Science Utsav 2014

Proceedings of One day Teachers' Conference

On

Demonstration of Science Experiments in High Schools

Saturday, 1 st February 2014
At
Gujarat Bhavan, Vashi

Organised by

Navi Mumbai Science Foundation, Vashi

In Association with

Shree Gujarati Samaj, Vashi

Navi Mumbai Science Foundation (NMSF) : A Concept Portal for Innovations in Education

Philosophy:

'*Freedom to innovate'* is a basic component to healthy growth of every individual and if guided properly will lead to a technologically advanced yet socially balanced Nation

Focus:

Enable students in the receptive age group of 10 – 15 years to innovate in a collaborative spirit

Vision:

Kindle and nurture Student's scientific temperament.
Support their ability to convert information into knowledge.
Enhance their Soft Skills including communication skills.
Enable their Creativity.
Nurture a sustained growth of scientific and collaborative outlook.
Build problem solving attitude in child's personality.

Approach:

Build problem solving attitude in child's psyche.
Develop a network of proactive research professionals and personalities who would further the '*pupil-centric' approach* in education.
Expose students to a rich variety of subjects, highlight the linkages in various disciplines and emphasize their relevance to real life. \
Mediate periodic interactions between leading educationist and teachers.

Activities:

Science Club: Multiplexes Formal and Informal Education Modes.
Guidance sessions for "Homi Bhabha Young Scientist Award Examination" : Focuses on "*Pupil-centric" enrichment to Formal Mode.*
National Children's Science Congress (NCSC): Provides an "Informal Intervention" into Formal Mode of Science Instruction.
Fun with Science: Promotes Process Motivation on sustained basis.
Exhibition of experiments: A **"**Learning through Doing" endeavor.
Teachers' Conference: A platform for teachers to share and disseminate the best teaching practices.

(About 3000 students are now being reached through these activities each year)
***Hands-on Science in Schools* About NMSF**

For further information, plese contact

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One Day Teachers' Conference
on
Demonstration of Science Experiments in High schools

Program

09.00 –09.30	Registration
09.30 –09.45	Assembly
09.45—10.55	Inauguration & Plenary Session
	Welcome address by Dr A M Bhagwat
	Plenary Talk by Dr Chitra Natarajan
	Vote of Thanks by Dr. A.K. rajarajan
10.55 .. 11.15	Tea
11.15 .. 13.30	Presentation by Teachers (8 min each)
	Chairperson: Dr Chitra Natarajan
	Concluding remarks by chairperson
13.30 .. 14.15	Lunch
14.15 .. 15.45	Invited Talks & Panel Discussion
	Introduction by Chairperson & moderator: Dr Chitra Natarajan
	Presentation by panel members (10 min each)
	Q-A session and teachers' observations
	Concluding Remarks by chairperson
15.45 .. 16.15	Feedback & Conclusion of the event

Content

Role of Experiments in Learning Science

Chitra Natarajan
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1. Experiments and science learning

Doing experiments can serve a large number of purposes in science learning. Each strategy of doing experiments serves one or more of these purposes. Several of these purposes were highlights of different periods in the past.

In the 60s and 70s, a powerful new idea was introduced into the science curriculum: the idea of learning science by doing science. Science was not seen just as a collection of facts. Science was seen as a way of thinking, and a way of finding out about the world around us. This was the nature of science. For students to understand the nature of science, they had to experience it by exploring, investigating, discovering and problem solving. But this "students as scientists" view was too naive and did not reflect the complex relationship between science and science learning. hence it did not succeed in improving science learning.

Following this failure educators recognised two main purposes for practical work. One is to help students understand concepts and phenomena in science. The other purpose is even more important. It is to develop students' skills of scientific enquiry. These skills include observing, classifying, identifying patterns, conducting controlled experiments, measuring, tabulating, and graphing. They also include learning the vocabulary to talk about scientific enquiry. Among several skills, practical work or experiments serve as perfect contexts for teaching the skills of measurement.

Many educationists argued that these skills will be picked up by students as they learn science, and they cannot be taught in isolation of the content of science. Besides students have a number of experiences, beliefs, ideas and expectations about the world around them. These are also different among different students. Hence different students interpret the same practical activity in the light of their own different experiences and prior knowledge. Students also do not have the correct vocabulary to interpret their observations and results correctly or as interpreted or expected by the teacher.

2. Teacher's dilemmas about experiments

Teachers know these problems well. So for instance, teachers expose the students to biological specimens under a microscope, they show them textbook diagrams and teach the essential aspects so that students do not end up missing the essential features and noting irrelevant ones. But teachers often go to the extreme. They guide the course of the practical activity. If the activity does not yield the results they are supposed to, then the results will be simply discarded or just explained away. So, even the explanations are either given by the teacher, or students are asked to get them from their textbooks. Thus the textbook or the teacher stand as the final authority on the facts of science.

How does a teacher avoid the two extremes? One is prescribing the activities and pushing students into rote learning to come up with correct results. Another is being dishonest by making the students think that are being like scientists, and that students' practicals is a scientific enquiry just like scientists' who understand all the theoretical basis of their experiments and observations.

These dilemmas are avoided by resorting to the constrictivist method, by getting students to making their ideas explicit, by involving students in dialogies of all kinds — making predictions, in argumentation, explanations and justifications — as they observe and help decide the steps in the practical, demonstration or experiment.

3. Experiments in Indian schools

The view that is presented by science textbooks also has many difficulties associated with it, some inherent to experimentation in science, and others arising from cognitive limitations of students and the pedagogical needs. Textbooks themselves are guilty of masking the connection between experiments and questions by calling for very high levels of inference, often leading to unreachable conclusions.

In the context of Indian schools, the idea of experiments as activities performed by people in authority, perhaps only reflects the actual state of affairs. Similarly, the over-generalisation of the word "experiment" is to some extent also present in textbooks. The models of experimentation held by students and those presented in textbooks are found to differ from scientists' and philosophers' models of experimentation. Each of these however, has aspects that can help us to formulate desirable models of experimentation for science learning.

4. Experiments and students

Studies have shown that the idea of experiments has been used in a variety of contexts. On the other hand, in the case of specific experiments related to science, students sometimes feel that only scientists or teachers could do experiments. It is important to note students do not connect an experiment to a question or hypothesis.

Given an experiment and a set of questions, students often have difficulty relating one to the other. Students freely draw unwarranted conclusions from experiments. Sometimes, they have difficulty in distinguishing their own beliefs about the phenomenon, from the evidence presented by the experiment.

5. Linking experiments with questions

Students do not link an experiment with the question to be answered by it. This may be related to the way in which questions are posed in relation to experiments. Consider the example of a teacher demonstrating a burning candle, which is covered with a glass and seen to be extinguished. The teacher then asks, "What does this experiment show?" Students' responses can range from the simple, "the candle stops burning," to the factually correct statement, "oxygen is necessary for combustion." In fact, the latter statement is appreciated by most teachers. They do not realise that the experiment demonstrated and the observations made do not lead to the stated conclusion. Even textbooks make the same mistake.

