Science Utsav 2020

Proceedings of

One day Teachers' Conference on

Effective Science Teaching- Learning Strategies for Classrooms

Saturday, 11th January 2020

Gujarat Bhavan, Vashi, Navi Mumbai - 400703

"Books are the means by which we build bridges between cultures".

Organised Jointly by

Navi Mumbai Science Foundation, Vashi

In Association with

Shree Gujarati Samaj, Vashi

&

Maharashtra Academy of Sciences (MC)

An humble tribute to a great educationist

Navi Mumbai Science Foundation (NMSF) considers itself privileged & honoured while acknowledging the support it received from late Dr. Chitra Natarajan during the short interactions while conducting one-day event “Teachers’ Conference” in the years 2013 to 2015. The seeds of “Teachers’ Conference”, which is part of NMSF’s bigger two-day event “Science Utsav”, were sown in the year 2012, mainly under the guidance of Prof. Jayashree Ramadas, the then Dean of HBCSE (TIFR) & peripherally under Dr. Chitra Natarajan’s counsel. Next year onwards, due to limited availability of Prof. Jayashree Ramadas, the responsibility of nurturing the year-old sapling fell on the shoulders of Dr. Chitra Natarajan. By this time, Dr. Chitra Natarajan had also assumed the responsibility of position of Dean, HBCSE (TIFR). She accepted this additional responsibility with all humility, despite her deep involvement in several other events & projects. We thus never got the feeling that she was looking after an adopted child.

It was during these interactions that we came to know about her & her personal qualities. No amount of words can describe all the facets of her charming personality & life as experienced by us at NMSF. She always had something more to contribute & enlighten us further in any area of our scientific endeavor related to the field of education, and especially those related to school students.

In her passing away, we at NMSF have lost a dear friend & a vibrant guide. However, we are sure that her soul will be always around us in the hour of need & guide us intuitively. At our end we will continue to ensure that the now 8-year old plant of “Teachers Conference” will continue to prosper with leaps & bounds and add stature to the image of the departed soul. Already the signs of this happening are visible. We now find teachers coming from places outside Navi Mumbai & taking advantage of the proceedings of the conference. It will, therefore, be not surprising if the roots of the event soon spread to district or state level.

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MUMBAI CHAPTER

Navi Mumbai Science Foundation

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Navi Mumbai Science Foundation (NMSF) is a science led NGO in India which is dedicated to development of "scientific temperament " in society in general & the student community in particular. This in turn will contribute towards the holistic development of the nation & prepare it to face the challenges posed by a technologically advancing global environment without losing sight of its societal commitments.

VISION

- ✓ Kindle and nurture scientific temperament in students;
- ✓ Enhance soft skills like problem-solving approach and communication skills;
- ✓ Promote 'Pupil-centric' approach in education;
- ✓ Create awareness in public about science and scientific issues;

MISSION

To advance, popularize and promote the cause of science in Navi Mumbai.

ACTION PLAN

- **Develop a network** of professionals and personalities to share their knowledge;
- **Provide multi-disciplinary environment** to students to understand their inter linkages;
- **Provide a platform** for interaction between leading educationists, teachers and students;
- **Encourage participation in** scientific activities like:
  - National Children's Science Congress: NMSF is in charge of Navi Mumbai region (August – November) includes workshop for students and teachers
  - Guidance for Homi Bhabha Balvaidnyanik Competition (March – September) 50 lectures on the weekends
  - Guidance for Regional Mathematics Olympiad. (November – August) 40 – 50 lectures through the vacation period
  - World Nuclear Energy Day (2nd December) In commemoration of the day the first nuclear reactor went critical
  - Essay Competition: Nurturing talent for Nobel Laureatism (June – September)

Inspiring children with the achievements of the giants

- Fun with science activity associated with Science day. (February)
  Scientific principles through fascinating demonstrations
- Science Utsav: Teachers' conference (January)
  Day one – meeting of teachers and researchers on chosen topics of interest to high school education
  Day Two Students exhibition of experiments (January)
  Away from the project and models, students go a step forward to present their experimental skills.

Create links with national organizations in the field of science and science education;

Arrange discussions on scientific topics of current interest and publish scientific articles in local papers and magazines.

ACHIEVEMENTS AT GROUND LEVEL

*About **2500 students & 250 teachers** are now being reached through these activities each year.*

IN SHORT, WE AT NMSF, ENDEAVOUR TO

Give meaning to science in ways more than one, and

Erase the artificial barriers that keep science away from the main stream of life.

OUR INDEBTEDNESS

We are indebted to several schools & colleges, a few institutions and volunteers, who have been active partners in our activities year after year.

For more information, please visit our website at:

- ***http://www.navimumbaisciencefoundation.org***

MAHARASHTRA ACADEMY OF SCIENCES

[Regd. Soc. No. 1020 Pune, Public Trust No. F-842 Pune]
[**Mumbai Chapter**]
{B-51, Gitanjali, Plot No.52, Sector-17, Vashi, Navi Mumbai-400703}

The Maharashtra Academy of Sciences (MASc) is the premier scientific learned society of the state of Maharashtra. It was established in 1976 with the specific aim to highlight the scientific and technological issues confronting the state, and to recommend appropriate steps necessary to be under taken by the concerned authorities for the promotion of science and technology.

The academy has very wide spectrum of interests and has scientists of eminence as its fellows in all the major scientific disciplines. The list of fellows includes eminent scientists in Maharashtra and some outside the state who are interested in the promotion of science and technology and have in particular special attachment to Maharashtra. It has also fellows from industry who have made a name in their respective fields. The fellowship of the academy is conferred upon senior scientists after a peer-group assessment based on their scientific achievements as is practiced in the national academies of India and in the prestigious academies abroad. The first President of the academy was Dr. H. N. Sethna, the then Chairman of the Atomic Energy Commission, who guided the deliberations of the academy in its formative stages.

The academy besides promoting science and technology addresses various issues related to the development of Maharashtra in the areas of: Education, Industry, Communication, Mass Transportation, Agriculture, Natural Resources, Medical & Public Health Services, Demography, Urbanization, Rural Development, Human Resource Development Management and Public Administration, Economics.

Some of the activities undertaken by the Academy so far include the following:

- Presentation of recommendations for the education of groundwater resources of the state.
- Assessment of the impact of the Thal-Vaishet fertilizer complex on the Alibag Magnetic Observatory.
- Presentation of geological sites in the state.
- National seminar on Biodiversity and sustainable developments.
- Celebration of the century of the discovery of X-ray and of radioactivity at various places.
- Sc education discussions from time to time & publication of detailed report in the book form by Dr. M. R. Bhiday.
- Several seminars on important topics and lectures by eminent scientists.
- Seminar on "Plastics: Bane or Benefactor"

Additional Activities of MASc (MC)

MASc (MC) is organizing several activities on a regular basis & some occasion-based as required. They are all in association with Navi Mumbai Science Foundation mostly, local colleges, schools & research organizations.

Some important ones are listed below:

- An annual event “Science Utsav” (having 2 parts: Sc. Exhibition for School Students & Teachers’ Conference)

- World Nuclear Energy Day: A novel annual event (on Dec. 2, each year)
- Regional Mathematics Olympiad Guidance sessions.
- Homi Bhabha Bal Vaidnyanik Competition Guidance Sessions.
- Science Nurture Club for students of Std. VII & VIII.
- National Children's Science Congress Activity for Navi Mumbai region.
- Fun with Science programs.
- Throwing Light on Light on Feb. 12, 2016-A half Day Meeting.
- Feeling the pulse of pulses on Jan. 19. 2017- A One Day Meeting.
- "Functional Materials" (2018) - A One Day Meeting.

At present, there are more than 900 Fellows of the Academy covering the disciplines of Physical Sciences, Chemical Sciences, Earth Sciences, Life Sciences, Medical Sciences, Mathematical Sciences, Agricultural Sciences, Social and Educational Sciences, Engineering and Technology, Economic Sciences, Management Sciences, Computer and allied Sciences and Environmental Sciences. There is also a provision for making honorary fellows, patrons, associate members, young associates, donor members, corporate members and industrial members. The academy is now planning in a major way to welcome in its fold Indian scientists residing abroad, who are specially interested in the welfare of Maharashtra.

Young Associate: An Overview

The MASc has introduced a new scheme for inducting "Young Associates" below the age of 40 from year2006-2007. This scheme is mainly directed towards young, active and dynamic researchers and teachers as also individuals engaged in activities associated with popularizing and promoting various aspects of science covered by the Academy.

The main criteria for selecting individuals under this scheme are as follows:

1. Age: between 25 and 40 years.
2. The individual must be currently engaged in the activities such as research and development, setting up of new and novel facilities for conducting science and technology related projects, popularization of science, spreading scientific temperament by writing popular scientific articles and development of new and novel techniques for teaching science at various levels.
3. The candidate must have demonstrated his/her outstanding contributions to the above activities with proven records.
4. The candidate to be nominated must have a post-graduate degree from a recognized university in the faculties covered by the academy (or a bachelors degree in engineering with more than 10 years teaching experience).

Navi Mumbai Science Foundation

Science Utsav: Teachers' Conferences

Glimpses of the topics covered during previous Teachers' Conferences…

2019: Main Theme: Subject and Pedagogical Content Knowledge in Science Teaching

2018: Main Theme: Moving towards a better understanding of the environment

2017: Main Theme: Use of ICT in Teaching-Learning Process

2016: Main Theme: Encouraging and Supporting students' thinking" in class room learning/ teaching of science

2015: Main Theme: Collaborative Learning: A Useful Teaching-Learning Method

2014: Main Theme: Demonstration of Science Experiments in High Schools

2013: Main Theme: Project Based Science Learning

2012: Main Theme: Hands-on Science in Schools

Science Utsav – 2020

Teachers' Conference 2020

Advisory Committee

Dr. Sugra Chunawala, Chairperson, Dean, HBCSE.

Dr. D.A.R. Babu, Convener, NMSF.

Dr. Kalpana Kharade, HBCSE.

Dr. Reema Mani, HBCSE.

Dr. Shweta Naik, HBCSE.

Dr. A.M. Bhagwat, NMSF / MASc (MC).

