LEARNING SCIENCE BY USE OF INNOVATIVE HANDS-ON ACTIVITIES

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Science is learning by doing. Learning by doing is a concept within economic theory by which productivity is achieved through practice, self perfection and minor innovations. Science is not just something taught in the classroom; our ordinary moments are full of science. Aim is to develop interest so that students know what, how, when and why of things happening around us. Hands-on science activities are essential components of any early childhood setting, and they lay the foundation for lifelong learning, enhancing ability to think critically and healthy development. Students learn and understand best from what they see, touch, feel and manipulate. No classroom teaching is complete without a live demonstration. It is a challenge, a teacher must face. We can also involve some students they really enjoy learning by doing. Besides routine experiments which are knowledge oriented we can have some simple low cost demonstrations which are motivation oriented. These low cost experiments do not require any routine instructions and can be performed by anyone and with easily available materials. I have designed many hands-on activities using low cost materials, their apparatus and manual covering topics like Mechanics, Properties of Matter, Optics, Sound, Electricity, Magnetism, Heat, Electronics and Chemistry. In my paper I will be demonstrating and explaining some of these activities. Statistical analysis was done covering a topic with simple learning and then with the use of low cost teaching materials. It was found that students retained and gave better result when topic was covered using hands-on activity. Most of the experiments have open ended questions which arouses curiosity in the minds of students. They would try to perform these experiments on their own in order to find the answers. These experiments require materials which are easily available and cost-effective. By studying these simple experiments, they will get an idea of how to develop some more new experiments.

Key word: *Innovations, productivity, enhancing, inspire, demonstration, curiosity, motivation.*

Introduction

Teaching science is a big challenge today. Experiments done in laboratory are mechanical and they appear trivial. We have to improve science education. Hands-on activities and demonstrations play a very important role. They are most valuable tools in the hands of competent and innovative teachers to inspire and excite the fertile mind of a student. Besides routine experiments, we can have some simple low cost classroom demonstrations to explain various concepts in science as when they will work with their own hands, they will gain confidence and develop an insight into fundamentals. By devising such interesting and challenging hands-on activities, we can bring the best students in science.

Why should we use innovative laboratory practices for teaching science?

Hands-on Low Cost Experiments vs. Traditional or Routine Experiments

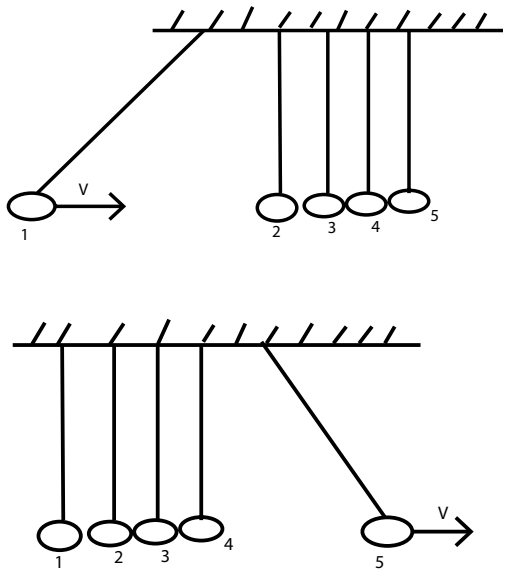
Experiments are an integral part of science teaching; they are broadly classified as traditional or routine experiments and hands-on low cost experiments. Traditional experiments are performed with a set of instructions under the guidance of a teacher with specially designed apparatus, that are part of the curriculum. Traditional

experiments are cognition oriented, i.e., supporting knowledge. On the other hand, low-cost hands-on experiments are motivation oriented. They do not require any special apparatus; materials required are low cost, easily available, no specific instructions are required and can be performed easily. Negative criticism is that it affects the seriousness of the subject but if some play or fun loving activity helps in gaining knowledge then it is surely useful. Thus, in my opinion, hands-on activities are essential components for learning science. My work is on designing low cost hands-on experiments for teaching science mainly for Classes XI and XII students as these days they are under a lot of stress. These will ignite their mind, relieve stress, develop interest and clear their concepts. Students will enjoy science, study with aim and curiosity and design their own activities.

Methods and Procedure

1. Designing low cost experiments by attending several workshops and seminars.
2. Designing low cost experiments of activities mentioned in NCERT textbooks.
3. Collecting ideas from students in live demonstrations in science club.
4. Transformation of some simple numerical problems into experiments.
5. Designing apparatus of science activities shared by interacting with other teachers.

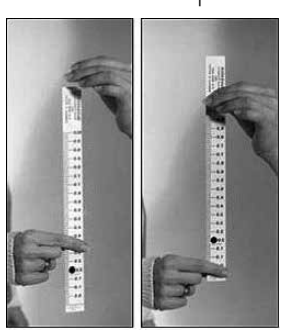
Hands-on Activities: The researcher has designed many hands-on activities using low cost materials, their apparatus and manual covering topics like Mechanics, Properties of Matter, Optics, Sound, Electricity, Magnetism, Heat, Electronics and Chemistry. In this paper



he has demonstrated and explained the details of some hands-on activities.

Activity 1: To demonstrate law of conservation of momentum

Take two plastic scales of equal sizes and



place them diametrically opposite parallel and place marbles of equal sizes between the two scales, with no gap. Now when you hit one marble, one will move, if we hit two marbles two will move and so on.