Students, and teachers as well, are so preoccupied with arriving at right answers that they fail to see whether the question is even relevant to the experiment.

Another common example shows that students do not relate a question with an experiment. Imagine the following experiment. Take two similar plants. Keep one in sunlight, and the other in the dark. Water the two plants regularly with the same amount of water. Observe after a few days. Does the experiment answer the question, "Do plants die if not given water?" And more than two thirds of the students state that it does answer this question. If the students knew the answer to the question the more likely they were to answer that the question was answered by the experiment. In short, if they knew the answer to a certain question related to the experiment, then the question must be answered by the experiment.

These mistakes can only be corrected if the observations of experiments are preceded by predictions, accompanied by discussions, and critical debates. Such discussions may even give students a glimpse of the nature of science.

6. Designing pedagogy for experiments

What we perceive the world to be depends in part on our expectations, which in turn are derived from our experiences and prior knowledge. Besides, even to talk about our observations we need some concepts and terminology, which must be supported by some theory. As we can realise that theories were wrong, we will also have to accept that the observations described using them were also incorrect descriptions.

There are differences between the purpose of experiments in science and the role of experiments in science learning. The process of experiments are not detailed by scientists while reporting on their findings. However, in a science classroom, the processes involved in the practical work a well as the discussions, arguments, persuasions, explanations, justifications, etc. that help in meaning making are just as important as the results.

7. Conclusion

In conclusion, classroom discussions and debates based on and around the demonstration, practical or experiment – both among students, and between students and the teacher — are the most crucial aspects of learning science. The talk will propose some strategies that can make experiments an effective teaching-learning pedagogy in science classrooms. It will also show how experiments can be conducted to enact some aspects of the nature of science.

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Introduction of ICT in Education
(Use of ICT in teaching-learning)

S.K.Mukherjee
Atomic Energy Junior College, Mumbai

Since ancient times India has always been in the seat of quality education that has inspired civilizations across the world. The best example is world's first university is The Nalanda University. Today we are faced with turbulence in our education system through multi pronged interventions in the guise of educational reforms. The vast diversity in the educational process across various states, boards and segments of our country poses several challenges to those keen on implementing these reforms.

All these challenges can be overcome by implementing ICT in school education and helping the educational institutes in

- ☐ Inexpensive science kits for demonstration
- ☐ New experiments for inclusion in the class
- ☐ Practical classroom management techniques
- ☐ Measurement tools as a part of classroom accessories
- ☐ Day to day objects as tools of demonstrating science

What is ICT?

The term, Information and Communication Technologies (ICT), refers to forms of technology that are used to transmit, store, create, display, share or exchange information by electronic means. This broad definition of ICT includes technologies such as radio, television, video, DVD, mobile phones and computers as well as the equipment and services associated with these technologies such as networking of computers, video conferencing, satellite systems, etc. and most important is course content in digital format with proper script and presentation.

Objectives:

The major objective of the Mission on ICT in Education would be of leveraging the knowledge resources in the country through appropriate ICT mechanisms. ICTs can be successfully employed to reach out to a greater number of students and help in promoting learning and knowledge, along with exposing students to the technical skills required for many occupations. Additionally ICTs also serve as useful tools for training teachers and in aiding them to teach course curriculums to students.

The aim would be to promote education, training and life long learning to build the human capital of the country through various educational technological interventions. The specific objectives in relation to the "Integrated Approach" are detailed below:

- Uniform level of teaching across the country, as best faculty can conduct virtual classrooms across India.
- To design and create multimedia materials, films, graphics, animations and other programs (for broadcasting as well as non-broadcasting use) which will be useful in strengthening the transition of curricular and co-curricular activities at the school level for students and teachers.
- Visual effects help the students to understand the topics and can be taught more interactively.
- It will save lot of energy & time since learning can be self paced. (Students and teachers can repeat the whole teaching learning process any number of times).
- All assessment & assignments are offered on an online platform with tutor interface given to schools to monitor the progress of its students. Using ICT will also help the parents to know about their wards performance, his/her strengths and his weaknesses. This would make the students more efficient and would help them to enhance their performance.
- The entire learning process is customized as per requirement & rigor is built in to students learning.
- Based on ICT platform, admission and other administrative jobs related to schools can be dealt with an ease.

Major Key challenges for implementing ICT in current EDUCATION SYSTEM.

- A need for a suitable and adequate content related to the curriculum.
- ICT in education are relatively ineffective unless the content relevant to the prescribed portion.
- An optimum infrastructure is needed at schools to start with ICTs like projectors, computers, TV etc.
- Chanelising the educational content.
- Inadequate support of the school administration along with the teachers.
- A difference in the opinion between traditional teaching and ICT based teaching among the teachers.
- To provide Internet access for all the students in a regular school hours.
- It is difficult to provide internet connection in rural areas.

- It is difficult to monitor the internet activity of every student.

Key challenges faced in SCHOOLS using ICT.

- Integrating ICT without disturbing the "**existing**" system of teaching in the schools.(few periods per week for each class assigned for ICT due to limited infrastructure in the school)
- Making ICTs inclusive in traditional classroom teaching, this makes it necessary to have proper hardware and software in each class.
- To ensure that teachers maintain control over the class and do not become "**slave**" of ICT.
- To ensure that the use of ICT add value to the teaching and transfer of knowledge.
- To ensure that ICT is not used for trivialities and in no case leads to confusion.
- Phenomena that could be shown live should never be simulated / animated only because of the ICT to be introduced.
- Teachers may only rely on the things shown on the screen instead of explaining the topic in his/her own methodology.

Advantages using ICT in SCHOOL EDUCATION.

- Watching visual expressions on a subject immediately brings the subject to life and thus enables a child to develop a better understanding of it.
- A computer package that permits simulation generates curiosity and a knowledge focus in students thereby making lesson more interesting.
- Students find easy and simple approach for the solution.
- It develops the imagination ability, increases the thinking capacity and improves the logical ability into the child.
- A multi-media package can transport a child to places that otherwise would have been impossible or expensive to visit.
- It forces to develop multi dimensional functioning ability.
- Appropriate use of the internet provides access to a large database of information, imparts research skills, and opens a window to the world.
- Students more participative in the classroom and it reflects in attendance.
- Better student performance in terms of grades / marks.
- Teachers are more enthusiastic.
- Once advantage known to students, they themselves can use ICT.
- Student find interesting as compare to traditional class room teaching.

I ndia must be a leader (as it is IT sector) in educational field to impart solutions in teaching-learning by utilizing the ICT innovations and managing the resource centre of quality educational, integration of technology and pedagogy.