Dr. A.K. Rajarajan, NMSF / MASc (MC).

Shri M.P. Bellary, NMSF.

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Dr. D.A.R. Babu, Secretary, NMSF.

Dr. A.K. Rajarajan, NMSF / Secretary MASc (MC).

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Shri Hasmukhbhai Kanani, Hon. President, Shree Gujarati Samaj.

Shri Kaushikbhai Patel Exe. President, Shree Gujarati Samaj.

Shri Maheshbhai M. Katharia Gen. Secretary, Shree Gujarati Samaj.

Program

(11th Jan. 2020)

Time	Description	Speakers
9:00 - 9:30	**Registration and Assembly**	
Plenary Session: 09:30 – 10:35		
9:30 - 9:35	Welcome and Introduction	Dr. A. K. Rajarajan
9:35 - 9:40	Opening Remarks	Dr. A.M. Bhagwat
9:40 - 10:10	Theme based talk by Chief Guest	Dr. Kalpana Kharade
10:10 - 10:20	Speech by guest of honour	NMMC officer
10:20 - 10:35	Prize Distribution for earlier events	By Chief Guest
	Vote of Thanks	Dr. D. A. R. Babu
Tea Break (10:35 to 10:50)		
Session I: 10:50 - 13:00		
Session I: To cover sub-themes I, II & III.		
10:50 - 11:30	**Invited talk:**	Dr. Reema Mani
11:30 - 12:10	**Invited talk:**	Dr. Rajendra Kavathekar
12:10 - 13:00	Teacher's Presentations	
Lunch Break 1300-1340		
Session II: 1340-1630		
Session II: To cover sub-themes IV to VII		
13:40 - 14:20	**Invited talk:**	Dr. Deepa Chari
14:20 - 15:20	Teacher's Presentations:	
15:20 - 16:00	**Invited talk:**	Dr. Brijbala Suri
16:00 - 16:30	**Feedback and Conclusion**	
	Distribution of Participation Certificates	
	Feedback, suggestions and Closing remarks.	Dr. K. P. Muthe
Tea		

Effective Science Teaching – Learning strategies for classrooms

Contents

Concept Note

Science education occupies an important place in the development of individuals, society and nation at large. In order to succeed in life the young generation needs to be scientifically literate, and also be explorers, inquirers, critical thinkers and problem solvers. The development of these skills among learners depends upon the teaching-learning scenarios in schools. It can be viewed from two perspectives: i) active, participatory and collaborative learning environments in classrooms & ii) research based pedagogical innovations for science education by teachers among teachers.

However, in the Indian context, the status of science teaching-learning is far from exemplary. Teachers face several challenges in their daily work, such as, poor infrastructure, unsatisfactory labs, pressure of curriculum load and examinations are some of them. Over-crowded classrooms or classrooms with diverse and heterogenous groups of students in schools are challenges which teachers have to face in their daily routine. These challenges can result in lack of individual attention for students, a non-participatory learning environment and total negligence of children with special needs. The situation also increases frustration among teachers.

Schools and teachers must create workable solutions to make the best out of an adverse situation. This conference provides a platform for teachers to share their thoughts, experiments and interventions for making science learning effective even in difficult situations, such as teaching in diverse and heterogenous classrooms.

Following are the main theme and sub-themes on which papers are invited. While theoretical papers are accepted, sharing of actual field-based experiences will be most welcome.

Main Theme: ***Effective science teaching-learning strategies for classrooms***

Sub Themes:

a) Designing engaging learning tasks for classrooms: Teachers can share or suggest creative tasks for engaging each and every student in the learning of science.

b) Active learning strategies: their development and use: Active learning is a buzz word today. Teachers can share or suggest active learning situations for meaningful science learning among learners.

c) Action research, interventions and experiments in science education in classrooms: Teachers can share their action research findings, effectiveness of the field-based interventions in the teaching-learning of science in classrooms.

d) Dealing with diversities in classrooms*:* Today's classrooms are becoming more and more diverse in terms of sociocultural contexts and varied learning needs arising out of gender, disability or geographical locations of the learners and teachers. Teachers are expected to take pro-active steps to cater to such needs to make science learning *effective*. Thought provoking ideas or field experiences presented by teachers will be the focus of this theme.

e) Reporting learning episodes from classrooms: Teachers can share science learning episodes about certain individual students which will help the participants at the conference to connect to the varied learning contexts of the presenters.

f) Teacher collaborations for effectiveness in classrooms: Teachers can share their experiences or suggestions about collaborative ventures designed to promote science learning in classrooms.

g) Taking note of students' informal ideas in the classroom- Learners have many ideas and perceptions about certain concepts or phenomenon which have developed from experiences outside the science classroom. This theme will throw light on this informal science learning.

Prof. Chitra Natarajan Memorial Lecture

CHANGING SCENARIO OF SCIENCE EDUCATION IN INDIA

Kalpana Kharade
Homi Bhabha Centre for Science Education, Mumbai

In today's national and global context, the scope of science education has widened. Today we cannot and should not treat science as a water tight compartmentalised discipline. Today we need to have an inter-disciplinary approach to learning science and hence must think about an approach which will bring four disciplines namely Science, Mathematics, Technology and Engineering under a common umbrella named STEM. Today we need to think about STEM education for our young generation.

What is STEM? STEM is an approach to learning and development that integrates the areas of science, technology, engineering and mathematics. STEM in the modern economy is extremely important as well as our near future if we think about the jobs of the future, and what this means for our kids looking at choosing further study options. We need to ensure that our students' priorities align with their future career opportunities. It is also important to think of and plan what we can do to make STEM learning available even for diverse learners as today's classrooms are becoming more and more diverse. And in conclusion, I'll talk about industry and the research sector and how we need to boost the commercial returns from research, and get industry more involved in inspiring the minds of our future STEM professionals.

STEM education and its significance: Our modern world runs on STEM. It's hard to imagine how we would have reached our present stage of development as a nation or how we can make further progress without STEM playing a leading role. Actually, much of what we use in our daily lives and the average living standards Indians enjoy today are a product of STEM.

At home, at work, in public places, we are surrounded by STEM products. With the flick of a switch—or the click of a button—rooms light up, screens beam images and voices from around the world to our homes and offices, meals are cooked within minutes or the critically ill receive lifesaving treatments. Today, while the students we teach are users of these and other innovations, such as, email, mobile phones, text messages, Facebook and so on, the Government also wants them to become the makers of tomorrow's innovations.

We need more and more young Indians to get the STEM foundation that will enable them to become agents of future scientific and technological breakthroughs. For this, we also need to make sure, that our teachers, have the full infrastructural, pedagogical support and resources needed to nurture

the next generation of the STEM workforce. At present we are mainly a nation of users and adopters of innovations. We must remind our young people that those who invented and produced these technologies were once students like them. They may have done nothing out of the ordinary while studying STEM subjects, but by applying their STEM skills, they were able to come up with some brilliant ideas. Ideas that were later turned into highly sought-after innovative global products or solutions to problems faced by humanity.

It is also important for students, parents and the community to understand that the future job prospects of young people lie in STEM. Most of the fastest growing occupations in India today require STEM skills. In the past decade, the bulk of job growth has occurred in industries such as health care, scientific and technical services, biotechnology, information and communication technology, and advanced manufacturing. The students who pursue a STEM career don't have to work for someone else because STEM skills inspire not only innovation, but also entrepreneurship. There are many organisations today through their Makers projects are kindling young minds and promoting in them creative abilities.

Actually, I do understand in today' presentations majority of you will speak about your genuine problems in science education. You all have very realistic issues to tackle like overcrowded classrooms, over loaded syllabus, scarce resources and non-academic responsibilities. In your own way, you all already taking proactive steps to solve these problems. All your papers will enlighten the participants about it. Nevertheless, we need to be ready for this field as well. Because STEM is the need of the day for our nation in general and individual learners in particular. It is their and our future.

What do we need for this? Certainly, well planned curriculum. For this educationists, scientists and industrialists should come together to understand the national needs and changes required in education in general and science education in particular. But I am of the opinion that teachers should be actively involved in the process of curricular reforms because they are the one who know the ground reality and face it every minute.

Secondly any curricular reform in science education should be accompanied by well designed teacher education both at pre-service and in-service teacher education levels.

At in-service teacher education level, institutions like HBCSE are doing a great job. They are regularly organising workshops for in-service teachers for improving the quality of science and mathematics education. In the month of June, a workshop was organised even for STEM education. Apart from this there is a greater need to create a platform for teachers to collaborate and think about different ways of making STEM education effective.

I do not know when STEM will become the part of our school curriculum but it has started gaining momentum through several after school/ summer science club activities. Several organisations are coming out with STEM educational packages. My worry is the commercialisation of STEM will make it inaccessible for the majority of learners and our focus should be making STEM education available for all. For this the schools and teachers need to be proactive in the spread of STEM for all children.

In all these efforts we should never forget about the learning diversities existing in our classrooms. There are several marginalised children in classrooms. They too have right to quality STEM education through curricular and co-curricular activities. We need to find pedagogical strategies to actively involve diverse learners in STEM learning. It is basically the welcoming attitude, accommodative pedagogical interventions which will help us to remove any barrier from the way of their science learning.

All this certainly require good financial provisions which is a challenge for country like India. But linkages with Industry will help us to overcome this challenge. Industry can come forward to offer funds for improving the Science labs, resource centres and even to promote research.

So, STEM is our future and the only approach for making our learners ready for a competitive tomorrow.

About the author

Dr. Kalpana Kharade

A teacher with a vision

Currently visiting faculty at HBCSE, Dr. Kalpana Kharade, is a retired adjunct associate professor and a recognized Ph.D guide in K.J. Somiaya B.Ed. college. Her 100% vision impairment has never come in her way of contributing immensely in the subjects such as *Philosophical Foundations of Education, Methods of Teaching Languages, Teacher Education, Institutional Building* and *Evaluation* and achieving a well deserved place in the academic community.