Activity 2: To measure reaction time

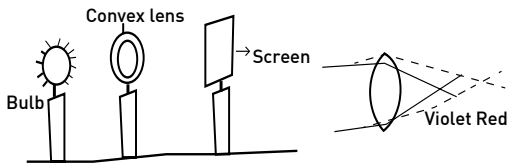
When a situation demands our immediate action, it takes some time before we really respond. Reaction time is the time a person takes to observe, think and act. For example, if a person is driving and suddenly a boy appears on the road, then the time elapsed before he applies brakes is called reaction time. It depends on the situation and on the individual. Take a ruler and ask your friend to drop it vertically through the gap between your thumb and forefinger. After you catch it, find the distance travelled by the ruler (h). Reaction Time t = (2h/g) 1/2

Activity 3: Collision ball experiment

Take a basket ball and a tennis ball and hold them in your hands— one over the other, with the heavier ball below the lighter one. Drop them together taking care that they remain together while falling and observe. When the balls hit the ground, the lighter ball on top will shoot off very high. The heavier ball on the bottom falls dead when it hits the ground. The bottom heavier ball has transferred its energy to smaller ball and will have small bounce.

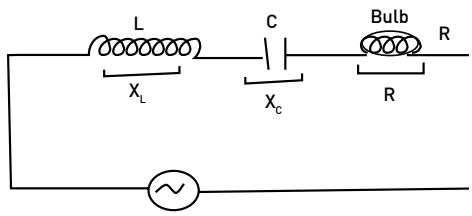
Activity 4: Watch Chromatic Aberration

Theory: White light is made up of seven colours; these colours have different values of refractive index. If light falls on a lens violet will focus nearest and red the farthest.



Take a convex lens with large aperture leaving few millimetres at periphery blocked by pasting an opaque sheet on it. Take a torch bulb and connect it to a battery and keep the bulb and screen proper so that the image is formed on the screen. Move the screen a little. If the screen is moved towards the lens you will see an image like a ring with inner rim violet and outer rim red. If we move the screen away from the lens the inner rim is red and the outer rim is violet.

Activity 5: To study resonance phenomenon in LCR circuit

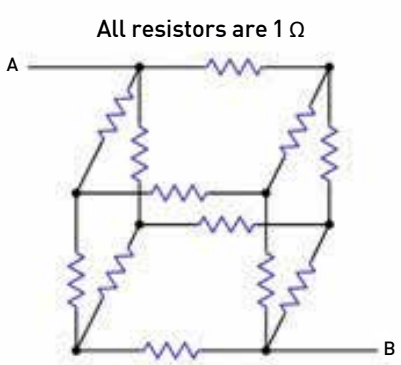


Theory: When XL = XC then impedance, Z is minimum current and glow will be maximum.

Set up an LCR circuit as shown using an AC transformer. Calculate values of XL and XC. Experiment with different values of L and

C so that XL becomes equal to XC. Take different values of capacitors and see that for which value of C, glow is maximum. We can decrease XC by increasing C or increase L by inserting spokes.

Activity 6: To verify Kirchhoff's law using network of resistances using a cube



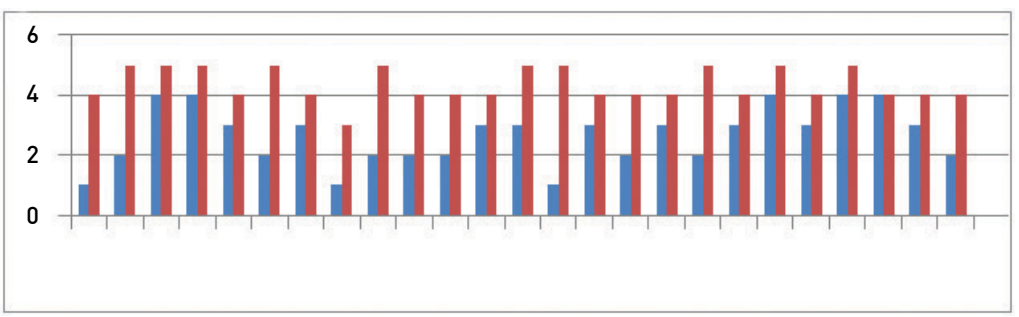
Take twelve wires of equal resistance R and join them to form a skeleton cube and connect multimetre across the diagonally opposite ends of the cube and measure resistance. Verify that value is (5/6) R, same as theoretical value. Verify by connecting across the edge of cube (7/12) R.

Results and Discussion

Statistical analysis was done on understanding and evaluation of a topic covered with simple learning and the same topic covered with the use of activities. It was observed that students retain topic shown with experiments much better and secure more marks than with rote learning. Red bar graph shows with activity and blue without activity on a 5-point scale.

Conclusion

Students can add further suggestions in these experiments. Hands-on activities help to ignite the minds of the students, develop interest in science among the students and invoke scientific ideas in them to bring the best students in science. These students with scientific minds will help in the growth of technology which will help in the advancement of the nation. These innovative methods of using hands-on activities make the learning and understanding of science simple and easy.



Students' performance on some topic taught with activity (Red bar) and without activity (Blue bar)

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