My experience in teaching field says the traditional way of teaching cannot be avoided at the same time we cannot ignore the advantages of ICT in the classroom. After understanding the above factors, now responsibility lies on us in what way the ICT can be incorporated in our teaching without disturbing the traditional methods that would help transfer of knowledge into wisdom.

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Electricals Made Easy

Meena Sharma
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High school students are very creative and imaginative, however, when it comes to understanding the scientific principles, they are left with in their own imaginative world. The reason being that not all principles can be demonstrated in the classroom nor can be explained with the help of simple tools.

Teachers, specially involved in high school teaching often face difficulties in communicating these very principles in absence of aids for demonstration. It is here that the role of a teacher as a science communicator comes to fore. With the help of materials otherwise strewn around or most simple of the gadgets available, he or she can make the things easier for one and all. This, in turn, creates excitement among the student community, as they start visualizing the scientific phenomenon taking place in front of their eyes.

This kind of approach, wherein they can 'see' for themselves things happening as if coming straight out of their textbooks, also helps in bringing students closer to their surroundings and fills up the gap between virtual and real worlds.

Experiments, particularly related to electricity, whether static or otherwise, are not so easy to perform with limited resources including time. In my demonstration, I would be showcasing some of these scientific concepts, which includes; simple AC and DC sources, resistance: its uses and different ways of connection, electromagnetism and the likes, for the benefit of the teacher participants of Science Utsav 2014, so that once they are back to their classrooms are able to replicate with great ease.

Ultimately, our objective is to turn the Science from 'WOW' to 'HOW' for the students

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Science is a systematic study of the facts and discovery of the reason of a happening'.

Mrs.Meenal Deshmukh
Greenfingers Global School. Kharghar

The demonstration method is pivotal in the field of science. Experts consider it to be a superior method of teaching science in comparison to the other available methods. Demonstration of science combines the instructional strategy of 'information imparting' and 'showing how'.

Demonstration of science experiments is based on the principle: 'Truth is that which works'. Before actually starting the demonstration, a clear statement about the purpose of demonstration should be made to the students. It is a psychological method and students take active interest in the learning process.

The demonstration experiment is presented by the teacher in a model way. All work should be in a tidy, clean and orderly manner while demonstrating an experiment. A good experiment, when carefully demonstrated, is likely to leave an everlasting impression on the young mind of the pupil and it would set his pupils talking in school and out of it, about the interesting experiment that had been demonstrated to them in the class. When the teacher performs an experiment before the class, he also asks relevant questions from the class and students are compelled to observe carefully because they have to describe each and every step of the experiment accurately. This is a less time-consuming process. Students learn by seeing. The sight and hearing sense of the students is more active when they see an experiment. Experiments help to develop the power of observation, reasoning and analytical thinking. The students get a clear picture of the topic and the acquired knowledge is thus permanent.

Researches have proved beyond any doubts that the pupils' time in laboratories does contribute positively to their enjoyment of the subject .Science experiments are appropriate for small classes also. It is a well-known fact that an object handled impresses itself more firmly on the mind than an object merely seen from a distance or through illustrations. Centuries of purely deductive work did not produce the same utilitarian results as a few decades of experimental work has.

Some of the important points to be kept in mind while demonstrating an experiment in the lab or class are: Experiments should be simple and fast. The aim of the demonstration should be stated before the students clearly. The teacher must assure the success of the experiment to be demonstrated and for this he should rehearse the experiment under the conditions prevailing in the class room. The experiments must work and their results should be clear and striking.

Experiments should be properly spaced throughout the lesson. Make a list of activities that will be used by the students to solve problems.

During science experiments, students come across innumerable things that arouse their curiosity and they have a large number of questions to ask and the teacher should try to answer them in a simple, precise and understandable manner. It has rightly been said that, “when we double the known, we quadruple the unknown”. It provides the students training in the methods and skills of discovering new knowledge. It develops in students the power of logical thinking. Among others, this method was also recommended by Swami Vivekanand who was not in favour of bookish and purely theoretical learning and emphasized the importance of including practical inputs in imparting a holistic education to the young minds.

In Gandhiji’s new scheme of education, he also wanted to start a new method of teaching in which students and teacher might come in contact with each other and instead of being passive listener the student might be an active investigator,observer and experimenter.In this method such experiments which are difficult for students can be included and it is time saving also.This is considered as one of the best methods of teaching science to secondary classes.Science teachers should encourage more direct experimentation by children in order to help children broaden their range of fact finding skills beyond three ‘T’s- teacher,textbook,television.

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Demonstration of Science Experiments in High Schools

Sushma Tyagi

Greenfingers Global School. kharghar, Navi Mumbai.

The evolution of human beings is a proven fact of learning of Stone Age Homo-sapiens, through keen observations and continuously monitoring the changes caused and encountered by them. Now the 21st century is considered to be acentury full of information and technology as far as communication and social networking is concerned, with the advancement in the field of communication the sharing of information is the need of hour and to enhance the overall exposure ofour next generation to the core.

If you have an apple and I have an apple and we exchange these apples then we both will still have only one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas.

The knowledge of science is directly linked with the life style of a person and the development of a nation. To import this knowledge to masses in an easy, entertaining way is a big challenge. How the knowledge of science can be effectively transacted in the class room or otherwise, is very important.

Students learn better when they experience science for themselves, not as abstract material for 'rote learning' but as real experiments to be designed, executed and evaluated. The old adage 'Tell me and I shall forget, show me and I shall remember, involve me and I shall understand' holds true

The Council for Science and Technology has recently written to the education secretary to warn about the loss of laboratory experiments in school science. The council, which provides strategic advice to the prime minister, says that cramming for exams is restricting the opportunities for practical learning. This focus on grades is "pushing inspiring practical work into the margins".

Science does not come from books but from experiments and from our natural environment. Therefore, it is necessary to follow the practical oriented teaching of science, at least at secondary and senior secondary levels so as to make the subject interesting. But sometimes, due to lackof some traditional equipment/apparatus, it becomes very difficult to do so. In such a situation they need to prepare low cost improvised equipment/apparatus by using the materials easily available in the immediate environment. Every activity which we perform in our day today life is related to science.

In the recent years, several efforts have been made in India as well as in other countries to improve the teaching learning process of science through experimentation and practical work.

On the same lines, the National curriculum framework for school education has emphasizes more on practical work and activity oriented teaching of science. This step, based on learning by doing, is, expected to be a step forward for the improvement of science education in this country.

Reform is therefore welcome, however not without risk. The Department for Education hopes that reforms, including the removal of the modular structure of exams 'will give teachers space and freedom to conduct more experiments and practical's.' Whilst there are many schools that would continue to engage in good quality practical work independently of any external requirement, it is a worry that this might not be the case in all schools and that absence of assessment, coupled with lack of resource or teacher expertise, could lead to less practical work. It risks pushing science lessons into classrooms and out of laboratories.