Dr Kharade is a dynamic member of the committee on the Status of Blind Women, Guest speaker at the National Association for the Blind (NAB) and a proficient resource person for the IGNOU and YCMOU graduate education programs. In recognition of her unstinted devotion to the field of education, she has been honoured with the Neelam Kanga award (2002), Best Teacher award (2002 and Giant Group award for academic excellence (2007). In 2013 the state ministry of social justice and empowerment has given her an award of “Best Employee”. In 2014 she received the National Role Model award conferred upon her by the President of India, Shri Pranab Mukherjee. She is also the recipient of the Hirkani award given by Mumbai Doordarshan in 2015.

Invited Talks

TEACHING SCIENCE: STRATEGIES, PRACTICES AND ACTION RESEARCH

Reema Mani

Teaching science can be interesting and daunting. The position of science teaching as an interesting activity assumes an inherent motivation and also the potential for making the subject relevant and motivating for students. All teachers want their students to do well and love their subjects. They have many tools at their disposal for making the subject and topic matters interesting for their students – various pedagogical techniques, different modes of delivering the topic, understanding of humanistic relevance of science, etc. Teachers are also aware, through training and experience, that the students are not blank slates and hence they need to address different conceptions about a topic or subject matter that students may already have. Teachers need to take cognisance of these while teaching and ensure only the right conceptions remain with the students. All this makes teaching not a unidimensional activity of delivering content but a complex activity involving canonical knowledge, newer and modern ways of dealing with the teaching of that topic, and addressing students' difficulties brought on by prior knowledge as well as those about new knowledge.

In a real classroom, the activity of teaching does not end with these concerns. A real classroom, especially in the Indian context, throws diverse challenges – linguistic, cultural, social, and of course, size of the classroom in terms of space as well as number of students. To add to these multiple challenges, most schools do not have adequate infrastructure, curriculum is time-bound, and teaching is tied to examination success. Thinking about teaching can then seem like a daunting task. Everyday practice often leaves no time to reflect on these factors and perhaps in some ways this makes the task less burdensome? Teachers could perhaps think about their daily practices to look for own innovations in the classroom and use them whenever they require. What are the ideas that worked? What did not work? One of the basic criteria for assessing teaching-learning activity as successful is student engagement. Most teachers might refer to these as 'joyful' and 'meaningful' experiences. Before we start designing an activity, we need to begin with what we mean by these terms? What are the other outcomes of teaching-learning experience that you would wish to create?

Daily teaching practices could benefit from accessing principles of designing engaging tasks that would be applied across various topics. How do we measure student engagement? If I say that a student is actively learning, how does that differ from her/his engagement? How can a teacher make and share her ideas, or even keep them readily accessible for her own self? These are some of the

questions that this presentation/talk will attempt to address. The presentation/talk will discuss the meaning of engagement in learning and proceed to discuss certain principles of designing engaging tasks. We will explore the feasibility of ideas with a few examples. Finally, we will discuss how to prevent the workable ideas from becoming obscure and lost.

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Goodnough, K. (2011). Taking action in science classrooms through collaborative action research. Rotterdam: Sense Publishers.

Action research for teachers. Article found at www.nsta.org

About the author

Dr. Reema Sanjay Mani

Currently a post-doctoral fellow in HBCSE, Dr. Reema obtained her Ph.D. in education from Mumbai University in April 2018. Between 2016 and 2018, she was a research associate in TLIx project in Tata Institute of Social Science (TISS), Mumbai.

TEACHERS' PARTICIPATION IN BUILDING RESPONSIVE CLASSROOM ENVIRONMENT AND FELLOW COMMUNITIES

Deepa Chari
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Learning can be described as a dynamic interplay between a repertoire of things such as learning practices, students' content knowledge, prior understanding, socio-cultural background, language interactions, and science identities which students carry with them in the classroom. Classroom teaching therefore should involve a deeper as well as continuous understanding of these aspects by the teachers so that she can cater to students' interest, needs, and expectations in the class, both at an individual and at a group level.

While focusing on the selective sub-themes of the conference, in my talk, I will begin with a discussion about range of research-supported practices that teachers can adapt to be responsive to the students' ideas. When I mean by responsiveness is a two-strand approach, first is the responsiveness towards the science content. In this strand, teachers develop classroom environment to create interactive opportunities for students through pre-designated epistemic games or tasks. Students discuss, assess one-another's ideas, and exhibit sense-making, and as it happens, teachers pays close attention to students' ideas to facilitate students in their disciplinary learning.

Another strand is cultural responsiveness where teachers are mindful of the diverse nature of their class. Teachers in this strand are not necessarily relying on one "fit for all" method, rather, make use their understanding of classroom diversity in pre-planning and design of classroom activities. Both these strands, operated simultaneously, consider students at the central spot of their learning by sharing ideas out loud in classroom while teachers coordinating these exchanges through a well-thought design (activity). Teachers are also sensitive that students who are encouraged to talk during the activities are not chosen with a deficit mindset, e.g. picking less-talkative, or less-attentive, or marginalized student for a specific response).

Additionally, my talk points out the extensive role of teachers in community building under 'teacher collaborations for effectiveness in classrooms' and 'reporting learning episodes from classrooms' theme. Institutional literature has constantly appreciated teachers as "agents of change" in their communities. Teachers often help fellow teachers in adapting successful local teaching explorations, and many eventually turn to well-developed institutional practices. I will discuss how these efforts can be synchronized through national forums where teacher members can regularly contribute pedagogic resources for others, as well as pose queries for expert guidance. I will present an example of video reflection workshop to discuss such teachers-originated and teachers-moderated effort of community building.

About the author

Dr. Deepa Chari is a faculty member at the Homi Bhabha Centre for Science Education (HBCSE). Her research interests are disciplinary identity and diversity research to enhance the representation of historically under-represented groups in physics. Deepa has earned her Ph.D. in physics education from the Dublin Institute of Technology, Ireland in 2014. She then moved to USA to conduct postdoctoral research. Before joining HBCSE, Dr. Deepa has worked in post-doctoral capacity at Kansas State University, American Physical and Florida International University.

EFFECTIVE TEACHING LEARNING STRATEGIES FOR CLASSROOMS

Brij Bala Suri
Associated with Mumbai University for M.Ed, PGDMA and IB lectures

The classroom is a dynamic environment, bringing together students from different backgrounds with various abilities and personalities. Being an effective teacher therefore requires the implementation of creative and innovative teaching strategies in order to meet students' individual needs.

For every teacher, the most challenging task is to grab a student's attention and convey the message in an effective way. They aim to impart each lesson in such a way that it creates a lasting impression on their minds. Another important aspect that concerns the teachers is how to continuously hold the attention of the students throughout a classroom session.

For teachers to create a conducive environment and to hold on to students' attention, classroom management is a must. In *The First Days of School*, Harry Wong states, "Classroom management is the practices and procedures that allow teachers to teach and students to learn."

Classroom management consists of four major aspects-

a) Teacher's Role
b) Instructional Strategies
c) Discipline
d) Procedures & Routines

Implementing an effective classroom and behavior management strategy is crucial to gain students' respect and ensure students have an equal chance of reaching their full potential.

My presentation will also focus on the following effective teaching learning strategies:

a) Engaging
b) Inspiring
c) Collaborative
d) Immersive
e) Experiential

That time has a gone when we viewed students as "empty vessels" who passively receive knowledge from their teachers through chalk and talk, with an end goal of positive results from testing and assessment. Students are already exposed to highly interactive mobile or PC based games from a very young age. Therefore, gamification of education by making lessons more interactive and visually interesting is paramount. It is a teacher's responsibility to bring dull academic concepts to life with visual and practical learning experiences, helping your students to understand how their schooling applies in the real-world. Therefore, teaching strategies should also be aligned with the student's technical knowledge and their interests.

Being an effective teacher is a challenge because every student is unique. However, by using a combination of teaching strategies we can address students' varying learning styles and academic capabilities as well as make the classroom a dynamic and motivational environment for students.

"No one should teach who is not in love with teaching." – Margaret E. Sangster

About the author

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NOTES ON DEMOSTRATION OF CERTAIN SCIENTIFIC PRINCIPLES

Rajendra Devidas Kavathekar

Rationale: Interaction of certain specific arrangements with air, which , though invisible and rare, plays a certain role, to be explored by us. (Based on page no. 75, class 2 book of 'New science in everyday life '.

In our childhood, each of us had a very strong attraction about aeroplanes. Therefore, let us begin with the activities based on flight;

Take three paper strips about half inch by six inches or so and fold them at the centre. These three folded paper stripes are locked into each other to make a funnel type shape. Now this cone is mounted on a pencil or ball point pen and moved rapidly in air, it spins as air passes around that. The same effect is observed when it is placed under a ceiling fan or dropped from certain height.

Now take a 1' by 8' paper strip. Give two half cuts on opposite sides of the strip, about 1' away from the end. and lock the two cuts together. The arrangement looks like a three dimensional winged loop, which when released in air, falls spinning. This spinning action, being unexpected, is enjoyed a lot.

Now take two similar paper strips, one about 2' shorter than another and give two half cuts at both the ends. Now instead of locking two ends of the same strip, lock both the ends of the two

strips and join the two stripes together and release that in air. Note the difference in spinning style as compared with the first.

Take a 3' X 8' paper sheet and give two cuts up to about 6' along its length in opposite directions and mount a U clip on the two ends and cast the paper loop in air by holding the paper clip. See how beautifully it whirls in the air.

Now to make wind power harnessing toy, *a fan that would last for five thousand years*. Cut and remove a 3'plastic cup from a small bottle of mineral water or a soft drink, disposal of which is otherwise a problem. Give around 12 to 14 parallel cuts on the cylindrical part of the bottle. Bend every strip outward and twist it a bit. Place this arrangement in the plastic cup with cap of the bottle on and hold under a ceiling fan and see the fun.

Now from fans, let us shift to sound based toys, mainly whistles, chirps and horns. We all know that sound is produced as a result of vibrations. (Vibrating fingers does not produce sound, at least audible to human ear.

Close one end of the strip file by a finger and blow through another end is blown, a high pitch sound is produced. You can vary the quality of sound can be by running finger over the file.

