, short comments will be included in square brackets for the benefit of the teachers and are they are not meant for the students. Teachers who want to use these write ups for their laboratory sessions must remove those comments appearing within square brackets. It is an attempt to take these experiments to teachers, to encourage teachers and students to indulge in thinking across subjects and syllabi. The experience of the teachers from these experiments may be shared on a “need to know” basis with the students by their respective teachers.

We will also encourage teachers to make changes in the procedures depending on their environment and significant changes can be shared with the teaching community for the benefit of all.

We hope that this activity will encourage teachers innovate their teaching methods and help students understand the concepts of science. We will eagerly look forward to feedback from teachers to this initiative of ours so that we may all benefit from the initiatives taken for the Junior science Olympiad.