We must start practical work at the earliest opportunity, in the schools; it is wonderful to see a sixth grade pupil's jaw drop when looking at water fleas under a microscope, seeing unexpected colour changes in a test tube and experiencing the effect of static electricity, Visits to local organizations like NAPP pharmaceuticals, Nehru Centre and the other Institutes to experience science in the workplace.

The human brain is 2% of the body weight but uses 20%of its energy.

It is crucial to broaden students' horizons beyond examination specifications, inspiring them certainly, but also enabling them to develop the confidence to work independently and inventively, using their intuition and practical knowledge to take intellectual risks. A sound appreciation of scientific method gained by hands-on experimentation in regular class practicals is the backbones of successful future of science in the country and to accomplish this task teachers play a very important role.

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Measurement Tools as a Part of Classroom Accessories

Shobha Srivastava
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T**eachers**
"Paint their minds
and guide their thoughts
Share their achievements
and advise their faults"

Poem by Kevin William Huff

The above lines from the poem " **Teachers**" written by Kevin William Huff envisage, a teacher as a facilitator, a mentor, a counselor provides great instructional skills, ample learning opportunities to the students, and make learning more interesting and interactive through innovative measurement tools. A teacher, as the driver of the car who needs to respond to the passengers'(students) needs, in order to ensure that the students reach their destination. Thus the one and only one measurement tool that is convenient & can be used effectively and is available all the time…..?

Yes, **the teacher** her or himself!

Substantial focus, preventative maintenance, set of skills through guidance; observation, reading, and trial and error all become a significant learning experience and are the key role of a teacher as a facilitator or as an instructor. Thus, I think a teacher who transmit's s information to students through a prescribed, but well-organized series of lessons that cover each curriculum expectation consider classroom accessories to be a **high priority and an area of concern**. Perhaps, a teacher, has a jigsaw box of puzzle pieces, where she/he cannot get all the pieces to fit together, and this makes she/he to understand how important the **measurement tools are as a part of classroom accessories**.

The classroom environment is influenced by the guidelines established for its operation, its users, and its physical elements. Teachers often have little control over issues such as temperature and leaky ceilings, but they greatly influence the operation of their classrooms. Effective teachers expertly manage and organize the classroom and expect their students to contribute in a positive and productive manner. It seems (judicious) prudent to pay careful attention to classroom climate; given that it can have as much an impact on student learning as well as student aptitude.

Measurement tools as a part of classroom accessories focuses on the physical environment. Strategically placed furniture, learning centers, and materials are in order to optimize student learning and reduce distractions. There are a number of classroom accessories available.

A few examples of classroom accessories include **bulletin boards, maps, whiteboards, carts, audio visual equipment and decorative items** etc.

Example

- ·**To motivate group learning** desks are preferred to be put in a circle.
- · To avoid disturbance through inner and outer noise which significantly reflect student's attention, the school should have **acoustic cabinets**.It also helps the students who are daydreaming, doodling, staring out the window or otherwise not focusing on the teacher's assigned tasks.
- **A smart board** (a convex whiteboard) is an innovation which reduces glare and reflection.
- · **Maps and globes** are very important and necessary in geography and history classes, whereas audio equipment is obligatory for music classes. However, each classroom must be the metrically designed and equipped with necessary accessories.
- **Bulletin board** provide an opportunity for educational elements, focus on historical events, geographic locations, mathematical concepts, animals, careers and nutrition or the items currently being covered & an option to provide the teacher to expand upon the lesson in a less structured way. Selecting a theme which is applicable to the current lesson plan will help to incorporate the décor into the learning process.
- A language learning lab is an excellent tool for learning languages & provides an opportunity for unlimited interaction between student and teacher as well as interaction among the students.
- **Observation tool:** *It provides* a convenient platform for recording observations of technology use in classrooms.

Tools that *can help to make maximum use of new access to sound is* ***Listening stations.*** *A* ***listening station*** *is* a facility established to make local transmissions more widely available. It is highly effective for learning languages and as an assessment tool. **Intercom systems** enables the instructor to hear problems quickly and make corrections immediately. The **virtual recorder** enables the student to record his own voice for use in self evaluations.**Evaluation tools** allow the instructor to evaluate the performance of each student by administering tests and examining the way in which the student responds. **A wireless** listening center offers greater flexibility to schools who utilize audio equipment for the learning process.

Thus, Classroom with suitable & modern measurement tools is essential to bridge the gap of yesterday & tomorrow and to meet the needs of the society to make life smarter, better, faster and wiser. The value measurement tools as a part of class room accessories cannot be underestimated. The way in which a classroom is organized can have a profound effect on the ability of the students to learn. Teachers should be aware of the way in which the structure of the classroom is impacting the learning process and should be willing to make changes to reduce any evident learning obstacles created by the organizational structure of the classroom.

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Demonstration of "Wightlessness" in High Schools

Shobha Ravindran

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Hands-on learning experiences are vital to gaining interest in science, showing students that what they learn on paper operates not only in books but in everyday life. What can be done to encourage interest? How can science be used to improve our world today?

It's like with inertia: student asked to put books on a chair, and teacher would roll the chair really fast; and then stop it, and all the books would keep on going. We did a lot of experiments with that, and that was, like, really fun for them.

Student's Discussion

Inertia is the quality in matter (matter is anything you can touch) that lets it stay still if it is still, or keeps it moving if it is moving. If you want to overcome inertia, you have to apply a force. A force will make something that is still start to move, like flicking a wad of paper with a pencil will make it move. Also force, due to resistance, will slow or stop something that is already moving. The wad of paper will be slowed by resistance made by rubbing up against the air it is passing through.

That's the most important thing we can do as educators is to help them find that joy within themselves for learning endeavours. And that's why we do all of these hands-on types of activities to make that connection between here's something I learned, here is something I can do with it. This is what I can do today. Tomorrow, as I learn new skills and have more information, I can change this, I can rebuild it, I can try something different. And in my future I can take all of what I've learned and use it in whatever career I may decide to have.

By entering into hands on experiences the student realised that science was not only for experienced technicians in lab coats, but to anyone.

Elementary years constitute the most impressionable years of personal life. By experiencing science at a young age one can find themselves passionate about science for a life time .Without interest and participation in science the world could not continue. From roller Coasters to doctors science affects every aspect of life. Science is the future. What can be done to encourage interest and participation in science?

Classroom Activity

Weightlessness Demonstration

This lesson demonstrates that free-fall eliminates the local effects of gravity.

Procedure

1. Punch a small hole in the side of the cup near its bottom.

2. Hold your thumb over the hole as you fill the cup with water. Ask students what will happen if you remove your thumb.

3. Remove your thumb and let the water stream out into the bucket on the floor.

4. Again seal the hole with your thumb and refill the cup. Ask students if the water will stream out of the hole if you drop the cup.