Another example of such minimum skill is a piece of corrugated pipe, used generally to conceal electric wiring in houses. Hold one end of it and whirl that in air. It producer a pleasant sound. Similar sound is produced if one blows through one end of the pipe, pitch of which can be changed by turning or twisting the pipe

Now to make a paper chirp take a small paper sheet, say3' by 5' and fold at centre along the length and cut two holes on the fold itself. Now open out the two wings of the folded paper hold between two fingers and blow through the folds, it makes a high pitch sound. Participants can try to learn what happens if only one hole is made or three holes, small sized, large sized, etc.

A toy with little more skill to play is a straw piece with a cut at one end, through which when blown, a high pitch sound note is heard. Variations in the pitch are noticed when length of straw is changed by cutting the straw while being blown through. Additional amplifying effect can be observed by using a funnel or cupping both hands around the straw. Everyone cannot play this whistle in the first attempt.

Now let us experience a whistle that makes very high pitch sound. I am going to stretch a cut balloon over plastic bottle cap and blow over the stretched rubber diaphragm. Note the pitch of sound produced.

About the author

Rajendra Devidas Kavathekar has been working as a chemistry teacher in K. B. Pendharkar College, Dombivali since the year 1983. For last 20 years he has been conducting workshops for school students of making scientific toys. So far, he has conducted more than 400 such workshops.

During these workshops, students make toys using material brought by him, enjoy, share and take the toys home. The toys are based on concepts that they study in their curricular books that are not very easy to understand. He has conducted these workshops in different parts of India as well as in foreign countries like England, Cyprus, Nigeria, Kenya, Thailand, etc.

Contributed Papers

UNDERSTANDING AND RETAINING INTEREST IN SCIENCE AMONG SECONDARY SCHOOL CHILDREN

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Over the last decade it has been apparent that there is a drastic decline in students opting for the stream of science at higher secondary level. The number of students applying for Science stream at different colleges has gone down considerably. This study therefore is an attempt to understand the cause of this declining interest by conducting a survey with students of Grade Five, Eight and Tenth of a school in suburban Mumbai.

The Objectives of the study were:

1. To identify Student interest in Science compared to other school subjects.
2. To discuss interest in Science in secondary school on gender basis.
3. To compare the relation between interest in science and teaching Methodology.
4. To review the relation between difficulties faced in learning science.
5. To estimate lack of interest in study of science due to monotony in teaching.

Self – constructed questionnaire was given to 50 students each from Grade Five, Grade Eight and Grade Ten. The questionnaire for Grade 5 was based primarily on Close–ended survey, whereas the questions for Grade 8 and 10 was based on Open – ended survey.

The conclusions drawn from the collected data were as follows:

1. Students' just entering secondary education had greater interest in Science as compared to students in the higher grade.

2. The teachers of the school co related the concepts of science with everyday life which created an awareness among the students of the importance of science in daily life.

3. Majority of students in Grade 5 and Grade 8 were unaware of existence of a science laboratory in their school.

4. Students across the secondary school felt learning science through experiments in small groups enhanced the understanding and application of the concepts in science.

5. Students opting for a career in Science showed a marked decline from lower grade to higher grade.

Many scientific concepts cannot be easily experienced as there are no immediate sensory ways to understand an idea. Students will perceive and observe in a selective way based upon previous

knowledge and experiences. Thus, this study suggests the following recommendations for enhancing teaching – learning process in Science.

1. Increased activity (debates, drama and literature) based learning should be incorporated from lower to higher grades in teaching of science.

2. In absence of a well-equipped laboratory and its facilities in a school, technology can be used as tool of learning through experimental method.

3. Field – trips and excursions with a resource person or an expert in that field based on the syllabus should be incorporated.

4. Learning science through experimentation helps in developing analytical thinking, problem solving and scientific attitude in a child.

ACHIEVING HIGHER ORDER LEARNING ACTIVE LEARNING STRATEGIES

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Abstract Active learning is an important element of education. By involving students in the active learning process, they are able to apply the information they acquire. Active learning pedagogies not only change the ways in which learning takes place but also enhance understanding and memory. Students find the work more exciting and thereby put more effort into it. This paper describes the use of active-learning strategies in school and also offers strategies for implementing active learning. Problem statement – The need for active learning was felt as the traditional method of lecturing was only useful in achieving lower end of learning such as knowledge and understanding and is not beneficial in achieving higher ends such as apply, analyse and evaluate. Introduction Learning without meaning is often forgotten because without understanding, it is difficult to apply information to future reasoning. The purpose of this paper is to enhance understanding of active learning, its role in education and to provide approaches for applying active learning in school. Evidence supports the use of active learning to stimulate higher-order thinking and improve student motivation to learn. Active learning engages students as partners in the teaching-learning process and helps them take charge for their own learning. Active-learning strategies used by teachers can nurture two-way communication and students enhance comprehension and meaningful application of knowledge. The benefit of active learning is that it involves student participation in activities, encouraging higher-order thinking, critical analysis, problem solving and providing feedback about the learning process to both teacher and students. It also places greater importance on student consideration of values, and attitudes, habits and can increase student enthusiasm to learn and expand their capabilities.

Active Learning Methods of interaction that allows students to actively participate in learning process through various activities for individual or group is known as active learning.

Activities-

- Group discussion
- Discussion
- Games
- Short readings
- Survey
- Worksheets
- Case studies/ Scenarios
- Role Play
- Voting device
- Spot light
- Share record
- Minute winner
- Shed the load

Requirements in classroom-

- Teacher should plan activities for students which engages them in writing, thinking, creating and analysing.
- Activities need to be planned carefully to be completed in time allotted.
- Classroom with movable chairs and tables, for effective conduction of activities.
- Computer for computer-based activities.

Different ways to practice Active learning strategies- Shed the load- Students are given a couple of minutes to write “shed the load” or most puzzling concept on the topic discussed. This happens at the end of the class session and works well for large and small classes. The teacher collects the Shed the load questions and then provides clarification at the next class. Minute winner- Students are posed a question regarding a topic and are asked to write a response in one minute. Whoever writes the most meaningful response is declared the winner.

Share record-The teaching is paused for 4-5 minutes, this is done when teacher has covered an important concept, and students are instructed to share and compare their notes. This active learning strategy works well in large and small classroom settings during the middle to end of the session. It is an active method for students to understand view point of their peers. This is good for students who have poor note-taking skills. Spot light-Students are placed in a group of 4-8 students and are seated in the classroom in a circle along with an extra empty seat. The group is given a topic to discuss. Only students sitting in the circle can take part in the discussion. If a student in the audience wants to participate in the discussion, he/she must come into the spot light circle and occupy the empty seat. Role Plays-Students are assigned roles to act out in a situational context. For example, if the aim is to explain the role of community health worker, the instructor may place students into groups of 3—1 student assumes the role of the community health worker, another assumes the role of a person living in that area, and 1 student serves as peer observer of the role performance. Students can then switch roles. Student Presentations-Students, as individuals or small groups, are assigned a topic which they have to research and about which they must develop and execute a presentation to the class. The student is placed in the role of teacher, which can greatly enhance understanding of the topic. This active-learning strategy works well in small classes but can be implemented in large classes if there is time for all students to present. Games-Following the format such as “Kaun Banega Crorepati?”, games promote friendly competition among students and are an effective means of reviewing knowledge and facts in a fun and engaging manner. Voting Devices-Voting Devices can help teacher measure students understanding of the topic in a large class. Teacher could pose conceptual questions to the class in a multiple-choice format and students submit their answers via the voting device. Case Studies-Case study require students to apply their, understanding, knowledge, skills, and attitudes to solve a problem relating to the course material. This strategy works well in big and small classrooms. Topic such as Overcoming shortage of water etc.

Chapter	**Topics**	**Active learning strategies**
Nutrition in Plants	Effect of mineral deficiency in plants	Children learn about hydroponics and come up with their ideas to find mineral deficiency in plants with their own experimental setup.
Nutrition in animals	Absorption by villi in small intestine.	Students explore how villi increase the area of absorption of food Students are asked to explore various mops available and what type best absorbs water and compare their study to the role of villi.
Fibre to Fabric	Animals yielding wool. Process to obtain wool. Different natural	Students are divided in groups of 4-5 and a detailed article on different animals producing wool is given to the students to be read in the class. Students can be taken to a handloom house to know and

	and man- made fibre	experience weaving or they can do weaving activity with two strip of paper.
Heat	Hot and cold Measuring temperature Heat transfer	Students are introduced to the concept of cold and hot temperatures. They can be provided with hot water, cold water and coloured dye .They are asked to perform in groups and using the given material they come up with their own activity to show that hot water is less dense than cold water.
Light	Convex and concave mirrors Convex lens (water in a glass)	Students are explained the shape and appearance of concave and convex mirrors. They are given a long cuboidal sponge to explore the shape of convex and concave mirrors. Students demonstrate the shape of spherical mirrors using the given sponge. Toothpicks (around 6 to 10) are pricked in sponge to represent light rays and students are asked to work in group and check the direction of toothpick (light rays) when the sponge is bent like a concave and convex mirror respectively. Students note down their observations and conclude if the rays are diverging or converging. Draw an arrow facing right side on a white card paper. Ask students to see this arrow through a glass without water and then through a glass full of water. Students note that direction of the arrow changes from right to left. Students are asked to explore the reason for this observation. The reason for this is that water in the glass acts like a convex lens that produces reverse or inverted image.
Sound	Sound is produced by vibrating body Low and high pitch sound	When the length of the straw changes the sound or pitch changes. Pitch is how high or low a sound is perceived. Students can work in group and 4 different length straws with different pitches. They conclude with their observation that longer the straw the lower the pitch – the shorter the straw the higher the pitch.
Electric current and its effect.	Electrolysis of water	Students are explained the concept of anode, cathode and electrolysis. Students are asked to explore in group a simple activity of electrolysis of water. Students are given a 9 V battery and tap water in a beaker. Few groups can come up with the activity of just dipping the 9V battery directly in the beaker containing tap water. They are expected to observe more bubbles at cathode or negative terminal of a battery which indicates release of hydrogen at cathode and less bubbles of oxygen at anode. Ratio is 2:1
Density	Density of ice	Students are shown pictures of various situation where they see ice in nature-e.g.-frozen ponds, lakes, oceans etc. They are divided in group and asked to discuss and

	How to increase density of water?	research the following questions- What happens to the underwater animals during such freezing temperature? They are asked why most solids sink while ice floats? To understand the concept of density, each child is provided with a rock, marble, apple and an egg. They add salt to the bowl one teaspoon at a time, to find out how much salt is needed to make the object float. Have the children start with the egg because it takes about 9 tsp. of salt to make it float. Students write their observations of the experiment on a piece of paper. Students can be challenged to make a density tower in a glass using sugar, water and 4 different food colours.

Conclusion-

Making students ready for future requires that students actively integrate knowledge, skills, attitudes, values, and behaviours in all activities. In classrooms, there has been a shift of emphasis from teaching to learning. Active-learning strategies should be combined with existing education system, to help students advance to higher levels of learning. As obstacles to the use of active-learning methods are identified, they can and should be overcome. Students must be prepared to be self-motivated, lifelong learners who can meet the challenges they will face in an ever-changing environment.

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EFFECTIVE SCIENCE TEACHING-LEARNING STRATEGIES FOR CLASSROOM

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ABSTRACT: The paper consists of thought provoking ideas and field experiences. Working in teams aide students in learning, share their resources as well as skills and knowledge. Verbal communication makes students understand the root concepts better. Here are some simple steps discussed to teach the subject in a diversified classroom.

"Teaching is a beautiful passion, as it allows you to see the growth day by day of people entrusted to your care. It is a little like being parents, at least spiritually; it is a great responsibility"

-Pope Francis

The first step for any teacher is being aware at all times that they are addressing a classroom spanning languages, cultures, abilities etc.

Whatever we say, the examples, the issues being addressed, the opinions expressed, and the stories shared should keep a higher perspective in order to avoid issues of prejudice in religion, culture, social structure and enigma.

The main aim of selecting this topic is that, it's the concern of the contemporary generation. During forgone years most of the children above the creamy layer especially had the privilege to attend the classes; but nowadays due to RTE ACT it's going to be challenging for every teacher to deal with students as the class would be highly diversified and with lot of parities between them. Self-awareness is a huge factor, as it is being able to create a space where students feel their opinions are valuable and acceptable so that no wrong notations can find a place in their tender minds.

Now I would also like to share few of my own experiences. How can a zero affect the life of a child? There was a boy named Shridhar. He was a scholar and the house captain of his school. Once he could not appear for his semester exams due to his health issue. As usual the class teacher distributed the report cards to all the students. When Shridhar went through his report card he was very upset. He had missed the rank. From that day he hesitated to attend the classes. He was evading his friends. He was depressed. His parents took the help of the counsellor too. Finally, he failed in 9th std. Somehow next year he started attending the school as his new class teacher's words motivated him to attend the school; not regularly but at least for a few days in a week. From that very day I think twice before giving zero to a child. Zeros can sometimes actually affect psychologically, decreasing motivation on students, and may reflect negatively on their aspirations.

Two years ago, I knew about another girl. From 9th she was promoted only on medical grounds. She had lost her memory in 9th. She had a major health issue related to the brain cells. But by the grace of God, she got back her life. She once wanted to join her classmates for a 2-day picnic. While she was in std10 she was also detected with arthritis and cataract. She asked the teacher "Why I am not allowed to go to the picnic mam?" It was difficult for the teacher to take a decision. Her dad also confronted by saying that her life was more important and board exams were also getting closer. Then she said my first wish was to reach STD 10th and then to join my classmates for a picnic, which I could not attend in 9th. Now if you are not willing to take me I may lose interest in my

studies and she started weeping. Her words were shocking and experienced more tension. If she starts taking tension it can make her life miserable. Finally with the parents support the teacher took her, and latter in her board exams she scored 73%. She thanked the teacher for the support offered to her.

Sometimes as a teacher we should be able to take strong decisions for the multifaceted welfare of our students.

The disinterest of students about learning is a major problem of modern education. Diversity in the sense can be in various forms like- physical and mental health, economic background, classroom environment, behavioural problems, morphological, family, class strength, etc.

To cater to the needs of the present generation, I would like to suggest some methods on the basis of experiences which can be used while teaching the subject.

1) LEARNING BY DOING: If we have to explain the structure of diamond, we can ask the students to get some amount of clay, toothpicks etc and while we are explaining the concept the students would use it and complete the model.

2) GAME BASED LEARNING: Ask students to get different tools to complete the circuit. Then ask these students to sit together during our explanation and ask them to complete the task. Students will not only learn the concept but will work in a group.

3) MAKING CONNECTIONS: When we are teaching Biodiversity we can relate it to the classroom diversity. Make them

understand that how varieties of organism live together peacefully without any kind of ego or jealousy.

4) EXAMPLE BASED LEARNING: Explain concepts by giving day to day examples for chemical reactions.

5) INCREASED AUTONOMY: Ask students to demonstrate the experiments.

6) COMMUNICTION SKILLS: Use of vernacular language whenever necessary. Child can give up learning if taught in the same manner. It’s just like we don’t eat the same kind of food everyday and develop a feeling of nausea.

7) CO CURRICULAR ACTIVITIES: Organizing Activities that have international dimensions will expose to the outside world and will help them to appreciate the diversity and uniqueness of each and every environment.

8) STOP-DROP-ROLL – concept for fire safety.

9) Students don’t care how much you know until they know how much you care.

10) Use of code words and sentences.

11) Some children have an interest in drawing, make them draw diagrams and learn the concept.

Being a teacher is not easy, being a student is not easy; being a human being is not easy. Nor should they be. We learn best

when we are challenged both positively and productively, in a way that resonates with us on personal levels.

One day a famous painter painted a picture and displayed withal tagline “NOT FOR SALE”. But it was so beautiful that who so ever attended the exhibition asked the painter to sell that painting. But every time he said, “I’m extremely sorry, but I can’t sell it for any amount. I will sell it to only that person who will understand its value.”

Then an old man came to that painter and said “I want to buy this painting and here is the price in this small box for it”. The painter gave that painting to the old man. Everyone surprisingly asked the painter, “Why did u sell it for a paint brush and few colours to this old man?” the painter said “If you noticed the painting there is a man who is teaching a kid to paint with so much dedication. The man in this picture is this old man and that kid is me. He is my teacher who taught me to paint and whatsoever I am today is just because of his dedication and blessings”. Everyone understood and respected the bonding of a teacher and a student.

A teacher always gives his/her best wealth to his/her student in the form of knowledge, wisdom and art with an expectation that his student will optimally utilize it.

I would like to conclude by saying that we should “have a heart that never hardens, and a temper that never tires, and a touch that never hurts”

Thank You…

EDU- REVOLUTION: ACTIVE LEARNING FOR THE NexGen INDIA

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The education field has under gone progressive changes over a period of time leading to learner centered learning from teacher centered learning. This rightfully made sense and success as the various evolutions that took place in teaching –learning process led to better understanding and better citizen out of the learners. Teachers continue to find new methods to apply technology to reshape and advance traditional teaching-learning process — inspiring innovation for quality education. Active learning is a method of learning in which teaching involve students in the learning process more directly Bonwell and Eison state "that in active learning, students participate in the process and students participate when they are doing something besides passively listening." Here all students engage in the learning process. It involves actively engaging students with the course material through discussions, problem solving, case studies, role plays and other methods to promote critical thinking about science.

Development and Use: Learning a new concept, instruction is needed and practice makes perfect. Active learning helps students master them. However, teacher has to keep it mind the different learning abilities of learners to development and use of active learning strategies. It should be in such a way that:

Teachers and students get more one-on-one interaction that is students receive frequent and immediate feedback during active learning activities. this builds rapport between teachers and students which is essential in today's education system

Students will learn through collaboration and interaction with other students, engaging deeply with the course content and building social skills as per Bandura's theory of learning Teaching becomes more inclusive resulting in students with different learning styles get a personalized experience s per Gardner theory of learning styles

Don't learn to do, but learn in doing." – Samuel Butler

In science during my teaching sessions I could observe students learnt more when they participate in the process of learning. Discussion, practice, review, leading to application

and problem solving. Exploring new concepts in groups were few ways I engaged the learners. It assisted learner's brain to activate cognitive and sensory networks, which helps process and store new information which eventually increased their learning potential. I used analysis, synthesis, and evaluation of class content.

Active in-class learning also provides students with informal opportunities for feedback on how well they understood the concept.

Types of Active Learning:

A) Question-and Answer Technique

Questions are simple, effective way to promote interaction, and it provides a sense of students' understanding. Develop questions to check previous knowledge or after the session as revision. When learners are asked to prepare question. It results in active participation due to competitive spirit. Questions can be asked at any time, but it is important to vary the timing to prevent repetition/boredom. It is important to encourage and stimulate activity from the whole class and acknowledge all answers, to support continued participation.

Interactive demonstrations can be used to demonstrate experiments. Students when involved in the demonstration reflect and analyse the process. For example, you can have students predict the outcome of the demonstrations individually, and then have them discuss it in groups, or with the whole class.

B) In-class Demonstrations and Laboratory Demonstrations

Interactive demonstrations can be used to demonstrate experiments. Students when involved in the demonstration reflect and analyze the process. For example, you can have students predict the outcome of the demonstrations individually, and then have them discuss it in groups, or with the whole class.

C) Brainstorming

Here, students are asked to generate ideas on a certain topic, while the teacher facilitate and record the answers on the blackboard/whiteboard. It is a process to encourage students to recollect prior knowledge and experiences. Acknowledgement to all answers during this idea formation period is very effective.

For example while teaching adaptation Just wrote the organism name on the whiteboard for grade 7 and students immediately come up with features. Here they corrected each other and collaborative learning took place.

D) Discussions

Discussions can be useful both during class and online. The teacher facilitates students' learning experience. Discussion helps students to think critically, analyse and to evaluate their own and other's responses. Students explore a wider range of perspectives, and build on each other's knowledge and understanding of the content leading to constructivism. It helps students cultivate knowledge synthesis skills. In this way students also develop tolerance and patience to listen opinions of others.

E) Case Studies

Case studies allow students to apply the concepts learned in class to "real-life situations". It can be as simple as posing a single question to the class and It can also be held at large scale, and require that students conduct additional research.