5. Drop the filled cup in to the bucket. The demonstration is more effective when you hold the cup high before dropping it.

The demonstration works best when students are asked to predict what will happen when the cup is dropped. Will the water continue to pour out the holes as the cup falls? Lead students in discussion below-

The falling cup for a moment demonstrates weightlessness. When the cup is stationary, water freely pours out of the cup. If the cup falls, the water remains inside the cup for the entire fall. Even though the water remains inside, it is still attracted to Earth by gravity and ends up in the same place that the water from the first experiment did

Application-

Earth-orbiting spacecraft experience a condition described as weightlessness. The spacecraft is in a state of free-fall as it orbits. If the spacecraft has astronauts on board, the astronauts are able to move about with ease because they too are in a state of free-fall. In other words, everything in their immediate world is falling together. This creates the weightless condition. Crew members and all the other contents of the spacecraft seemingly float through the air.

On Earth, momentary weightlessness can be achieved in a number of ways. Some amusement parks achieve a second or two of weightlessness in certain wild high-tech rides.

Classroom Activity

This activity provides an introduction to air as a fluid. Any substance that flows is considered a fluid. This includes such things as water, shampoo, sunscreen, and even honey. Although not necessarily obvious, even gases, such as air, can be classified as fluids. This activity will allow students to 'pour' a gas and watch the results.

Procedure

1. Discuss the physical properties of a fluid with students. Be sure to include the idea that fluids can be poured. Ask students if they think air is a fluid. Ask how it could be demonstrated.

2. Fold the cardboard lengthwise into a funnel.

3. Place the candle on a plate and light the candle.

4. Put about a tablespoon of baking soda in the glass jar or beaker.

5. Pour about 1/4 cup of vinegar in the jar or beaker. (The vinegar and baking soda will react immediately filling the jar with carbon dioxide gas.)

6. When the fizzing subsides, hold the board "funnel" at an angle so that one end is near the candle flame and the other end is slightly higher.

7. "Pour" the gas in the beaker or jar down the funnel. The flame will go out in a second or two.

(Because of the involvement of fire and matches, you may choose to do this as a demonstration for younger students)

Discuss with the class what happens when the vinegar and baking soda are mixed. (The mixture froths and bubbles, producing carbon dioxide.)

Explain to the class how the flame was extinguished. (There was no more oxygen available for the flame, so it went out. Pure carbon dioxide is denser than air, so it flows like a liquid from the jar or beaker along the funnel. Carbon dioxide is used in fire extinguishers because it is effective at smothering flames.)

Principle

All learning activities should focus on using information-processing skills (from observations to synthesis) and applying the discipline "ground rules" as a means to learn content set in a broad conceptual context.

Inquiry learning puts the learner at the centre of an active learning process, and the systemic elements (the teacher, instructional resources, technology, and so forth) are prepared or aligned to support the learner.

The role of the teacher becomes one of facilitating the learning process. The teacher also becomes a learner by finding out more about the learner and the process of inquiry learning

What is assessed is what is valued. Therefore, more emphasis needs to be placed on assessing the development of information-processing skills, nurtured habits of mind, or "ground rules" of the discipline, and conceptual understandings — rather than just the content of the field.

While questioning and searching for answers are extremely important parts of inquiry, effectively generating knowledge from this questioning and searching is greatly aided by a conceptual context for learning. Just as students should not be focused only on content as the ultimate outcome of learning, neither should they be asking questions and searching for answers. Well-designed inquiry-learning activities and interactions should be set in a conceptual context so as to help students accumulate knowledge as they progress from grade to grade. Inquiry in education should be about a greater understanding of the world in which they live, learn, communicate, and work.

The inquiry approach is more focused on using and learning content as a means to develop information-processing and problem-solving skills. The system is more student centered, with the teacher as a facilitator of learning. There is more emphasis on “how we come to know” and less on “what we know.” Students are more involved in the construction of knowledge through active involvement. The more interested and engaged students are by a subject or project, the easier it will be for them to construct in-depth knowledge of it. Learning becomes almost effortless when something fascinates students and reflects their interests

Day-to-Day Objects as Tools for Demonstrating Science

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Science is not a dry subject devoid of emotion or passion. The more we hear what motivates scientists the more we understand that science can be a deeply felt and human experience enabling as many personal rewards as the arts.

Science teachers have an exciting opportunity to teach kids about how science makes the world work. Unfortunately, reduced teaching budgets and apathy on the part of students sometimes makes it difficult to get students interested in topics like biology, earth science and anatomy.

Below are few examples which ensures interest development, simplifying of the topic to encourage students participation and attention in the class. The experiments performed and explained by students will help them memorize and understand the content fully as said that we learn 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we both see and hear, 70% of what we discuss with others, 80% of what we experience personally and 95% if we teach someone.

Biological Classification

Obtain a collection of cardboard boxes in widely ranging sizes, from extremely large, all the way down to tiny pillboxes. You can label (In black letters) the largest mega box “ANIMAL KINGDOM” Find at least a few somewhat smaller boxes that will all just fit into the kingdom box. Label these with “PHYLUM: ARTHROPODA” and “PHYLUM CHORDATA” or name of two other phyla. Find at least 3 smaller boxes that will fit into one of the PHYLUM boxes label these with “CLASS” like “CLASS: MAMMALIA” for “PHYLUM: CHORDATA”. And so on, building a nested series of boxes, continuing down: CLASS- ORDER- FAMILY- GENUS- SPECIES, with 2-3 boxes for each level. Try adding pictures of different organism of the same level to each box to show the correlation of the organism of the same level. For example, for the classification of dog labrador photographs fishes, toad, snake, peacock can be placed for “KINGDOM ANIMALIA”. For “PHYLUM CHORDATA” photos of lion, tiger, jackal, fox, wolves, racoon, coyote can be placed in the box. For “ORDER CARNIVORA” tiger, spotted hyna; for “FAMILY CANIDAE” (family of carnivores and omnivores dogs, wolves, foxes, jackals, coyotes etc. can be placed. “GENUS *Canis”* domestic dogs, wolves, coyotes can be placed. This will help the students to observe, derive and understand the concept the classification

DOG: LABRADOR
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia

Order: Carnivora
Family: Canidae
Genus: *Canis*
Species: *C. lupus*
Subspecies: *C. l. familiaris*[1]

Study of germination of seeds.

Materials You Will Need for This Activity

Paper towels, Baby food jars, Radish seeds, Water, Light source

What to do

1. Crumple a piece of paper towel, and place it in the bottom of your jar.
2. Add enough water so that the paper towel is wet and there is a shallow layer of water on the bottom.
3. Place 5 radish seeds on the paper towel, keeping them out of the water.
4. Put your jar in the same place as the jars of your classmates.
5. Observe your jar each day for 10 days, and draw a picture of your seeds each day.