F) Design thinking

In our school we implemented design thinking, whole new way of active learning. Here students come cross problems and find different methods to resolve it. This develops the problem solving ability of the students.

G) Flip classroom

Flipping" the classroom is wonderful method along with technology in order to free class time from lecture and passive learning. This allows for an expanded range of learning activities during class time. This provides opportunities for greater teacher-to-student mentoring, peer-to-peer collaboration.

H) Simulations:

In Cambridge session we have IBT, hence I conducted stimulations, which is recommended by IGCSE syllabus. This reduces the boredom of just sitting and discussing. Students come up to the IBT enhance their learning through simulations. I observed it increase their curiosity and learning at their ease.

These methods have assisted my students in the following ways:

Develop collaborative skills leading to tolerance towards each other

Student preparation.

Increase engagement and retention to connect to daily life.

Improve critical thinking and lateral thinking

Make technology more powerful and leading to innovations

Make learning effective, progressive and successful.

ACTIVE LEARNING STRATEGIES

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Active learning is a form of learning in which teaching strives to involve students in the learning process more directly than in other methods. Bonwell and Eison (1991) state "that in active learning, students participate in the process and students participate when they are doing something besides passively listening." (Weltman, p. 7) Active learning is "a method of learning in which students are actively or experientially involved in the learning process and where there are different levels of active learning, depending on student involvement. (Bonwell & Eison 1991). In the Association for the Study of Higher Education (ASHE) report the authors discuss a variety of methodologies for promoting "active learning". They cite literature that indicates that to learn, students must do more than just listen: They must read, write, discuss, or be engaged in solving problems. It relates to the three learning domains referred to as knowledge, skills and attitudes (KSA), and that this taxonomy of learning behaviour can be thought of as "the goals of the learning process". In particular, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation. Active learning engages students in two aspects – doing things and thinking about the things they are doing.

Abstract

Active Learning Strategies is the key phrase dominating our education world in recent times. Internet is overboard with several ideas, experiences, data and analysis based on various ideologies. In matter of few clicks we come across unlimited Active Learning Strategies keeping the content, learners and the facilitators in mind. The trick to fish for the right strategies suitable for the set of students we are catering to from the boundless ocean of pedagogies.

In the age of instant gratification, the challenge is to keep the students interested and glued to studies. The balance between distractions and concentration always seems to be bending towards the former. To keep the student physically as well as mentally present in the class amidst are the worldly chaos, is a constant challenge universally faced by all of us.

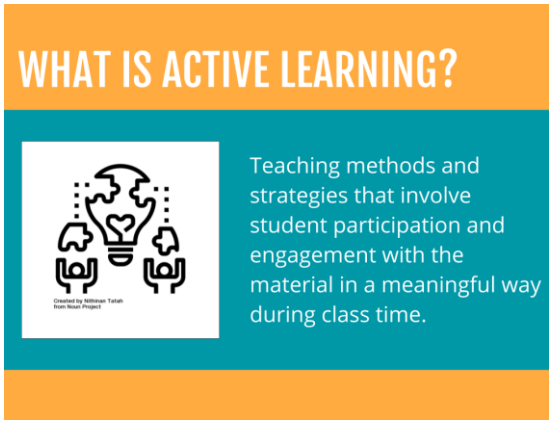
Active Learning Strategies are very appropriate to motivate the student to explore more, to get involved and to be focussed on the concepts in hand. It is instrumental in guiding the students from extrinsic motivation to intrinsic motivation. Active Learning Strategies encourages the students to own the subject.

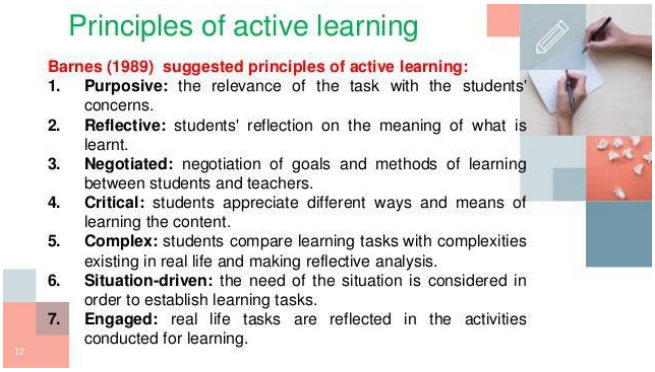
Introduction

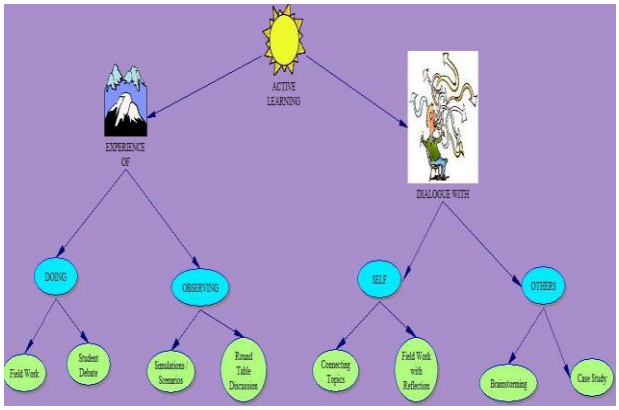
Active Learning Strategies help to initiate learners and instructors into effective ways of helping everyone engage in activities based on ideas about how people learn. Multiple active learning strategies may be used in each of the active learning designs.

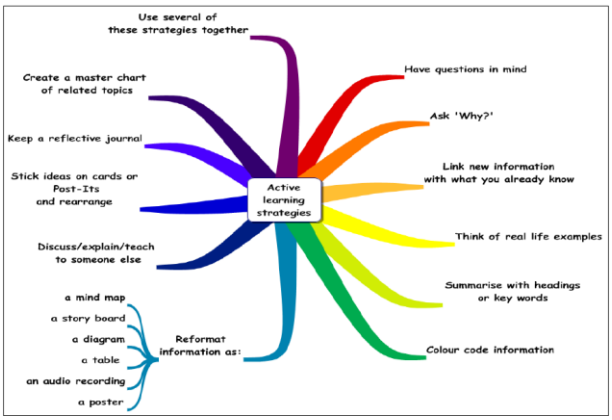
Table: Different ways to practice Active Learning Strategies in class

Peer teaching	Investigate, Inquire,	Group / personal projects	
Odd one out	Recording of observation	What's in the box	
Data analysis	Loop cards	Starter activities	
Tell me more	Give me five	Matching pair	
Demonstration	Recording of analysis	Discussion	Data analysis









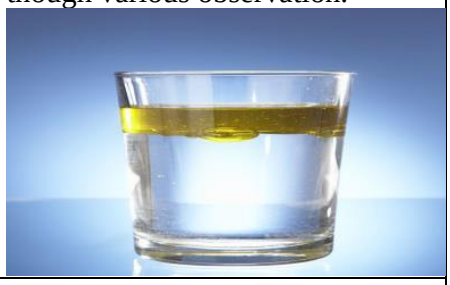
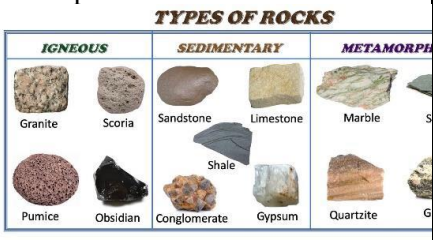
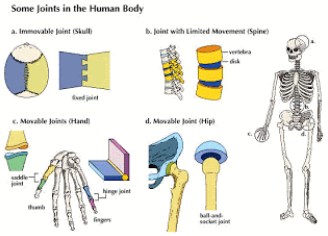
Figures: Ways to form Active Learning Strategies

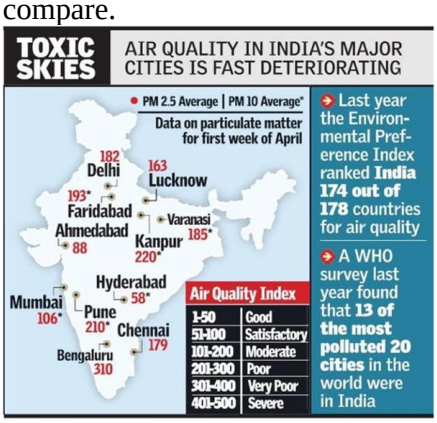
Some examples of type of active learning strategies and where they can be incorporated

Types of active learning strategies	**Topics where active learning strategies can be incorporated**
Think-Pair- Share.	Dispersal of seeds
Quick write	Components of food
Turn and Talk	Types of energies
Polling	Choosing the best First Aid
Individual plus Group Quizzes	Revision
Tests/Quizzes with common preconceptions as distractors	Solar system
Gallery walk	Habitat & Adaptation
Fish bowl	Our environment
Idea line up	Purification of water

Following are some of the Active Learning Strategies the student can practice in primary standard:

Chapter	Topics	Active Learning Strategies
Growing plants	Identifying seed producing plants Seed Germination-Stages in Germination Dispersal of Seeds New plants from other parts Crops and Vegetables A balanced Diet, Keep fit.	Bring seeds found at home, sow them and observe the result.  Think and answer. How does water enter the seed? Draw a dandelion flower and write its special features.
Food and Health	A balanced Diet Diseases-Communicable and Non-Communicable Disease Disease causing Microbes and Insects. Prevention of Communicable disease Pasteurization Vaccination	Crush any nut press it in a newspaper, keep it under the books and observe after a few days. Discuss. Demonstrate three ways to prevent communicable disease with action.
Safety and First Aid	First Aid- For cuts and scratches, for nose bleeds, for sprains, for burns-Minor, Severe, and Chemical. First Aid- for firefighting, for Animal bites, for Snake bites, for poisoning.	Learn and practice the mnemonics for First Aid. For E.g. **LOCPRESS" stands for:** LOC – Level of consciousness. P – Pulse. R – Respiration. E – Eyes. S – Skin Colour. S – Skin Temperature.
Solids, Liquids and Gases	Matter Molecules Arrangement of molecules in solids, liquids and gases Properties of solids, liquids and gases Solubility of Solids, Liquids and Gases in water. Melting and boiling points	Demonstration of various experiment without explanation. The students are encouraged to come up with the conclusion

	How temperature affects change in state.	though various observation. 
Rocks and Minerals	Kinds of rocks- Igneous rocks- granite, Pumice, Obsidian, Sedimentary rocks- Sandstone, Conglomerate, Shale, Limestone, Metamorphic rock- slate, Gneiss, Marble, Quartzite Minerals- Metallic and Non-metallic minerals Conservation of natural resources	Rocks samples are shown to them and explained. 
Animals: Habitat and Adaptation	Habitat Understanding animal behaviour Special organs Breathing in animals- Organs of breathing Feeding habits in animals- Organs of feeding Some adaptations Movement in animals- Land animals, Water animals and insects Migration among animals	Students are shown specimen of different animals and their systems in the lab. They are explained about adaptation of animals and are asked to list more such examples. 
Skeletal system and nervous system	Organ system The skeleton- The skull, the spine, the rib cage, the limbs Functions of the skeleton Joints- Movable and Non- movable Muscles and movement Types of muscles, how do muscle work. The brain- cerebrum, cerebellum, medulla The spinal cord Nerves- Sensory, motor and mixed Sense organs- the eyes, the nose, the tongue	Specimens of different joints are shown and explained. Some joints are shown and the students are asked to identify the types of joints based on th eir mobility. 