What you will learn: Seeds germinate and grow at different rates. The roots grow down regardless of how the seed is originally positioned.

Minimal surfaces and volume

In the following activity, you will see how spheres are formed as vegetable oil takes on the most efficient form and shape possible.

Materials You Will Need for This Activity

A flat-sided bottle, Rubbing alcohol, An eyedropper, Vegetable oil, Water

What to do

1. Fill a flat-sided bottle (a round bottle will distort what you see) 2/3 full with rubbing alcohol.
2. Using eyedropper, place a few drops of vegetable oil on the surface of the alcohol.
3. Slowly add water to the bottle until the drops of oil float between the water and the alcohol.
4. No matter how many drops you add, the oil will always form into spheres.

What you will learn: Nature is essentially parsimonious and likes to save energy. Natural forms will tend to take on the simplest and most efficient shape possible. The shape that can hold the greatest volume within the least area is a sphere. This is why soap bubbles become round. What happens with the oil in this experiment is what happens when a soap bubble is formed. The surface area of the suspended soap bubble or oil causes it to take the shape of a sphere because

this is the most economical way it can function—it saves energy and space. Similarly, whenever a drop of water falls through the sky as a raindrop, it will always tend to form a sphere.
Thinking like a scientist: Why are raindrops not perfectly shaped spheres? What other factors influence their shape? What shape would a drop of water take in outer space?

1. A model to study the effect of carbon dioxide on temperature changes

In the following activity, you will create a model to study the effect of carbon dioxide on temperature changes as a result of trapped gases similar to those that create the greenhouse effect on the Earth's atmosphere.

Materials needed for This Activity

Two 2-liter plastic soda bottles (with their labels removed), Modeling clay, Vinegar, Baking soda, Two thermometers, Measuring spoons, Sunlight.

What to do
1. Label one 2-liter bottle "With Carbon Dioxide" and label the other bottle "Without Carbon Dioxide."
2. Add two teaspoons of baking soda and then two teaspoons of vinegar to the bottle labeled "With Carbon Dioxide." This mixture will produce carbon dioxide gas.
3. Quickly cover the opening of the bottle with modeling clay to stop the carbon dioxide from leaking out.
4. Add two teaspoons of vinegar only to the bottle labeled "Without Carbon Dioxide" and cover the bottle opening with modeling clay.
5. Carefully make a small hole in the modeling clay covering the opening of each bottle and poke the thermometers through the holes.
6. Place both bottles in a sunny place.
7. Make a data table and record the temperature in each bottle every five minutes for a 60-minute period.
8. Make a line graph representing the temperature in each bottle over the 60-minute time period.
What you will learn: The heating effect you observed in this activity is known as the greenhouse effect because carbon dioxide in the Earth's atmosphere acts like the glass in a plant greenhouse. The carbon dioxide allows warm sunlight to enter the bottle but prevents the re-radiated heat from escaping the bottle. The greenhouse effect is a natural phenomenon that is actually very important to life on Earth. Without this effect at work, the average temperature on Earth would be approximately 30°C colder than it currently is. However, the enhanced greenhouse effect, also known as global warming, has the potential to create too much warming, which could result in a destructive global sea level rise, Significant shifts in the planet's climate patterns and other dire consequences for the inhabitants of Earth.

2. Basic physical mechanics of the human arm

In the following activity, you will create a working model of the muscles that move the human arm.

Materials You Will Need for This Activity

Tape, Whole punch, empty toilet paper rolls, five-inch long balloons, pipe cleaner cut in half

What to do

1. The two toilet paper roles represent the upper and lower arm. To connect the two arm parts, make two holes 180 degrees apart, 1/2 inch from the end of each cardboard tube.
2. Thread a piece of the pipe cleaner through the holes on each side of the two tubes to connect them together, and bend the ends to form a joint. The pipe cleaner represents the ligaments that function to hold the muscles in place. The tubes represent the major bones in your arm.
3. Bend your model arm at the “elbow” to form an L shape.
4. Inflate one balloon slightly, and tape one end of the balloon to each arm part on the inside of the arm’s L shape. This simulates the contracted biceps muscle.
5. Inflate the other balloon slightly and tape it to the arm parts on the outside of the L. This simulates the triceps muscle.
6. Move your model arm’s lever up and down. What happens to the balloons?

What you will learn: Every moving bone in the human body has at least two muscles connected to it.These pairs of muscles work together to facilitate movement. When you bend your arm at the elbow, the top muscle (biceps) contracts and shorten. This causes your forearm bones to pull into a bent position. At the same time, the bottom muscle (triceps) stretches because it is relaxed. When you straighten your arm, the opposite occurs—the biceps relaxes and straightens, and the triceps contracts and shortens. The contraction of the triceps pulls down the bones of your forearm and your arm straightens out.

Simple Concepts and Scientific Skills through Activities

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HBCSE has been conducting teacher professional development for teachers, and teacher educators in science and mathematics education. In order to do hands-on science in the teacher education workshops, HBCSE has introduced science through investigation activities for the teacher educators during its faculty development program for various states.

Among other relevant themes, the program has a strong presence of inquiry based approach in developing science activities. Rather than providing with activities, the participants are encouraged to think of some questions that can be investigated with hands-on, with easily available materials and brings in conceptual understanding as well. During this, the teachers, along with mentors device experiments, design research questions, frame hypothesis, conduct observation, collect data, analyse it and try to make a short presentation of their science through investigation activities.

The science through investigation activities are also supplemented with worksheets. The following activities will be presented during the 'Science Utsav': *Simple concepts through balloon activity; Effect of length and weight of pendulum on oscillation; Effect of detergents on cleaning of clothes; Effect of seasons on drying of clothes; Effect of salinity on buoyancy; soil fertility test*. The activities will be conducted in an inquiry based approach.

Simple concepts and scientific skills through an activity using balloons

Teachers, individually, or in groups, are given a balloon each, and asked to enlist their observations before and after inflating it. They are also asked to enlist all possible questions that come to their mind while doing this. Then, through a discussion, we appreciate the skills of fine observation, raising good questions, and constructing good explanations. Some of the observations, questions and explanations have been around the following: elasticity of material, measuring volume/weight, shine/colour, gushing out of air and sound on puncturing, long-term observation of inflated balloon for a few days, static electricity, air pressure, etc. Balloon is perhaps one of the cheapest TLM and a good discussion can yield a lot of innovative ideas and experiments.

Effect of length and weight of pendulum on oscillation

Teachers are asked to make small pendulums using strings of different lengths, thicknesses and stones of different shape, size and weight. After a little exploration of all possible motions, they are asked to guess or form hypothesis as to how the time period could vary with the variables above, with some intuitive reasons for it too. They are also asked to design an experiment in which they could test their guesses, which often brings out the idea of a controlled experiment. The teachers can play with controls, even try out different mediums, find out ways to measure the

effective length or time period, characterize shape, etc. and from the data, see if their guesses are correct. They get to appreciate non-linearity and deviations from ideal pendulum behaviour like effects of pendulum rotation, friction at hinges, air friction, etc. The skills developed could include designing, controlling experiments and searching for sources of error and ways to minimize them.

Effect of detergents on cleaning of clothes

Commercial ads highlighting one detergent's superiority over another are often seen on TV, an instance of science being up close with our family atmosphere. Doing this for oneself in classroom could interest teachers, students and parents, all the three. Teachers are asked to choose clothes of different fabric, stain them with different materials like turmeric, ink, oil, etc. and apply on them different detergents available in market. They find out ways to measure the qualitative cleansing, effort, other resources required, etc. and conclude with a decision on the best or most cost effective detergents. This is also an avenue to clarify the composition of detergents, mechanism of stain removal, etc. The skills of quantitative thinking, tabulating, demonstrating and explaining are developed.

Effect of seasons on drying of clothes

Here is another instance of science, coming up close with family concerns. Even children notice, that clothes take different times to dry in different seasons. Teachers could make hypothesis as to this, but the question comes as to how one waits for a season to come. An innovative suggestion is to 'simulate' the weather conditions. This elicits out creative thinking on the part of teachers, perhaps getting them to simulate summer using a closed box with bulb, winter with a box surrounded by ice, or rainy season by water soaked cotton balls etc. Long-term temperature or humidity measurements could be done through in-situ devised ways. A range of concepts like season-cycles, humidity, etc. could be addressed, as well as skills of design, measurement, long-term observation, rigour, etc.

Effect of salinity on buoyancy

Teachers could be asked for reasoned hypotheses as to whether an egg will float or sink in saline water. A demonstration (somewhat unexpected, hence fun) could be staged by them. They are asked to plan an experiment involving measurement of density, mass, volume, etc. of the solution with sequential, measured increase of salinity. An innovative way to measure density of solution, involves measuring its mass while dipping a pendulum in it, comparing it with mass without the pendulum. There could be other ways to measure salinity, weights, volumes etc. They could arrive at the precise salinity at which the egg begins to float. This is an avenue to make rigorous concepts like Archimedes Principle, buoyancy, density, salinity, etc. An approach to this experiment could involve successive dilution, honing the skills of planning an experiment, apart from others like observation, measurement, demonstration, etc.

Soil fertility test

The teacher educators are curious to analyse their soil. It's very important part of their life because farming in the major concern. Soil analysis is a valuable tool for farming as it determines the inputs required for efficient and economic production. A proper soil test will help ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil. There are very sophisticated methods for soil testing but we had discussed among us and came up with few good ideas like if we have to test soil PH we can test with simple turmeric solution. This is how we arrived with very simple methods that we can pursue from our day to life and tested different parameters of soil like Ph, humidity, water holding capacity etc.

New Experiment for Inclusion in Classroom

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Strong personality of teachers leads to learning, which becomes the catalyst for the learning by spreading knowledge and inspiring students and peers.

A good teaching procedure will lead to effective learning that's why it is very important for a teacher to understand and apply new methods of teaching. In our modern technological world, where the use of computer is vital. Teachers need to learn how to use or apply this new technology so that the teaching learning procedure by audiovisual will be enjoyable.

Example as –

1. Different parts of flower can be seen simultaneously in the classroom as well as on screen videos can be shown from blooming till maturity and formation of fruits.

2. Opening and closing of stomata slides + visuals.

3. Exchange of gasses by lungs, when each organs can be felt by individual student. 3D technology can be used to show process of respiration, in 3 dimensional aspects.

For classroom activities to be effective it must be governed by different strategies. Pupil to pupil interaction must be observed every time, a lesson will be introduced in the class. In doing this pupils will be trained to communicate well with peers.

Example: 1. Dividing class in small groups. Giving them different topics, they are allowed to search extra knowledge from you tube, can make models, charts and have quiz among pupil.

2. Experiments like making soap, using different types of oils.

3. Use of litmus water in different juices indicates acidic and basic nature, especially cold drinks (soft drinks).

A) Effect of acid on our body especially teeth can be shown to them.

B) Change in colour is due to difference in PH value, as well as how you prepare litmus water. (Roccelta Tinctoria which is an algae + fungus).

Variety of instructional materials should be visible in each classroom. (Posters, charts, models) so that learning will be full of fun and interesting. Ideal teaching today encourages the application of new methods of teaching to develop initiative, creativity, confidence, self reliance and independence among the students.

As 1.Newton's law of motion (inertia)

2. Sound waves travel.

3. Linear motion" by string "and wave motion/ transversal motion with small experiments.

4. Light travels in a straight line.

Interschool quiz, chart making, exhibition, workshops should be motivated.

The goal of workshop project is to motivate pupil to higher class to become more interested in science topics and to increase the interest of science subjects among younger pupil. Older students are interested in science, like to experiment and want to spread their knowledge among their junior peers that percolate the knowledge in the long term. This could encourage more students to choose further scientific studies and careers and maintain a healthy student relationship in class.

Experiments for Students

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Students don't need instructions but they need information. While many of us would put theoretical knowledge ahead of experimental knowledge a few will agree that most of the fundamental laws of science find their origin in the term 'experiments first, theory later'. Needless to say that scientists must have taken countless efforts and conducted numerous experiments which demonstrated repetitive results that were further formulated into a 'law'. Hence, although educating students by means of text books is imperative it becomes equally important for a teacher to take the student out from the 'two dimensional world of textbooks' to 'three dimensional world of experiments' to make him/her understand the concepts associated with the topic. Indeed we have a framework of education where students are exposed to performing practicals but that does not sufficiently arouse the curiosity of the student to appreciate the topic that he/she is learning. And since there is a thin line between tolerance and appreciation we need to device experiments which can inspire the student to ask the most basic question in science. And the question is 'Why is it so'?

This can be done by taking the student out of his classroom and introducing him to think about the science that is daily use. Let's take a simple example of preparation of tea. For instance a person can prepare tea in two different ways.

1) He can put the water to boil first and then add the necessary ingredients.
2) Or he can put all the ingredients together and then put the mixture for boiling.

If the time required to prepare the tea is monitored we can observe that in former case the time required is less that later. This helps us to not only conserve energy but also guarantees us economic savings. Now where does science come into picture? Very few students will know that the phenomenon of boiling water is associated with colligative property which states that a 'boiling point of the solvent is increased when a solute is added to it'. Accordingly pure water will boil first than the water which contains all the ingredients.

Furthermore with the help of the same experiment it will be also possible to introduce the concept of vapour pressure to the students which shows that the more the number of molecules of solvent in contact with atmosphere the more is the vapour pressure. Hence if we consider two set of experiments that we have preformed earlier we will come to know that addition of solute will decrease the number of solvent molecules at the surface which eventually will decrease the vapour pressure and hence increase the boiling point.