Measurement	Need for measurement History of measurement, Measurement of different quantities Measurement of capacities	Measure your desk using hand span. They are shown the correct way to read the units on measuring cylinder.
Force and Energy	Force – Types of forces- Muscular, Gravitational, Frictional, Elastic, Mechanical, Buoyant Simple machines- Levers, The inclined plane, The pulley, The wheel and axle, The screw	Demonstration of various examples without explanation. The students are encouraged to come up with the conclusion though various observation.
	Energy- Different forms of energy Law of conservation of energy	Students are asked to make simple machine and explain them. Peer teaching is done for the topic 'Various forms of energies. They are encouraged to give lots of examples.
Air and Water	Properties of air Properties of water Air around us Layers of atmosphere Composition of air Properties of air Water too support life Purification of drinking water	Students are asked to collect air quality data of various city and compare. 
Earth, Sun and Moon	The surface of the moon Phases of moon Eclipses of the moon and the sun Artificial satellites	The students are encouraged to make a working model (group project) of the eclipse and explain the same. Students are asked to tabulate the similarities and difference between Chandrayaan 1 and 2 
Light and Shadows	Luminous and Non-luminous objects Types of materials Formation of shadow	The students will observe patterns of the shadows made by their pen on the desk from various angles and height in the presence of natural and artificial light. They

		come with conclusion based on their observations.  Sharp Shadow Fuzzy Shadow
Volcanoes, Earthquakes, and Tidal waves	Magma Lava Earthquakes Volcanoes Tidal waves	Students are shown videos of the given natural phenomenon and are asked to analyse and discuss the same.
Our Environment	Greenhouse gases Global warming Pollution Steps to control pollution Organizing drives for cleanliness Motivating people to care for environment	They are asked to come up with probable solutions of air pollution. Class wise monitoring of minimising wastage and maximising cleanliness.

AV Aids play a great role in Active Learning Strategies provided it is shown in a very interactive way as it is a common tendency to shift to a passive viewing mode while watching.

AV Aids are used in all the lessons for better understanding and assimilation of the topics.

All the ideas and listing shared are indicative and not exhaustive. We as teachers can come up with a new gem every time we dig deep in our treasure.

Conclusion

Children are very inquisitive in nature, **Active Learning Strategies helps and nurtures them to find answers on their own. It increases the focus and uses distraction in a positive way.** Active Learning Strategies are very appropriate to motivate the student to explore more, to get involved and to be focussed on the concepts in hand. It is instrumental in guiding the students from extrinsic motivation to intrinsic motivation. Active Learning Strategies encourages the students to own the subject.

Students are of utmost importance in the educational pyramid. The more involved the students are in the teaching leaning process the more settled the basic framework of the concept taught will be. It helps the students to progress from known to unknown confidently. Active Learning Strategies keeps an everlasting impression on the students' mind and allows them to be their own master in a controlled and constructive environment.

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https://slide share

प्रभावी विज्ञान अध्यापन

वैशाली खिलचंद बेंडाळे
शाळा क्र.११, नवी मुंबई महानगरपालिका, नेरुळ.

विज्ञान हा एक महत्वपुर्ण कारणासाठी मुख्य विषय आहे, कारण विद्यार्थांना वेगवेगळया तपासणीचा अनुभव घेण्यास अनुमती देतो. त्यामुहे त्यांना या विषयाची समृध्दी मिळते. प्राथमिक शाळेत बऱ्याच वेळा प्रॅक्टीकल कामाद्वारे चालविले जाते आणि विषयांकडे भाषण करतांना विज्ञान यशस्वीरित्या सामील होण्यासाठी हा सर्वोत्तम विषय आहे. व्यवहारीक अनुभव आणि वर्गातील चर्चा ही सृजनशील दृष्टीकोन असुन मुलांना वैज्ञानिक विचार करण्यास प्रोत्साहीत करतात, म्हणुनच मुलांना त्यांच्या विचार प्रक्रीया आणि समज व्यक्त करण्यात मदत करण्यासाठी अभ्यासक्रमातील कल्पना वापरु शकतात.

आधुनिक मानसशास्त्राच्या दृष्टीनेही प्रेरणा व मार्गदर्शन हेच अध्यापनाचे सारसर्वस्व होय. अध्यापन करणारा शिक्षक व शिकणारा विद्यार्थी यांना जोडणारी, अध्ययन हे फळ असलेली आणि निवेदन, विवरण, चर्चा, मार्गदर्शन इ. चा समावेश असलेली कृती म्हणजे अध्यापन. त्यात उद्दीष्टये, अभ्यासक्रम, अध्ययनप्रसंगाची योजना अध्यापन पध्दती आणि उद्दीष्टयांच्या सफलतेचे मुल्यमापन या पाचही गोष्टींचा समावेश होतो. संपुर्ण अध्यापन प्रक्रीयेचा अध्यापनपध्दती हा एक महत्वाचा भाग होय.

अध्यापन व अध्यायन या प्रक्रीया एकमेकांशी निगडीत आहेत. यशस्वी अध्यापन म्हणजे विद्यार्थ्याला अधिक ज्ञान होणे आणि त्याची आकलनशक्ती वाढणे. काही नविन शक्ती सामर्थ्य लाभल्याचा आनंद होणे आणि त्याच्या प्रतिसादातुन नव्या अध्यापनाला गती मिळणे, विद्यार्थी शिकला याची साक्ष त्याच्या वर्तनात दिसते जे समजले नव्हते ते समजले व जे करता येत नव्हते ते करता येऊ लागले, म्हणजे शिक्षण झाले म्हणून अध्ययन म्हणजे संस्कारग्रहण आणि वर्तनात परिवर्तन व ते घडविण्यास साहाय्य करणे अध्यापन. शिक्षक व विद्यार्थी यातील क्रियाप्रतिक्रियांच्या या दोन बाजु आहेत, म्हणून शिक्षण ही द्विधृह-प्रक्रीया म्हटली जाते.

१) प्राथमिक स्थरावर विज्ञान विषयक प्रयोग सांगायचे झाले तर ज्वलनास ऑक्सीजनची गरज असते. हे आपण बशीमध्ये मेणबत्ती उभी करुन त्यावर काचेंची बरणी उलटी मारल्यावर (ठेवल्यावर) काही काळाने मेणबत्ती विझते या प्रयोगाने दाखवू शकतो.

२) रोपटयाला जगण्यासाठी हवा, पाणी सोबत सुर्यप्रकाशाची आवश्यकता असते. हे दोन सारखी रोपे घेऊन एक रोप दोन दिवस अंधारात ठेवायचे व दुसरे रोप सुर्यप्रकाशात ठेवायचे, या प्रयोगाने मुलांना अतिशय छान समजविता येते.

३) मातीत "बी" रुजविण्यासाठी पाण्याची आवश्यकता असते हे दाखविण्यासाठी दोन सारख्या डब्यात माती भरुन त्यात गहू,मोहरी पेरावे व एका डब्यात आवश्यक तेवढे पाणी द्यावे व दुसरे तसेच ठेवावे. काही दिवसातच पाणी दिलेल्या डब्यात अंकुर मोठा होऊ लागतो. तर पाणी न दिलेल्या डब्यात बी वाढत नाही. याद्वारे विद्यार्थांना बी रुजविण्यासाठी पाण्याची आवश्यकता असते हे स्पष्ट करता येते आणि विद्यार्थी हा प्रयोग अतिशय आवडीने करतात.

अशाप्रकारे छोटया छोटया प्रयोगातुन आपण विद्यार्थांची जिज्ञासु वृत्ती जागृत करतो व त्यांना विज्ञानाबद्दल आवड निर्माण होत जाते.विद्यार्थांनी प्राथमिक विज्ञानामधुन जे कौशल्य प्राप्त केले ते स्वातंत्र मिळविण्यास आणि वैज्ञानिक विचार कसे करावे हे शिकण्यास सक्षम करते.

वर्गात विज्ञान शिकवण्याची प्रभावशाली प्रणाली / पद्धती

सौ. वंदना गोपाळ सोनवणे

न.मु.भ.न.पा. शाळा क्र. ५०

एकविसाव्या शतकात विज्ञानाने घेतलेली झेप म्हणजे 'अथ तो ज्ञानजिज्ञासा' व या ज्ञानजिज्ञासेच्या लालसेमुळे आज विविध शोध लावले जातात. आजची लहान मुले म्हणजे उदयाची भावी पिढी आणि ज्यांच्यातून आपणांस शास्त्रज्ञ तयार करायचे असतील तर लहाणपणापासूनच त्यांच्यात विज्ञानाची गोडी निर्माण झाली पाहिजे व ही जबाबदारी शेवटी शिक्षकांवरच येऊन पडते म्हणून शिक्षकाने विज्ञान शिकवण्याची प्रभावी पद्धती वर्गात वापरली पाहिजे.