To reinforce this idea a student can then be allowed to perform further set of experiments where he will be required to find out the boiling point of pure water and salt water. Needless to say the boiling point of pure water will be less than the salt water. At the end of the day since the

student has 'OBSERVED' and performed the experiment it will be much easier for him to understand the concept of 'Colligative properties' and will help him to device some experiments associated with the same topic.

There are still a few more experiments which can be carried out to understand more the concept of colligative properties. For eg.

1) Melting of ice upon addition of salt.

Many people know that addition of salt to ice decreases the temperature of the mixture but very less people know that during the process ice melts faster than the normal rate. This takes us to another interesting colligative property which states that there is depression in freezing point of solvent if solute is added to it. To demonstrate the idea following two sets of experiments can be carried out

In one experiment the time required for complete melting of pure ice can be monitored and can be compared with melting of ice when salt is added to it. Presence of solute molecules will increase the rate at which ice will melt and hence the time required for complete melting of pure ice will be more than ice salt mixture. (The same phenomenon is used by people in European countries to remove the ice during snowfall. Salt is sprayed over the roads in order to facilitate the melting of ice that gets accumulated on the roads during the snowfall). It can be also recalled that the freezing point is also lowered than the normal, which gives us an opportunity to set up another experiment of monitoring the depression in freezing point by addition of solute to solvent molecule. In this experiment one can monitor the difference in freezing point of ice made up of pure water and ice and salt mixture. Naturally because of colligative property the freezing point of pure water is lowered by addition of salt to it.

2)\ Movement of solvent molecules across a semi permeable membrane from lower concentration of solute to higher concentration (Osmosis).

Salting is one of the ancient methods practiced in India for preserving food. In the process of salting salt is added to food in order to prevent it from 'spoiling'. Scientifically the salt concentration is kept very high so that the bacterial development is arrested. This is because due to osmosis water from the bacterial cell moves out of the cell where the concentration of solute i.e, salt is very high and hence the bacterial cell ultimately shrinks and dies. Same phenomenon is used when sugar is added in preparation of jams or jellies.

Thus by carrying out the experiments of science related to day to day life one can sufficiently arouse the curiosity of the student to increase his penchant for studying science.

Inexpensive Science Kits for Demonstration

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Just as an artist uses a paintbrush to reveal an underlying concept, a science educator uses a demonstration as his or her tool to illustrate scientific principles. In both cases, the picture is worth a thousand words. Demonstrations can be effective in sparking student's interest, initiating scientific inquiry, and displaying scientific phenomena in the classroom. A demonstration can help in gaining student's attention, awakening student's interest and curiosity in the lesson being taught. Students are more likely to understand science practically rather than theoretically. Keeping this in mind we would like to share some inexpensive and practical ways to demonstrate few topics as under.

1. IUPAC nomenclature :

Objective : To make students understand the concept of covalent bonding in Organic compounds and help them write names of these compounds according to IUPAC rules.

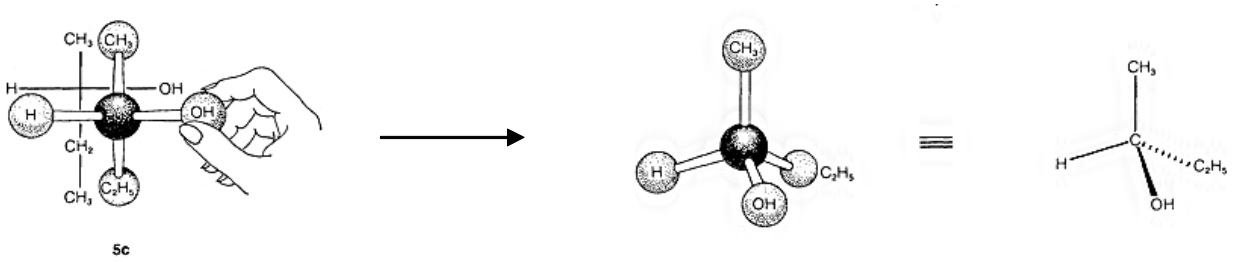
(a) Ball and Stick model:

Material required: Coloured Balls (clay or thermocol) and sticks(tooth picks or refills of ball point pen)

Procedure : 1. Take Coloured thermocol balls or use different colours clay to form balls representing different elements like carbon , oxygen , nitrogen , hydrogen, sulphur , chlorine , bromine etc.

2. Make small holes in clays according to their bonding capacity like in carbon 4 holes , oxygen two holes , nitrogen three holes.

3. Join different elements (coloured balls) with help of sticks to show covalent bond formation like

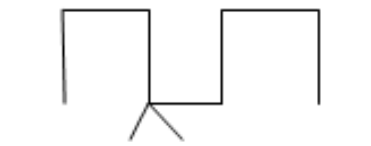


5c

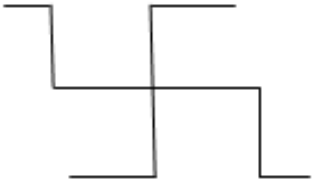
4. Form different types of structures and teach IUPAC names .

(b) Bond Line Notations for Organic compounds :

This can be taught with help of sticks (tooth picks or match sticks etc.) only . Make different types of figures with sticks and help students to write their IUPAC names like



4,4 - dimethyloctane



4, 4-Diethylheptane

Now divide the class into number of groups according to class strength, minimum four students in each group and ask them to form different types of figures with sticks. Then involve entire class to name that figures according to IUPAC names.

2. Surface tension

Objective – To make the students understand the concept of surface tension, stretched film, force of cohesion and adhesion.

Materials required - Paper clip, fork , a container of water, a bottle of dish washing detergent.

Procedure- Fill the container with water. Put the paper clip on the surface of water. This may take several attempts. Once the paper clip is floating on water, add few drops of dish washing detergent, the clip will fall to the bottom of the container. This demonstrates the surface tension of water.

Water molecules have an attraction for each other due to the cohesive force and creates a skin like surface on water. When detergent is added to the container it disrupts the attraction between the molecules of water and the paper clip falls to the bottom.

3. Defying gravity

Objective- To help the students understand the concept of pressure at different conditions.
Materials required- a clear container as a measuring cup or a jar, food colour, piece of clay and a straw.

Procedure- Stick the clay at the bottom of the container and fill it with water. Add few drops of food colour to the water. Slowly put the straw into the water and push it into the clay so that it stands fix. Turn the container over quickly. Even though all the water from the container rushes down , the straw still contains the liquid.

Water stays in the straw because air pressure from outside the straw pushes up on the water when the container is flipped. The air pressure pressing against the straw's liquid from the bottom is greater than the force of gravity pulling the liquid down. The clay is the key in this activity because it blocks the air pressure from entering the top of the straw, which would cancel out the effects of air pressure entering from the bottom.