मानवाचया वैयक्तिक, सामाजिक आणि राष्ट्रीय विकासामध्ये विज्ञान शिक्षणाचा अतिशय महत्त्वाचा वाटा आहे. जर जीवनामध्ये यशस्वी व्हायचे असेल तर नवीन पिढीला वैज्ञानिक दृष्ट्या साक्षर, शोधकर्ता, चौकस, वैचारिक आणि प्रश्नांची उकल करणारा होणे गरजेचे आहे. मुलांमध्ये या गुणांची वाढ होण्याची प्रक्रिया शाळेमधील शिकवण्याच्या वातावरणावर अवलंबून असते. वर्गातील सर्व मुलांना शिक्षणाच्या प्रक्रियेत गुंतवून ठेवण्यासाठी त्यांच्याशी संवाद साधने, त्यांचे गट बनवून गटाला विविध गटकार्य किंवा प्रयोग करण्यास सांगणे त्यातून आलेले निष्कर्ष सर्वांपुढे सांगणे असे प्रयत्न प्रभावी ठरु शकतात.

उदा. मुलांना निरीक्षण करुन दैनंदिन व्यवहारातील शीघ्र बदल सावकाशबदल, मानवनिर्मित बदल, नैसर्गिक बदल यांची नोंद करुन ठेवण्यास सांगणे.

वर्गात विविध उपक्रम करण्यास तसे सादरीकरण करण्यास सांगणे – जसे – विविध पानांची चित्र जमवणे अथवा रेखाटणे अन्नसुरक्षा, काळजी कशी राखावी, अन्ननासाडी रोकण्यासाठीचे उपाय सुचविणे.

वर्गामध्ये सक्रिय सहभागपूर्ण आणि सहयोगपूर्ण शैक्षणिक वातावरणाची निर्मिती करुन अध्यापन केल्यास मिळालेले ज्ञान विदयार्थ्यांपर्यंत सहज आणि कायमस्वरुपी टिकते. त्यामध्ये विविध घटनांना का? असा प्रश्न विचारुन त्याची उत्तरे शोधण्याची जिज्ञासा निर्माण होते. सक्रिय शिक्षणासाठी विदयांर्थ्यांना विविध घटनाक्रम देऊन त्यातून अपेक्षित मुद्दा स्पष्टपणे सांगता येऊ शकतो.

उदा. शब्दकोडी तयार करणे (शास्त्रज्ञांची नावे, त्यांनी लावलेले शोध यावर आधारीत)

* भेसळ ओळखण्याच्या पद्धती
* भौतिकराशी मापनाची साधने
* घोषवाक्ये तयार करणे – जसे

''नको दुष्काळ नको जमिनीची धूप, झाडे लावा खूप खूप

* दुष्काळाची तीव्रता कमी करण्यासाठी आपण काय करु शकतो ? असे वैचारिक प्रश्न विचारुन त्यावर उपाय शोधण्याठी प्रवृत्त करुन आपत्ती व्यवस्थापन ही संकल्पना प्रभावीपणे समजावून सांगता येऊ शकते.

कृती संशोधन, मुलांचा हस्तक्षेप आणि प्रयोग याद्वारे झालेले अध्यापन हे विदयार्थ्यांच्या कायमस्वरुपाचे व परीणामकारक ठरते.

प्रयोग हा विज्ञान विषयाचा आत्मा आहे. प्रयोगातून विदयार्थी ठराविक निष्कर्षापर्यंत स्पष्टीकरणासह पोहचतो

उदा – प्रयोग – १ – उष्णतेचे अभिसरण

साहित्य – चंचुपात्र, पाणी, बर्नर, पोटॅशिअम परमँगनेटचे खडे

कृती – १) काचेच्या चंचुपात्रात पाणी घेणे.

२) चंचुपात्राला बर्नरच्या सहाय्याने उष्णता देणे

३) पोटॅशिअम परमँगनेटचे खडे त्यात टाकणे व पुढील होणाऱ्या बदलांचे निरीक्षण करणे.

निरीक्षण – १) पाण्यात खालून वर व वरुन खाली येणारे प्रवाह दिसतील.

२) पोटॅशिअम परमँगनेटमुळे हे लाल–जांभळे प्रवाह लगेचच ओळखता येतात.

३) पाण्याला उष्णता दिल्यामुळे नळालगतचे पाणी गरम होते.

४) गरम पाण्याची घनता कमी होऊन ते वरील भागाकडे जाते व त्याची जागा वरुन येणारे थंड पाणी घेते.

निष्कर्ष : उष्णतेचे संक्रमण प्रवाहांद्वारे होते त्यास उष्णतेचे अभिसरण असे म्हणतात.

वर्गामध्ये विदयार्थ्यांमध्ये अपंगत्व, भौगोलिक, रहाण्याचे स्थान, सामाजिक भिन्नता या आधारे विविधता आढळून येते परंतु तरीही विज्ञान शिक्षण परीणाम कारक बनविण्यासाठी त्या त्या विदयार्थ्यांची बौदिधक क्षमता लक्षात घेऊन आवड विचारात घेऊन त्यास अनुसरुन कामाची प्रयोगातील हस्तक्षेपाची जबाबदारी देऊन अध्यापन यशस्वी करता येऊ शकते झालेल्या प्रयोगाचे साहित्य कोणते, त्यातून काढलेले निष्कर्ष सांगणे, निरीक्षण सांगणे, साहित्याची काळजी घेणे अशा जबाबदाऱ्या वाटून देता येऊ शकतील सुमारे ८०% आजार हे अस्वच्छतेमुळे होतात. परिसर स्वच्छ ठेवणे, कोठेही कचरा न टाकणे, उघड्यावर शौचास न बसणे शौचानंतर साबणाने हात धुणे हे संसर्गजन्य आजार

रोखण्याचे सोपे मार्ग आहेत.

आपल्या वैयक्तिक स्वच्छेते बरोबरच सार्वजनिक स्वच्छते बाबतीतही जागरुक राहण्यासाठी देशभरात स्वच्छ भारत अभियान, हे राष्ट्रीय चळवळीच्या स्वरुपात कार्यान्वित आहे. शिक्षकही वर्गात, शाळेत विविध उपक्रम राबवून मुलांना त्यात सहभागी करुन घेऊ शकतात.

विज्ञान विषय शिकवताना शिक्षकांनी घेतलेले प्रयोग त्यातून निर्मण झालेल्या अडचणी प्रयोगाचे निष्कर्ष या सर्व बाबी विदयार्थ्यांना समोर येऊन सांगण्यास प्रवृत्त करुन त्याच्या आकलनाचे मूल्यमापन करता येऊ शकते.

उदा – उष्णतेचे संक्रमण करणाऱ्या वस्तूंचे निरीक्षण करुन नोंदी करणे – चहा पिण्याचे भांडे स्टील, तांबे असेल तर ते लवकर तापते. चहा पिणे कठीण होते.

परंतु उष्णतेचे संक्रमण न होणाऱ्या लाकडी, प्लॅस्टीकच्या वस्तु असतात व त्यांचा वापर विद्युत उपकरणे बनवताना केला जातो.

उदा. विहिर / तलावाच्या पाण्यामध्ये पोहण्यापेक्षा समुद्रात पोहणे सोपे जाते. कारण समुद्रातील मीठ व क्षारांमुळे पाण्याची घनता वाढली की त्यातील वस्तु तरंगते. हे विदयार्थ्यांना वर्गात एका लहान प्रयोगाद्वारे सांगता येईल. एका पेल्यातील पाण्यात बटाटा टाकले असता ते बुडते. तसेच त्या पाण्यात ४–५ चमचे मीठ घालून ते विरघळले की त्यात बटाटा टाकला असता तो तरंगतो. कारण मिठामुळे पाण्याची घनता वाढते व बटाटा तरंगण्यास मदत होते.

वर्गातील अध्यायन परीणामकारक होण्यासाठी शिक्षकांचा एकमेकांतील सहयोग हा सुद्धा विदयार्थ्यांच्या शिक्षणासाठी फायदेकारक ठरतो. शिक्षकांच्या मनातील संकल्पनांचा वापर करुन घेऊन विज्ञान विषयात रुची निर्माण करता येऊ शकते.

उदा. १) शिक्षकांनी परस्पर सहकार्यातून तयार केलेले प्रयोग ज्याप्रमाणे माझ्या शाळेतील शिक्षकांनी तयार केलेला गरीबाचा हीटर – स्टोव्ह चालू असताना त्याचा बर्नर गरम होत रहातो ती उर्जा वाचवून त्याला पाईप जोडून ती उर्जा बाजूला पाणी गरम करण्यासाठी किंवा इतर कामांसाठी वापरली जाणे. म्हणजे अन्न शिजवताना, पाणी देखील गरम केले जाऊ शकते.

२) कचऱ्यापासून बायोगॅस यंत्र तयार करणे.

३) गरीबाचा फिल्टर – पाणी साचवून ते सूर्यप्रकाशात ठेवल्यास त्यापाण्याची वाफ होते व त्यावर झाकण असल्यामुळे ती वाफ झाकणाला लागून थंड होते व ते मिळालेले पाणी हे स्वच्छ असते व ते वेगळे करुन पिता येऊन शकते.

विज्ञान विषय शिकवताना विदयार्थ्यांच्या अनौपचारीक कल्पनांचा वापर करुन त्यांच्यातील वैचारीक पातळी वाढवण्यास प्रोत्साहन देऊ शकतो त्यांतील नवनवीन कल्पनांचा वापर इतर विदयार्थ्यांच्या शिक्षणासाठी सुद्धा करता येऊ शकतो.

उदा – ❊ टाकाऊपासून टिकाऊ वस्तू तयार करणे.

❊ शंख शिंपले यांपासून शोभेच्या वस्तू, फ्लॉवर पॉट, पेन स्टँड, मोबाईल स्टॅण्ड, वॉल पीस वगैरे.

❊ गवतापासून सुगंधी अगरबत्ती तयार करणे

❊ बाटलीपासून व्हॅक्यूम क्लीनर तयार करणे.

❊ प्लॅस्टीकच्या पिशव्यांपासून उषा, छोटी गादी तयार करणे वगैर.