

Indian Women Scientists' Association (IWSA)

REPORT

Three-day School Teachers Training Workshop on “Innovative & Inquiry-Based Science Teaching for Middle School (Std 5–7)” 11th –13th August 2026

The **Indian Women Scientists' Association (IWSA)** organized a three-day training workshop on “**Innovative & Inquiry-Based Science Teaching for Middle School (Std. 5–7)**” from **11th to 13th August 2026** at the IWSA Headquarters, Vashi. The workshop was designed for teachers of Maharashtra State Board schools from the **Mumbai South Zone**, with the objective of strengthening conceptual understanding, scientific temper, and innovative, inquiry-based approaches to science teaching.

30 teachers attended on Day 1 of the workshop which provided a blend of concept enrichment, hands-on demonstrations, low-cost experiments, inquiry-based lesson planning, and laboratory safety. The training was conducted by experienced scientists, educators, teachers and IWSA members, providing participants with practical approaches that could be readily adapted for middle-school and high school classrooms.



DAY 1-- 11th August 2026- Strengthening Science Concepts & Scientific Temper

The first day focused on strengthening teachers' understanding of core science concepts and developing approaches that encourage scientific thinking, curiosity and inquiry among middle-school learners.

Inaugural Session

The day commenced with breakfast and tea for all participants, followed by a welcome address by Dr. Suparna Kamath, Vice President, IWSA. The participants introduced themselves, followed by an introduction of the IWSA Trustees.

Dr. Nootan Bhakal, President, IWSA, introduced the organization, its objectives and its various initiatives in science education and outreach.

The Chief Guest, Dr. Vaishali Veer, Education Inspector, South Mumbai, Government of Maharashtra; Shri Vilas Parab, Head of the Primary Section, LAHS and educator at Balmohan Vidya Mandir, and Ms. Mote, Assistant to Dr. Vaishali Veer, were welcomed and felicitated. The guests

Time: 9am to 10am



Dr. Vaishali Veer

were presented with potted plants and IWSA publications on Biodiversity and Millets by Dr. Nootan Bhakal, Dr. Lalitha Dhareshwar, Dr. Yojana Singh and Dr. Smita Kekatpure.

In his address, Shri Vilas Parab shared valuable insights on the importance of innovative approaches in science education and appreciated the initiative of bringing teachers together for experiential professional development.



Dr. Nootan Bhakal

MODULE 1-- Understanding the Middle School Learner

Time: 10:00 to 10:30 am

Characteristics of 10–13-year age group,

Common misconceptions in science -How children construct scientific knowledge

Resource Person: Dr. Saramma Mathew, Assistant Professor, AIKC College of Education

Dr Saramma Mathew described the middle school learner's characteristics. She touched upon Piaget's theory of cognitive development, which considers this as the stage when the child starts formal operational thinking, develops abstract reasoning and can think of hypothetical situations. In this transition stage towards adolescence, they are very sensitive to criticism, and seek greater independence. She emphasized that a class room should be a psychologically safe environment and this stage is important in developing scientific attitude and science activities give them an opportunity to work in groups.



MODULE 2-- Concept Enrichment – Core Topics

Time: 10:30 am to 1:00 pm

2a: Universe, Force, Motion, Work & Machines, Sound and Light

Resource Persons:

Dr. Lalitha Dhareshwar, Member BOT, IWSA and retired Scientist, BARC

Dr. Devaki Ramanathan, Secretary BOT, IWSA and retired Scientist, BARC

Ms. Vidika Mirpuri, Std. 12 student

The session focused on concepts in Physics.

Dr. Lalitha Dhareshwar introduced participants to the **Big Bang Theory and the Universe** and used simple models and demonstrations to explain concepts related to **light, reflection, lenses, centrifugal and centripetal forces, and motion**. She explained universe with the help of a video. The demonstrations and video helped teachers to visualize concepts.



Dr. Lalitha Dhareshwar

Dr. Devaki Ramanathan explained the **properties of sound** and demonstrated the scientific principles behind musical instrument **Jal Tarang**. Simple machines used in everyday life were also demonstrated by her helping teachers connect textbook concepts with familiar objects and situations.



Dr. Devaki Ramanathan

Ms. Vidika Mirpuri, a Std. 12 student volunteer at IWSA, demonstrated how students can construct a simple **telescope using concave and convex lenses**.



2b: Food Adulteration – Detection and Harmful Effects

Resource Persons:

Dr. Srirupa Mukherjee, IWSA Member & Retired HOD & Assoc. Prof. in Chemistry, ICL College, Vashi

Dr. Maitrayee Paul, IWSA Member & Retired HOD & Assoc. Prof. in Microbiology, Vivekanand College, Chembur

The session focused on the **common types of food adulteration, their harmful effects and simple methods of detection**.

The resource persons demonstrated how everyday food products can be tested for adulteration and explained the health implications of consuming adulterated food. The session also emphasized the importance of developing awareness among students about **food safety and informed consumer choices**.

Participants were introduced to the importance of checking **expiry dates, labels and food safety information** on packaged products. The role of **FSSAI** in regulating food safety was also discussed.



2c: Heredity, Human Body and Organ Systems

Resource Person: Dr. Seema Das, Jt Secretary, IWSA & Retired Professor & Head of the Department of Life Sciences, St. Xavier's College, Mumbai

Dr. Seema Das conducted an interactive session on the **human body, organ systems and heredity**.

The digestive system was discussed in detail, with emphasis on understanding the functions of different organs and their interrelationships. The concept of **heredity** was explained by her using attractive and easy-to-understand models.



2d: Matter and Its Properties

Resource Person: Dr. Yojana Singh, Executive Committee Member, IWSA and Retired Scientist, BRIT, DAE

Dr. Yojana Singh conducted an interactive session on Matter and its properties.

In her session Dr. Yojana explained properties such as **elasticity, plasticity and rigidity**, using examples and made the concepts relatable.



2e: The Science Behind Water

Resource Person: Ms. Tripta Tewari, IWSA Member and Retired Chemistry Teacher, Our lady of Good Counsel, Sion, Mumbai

Ms. Tripta Tewari explained the **science behind water** and its importance in everyday life with an interactive approach and engaged participants through a questionnaire designed to test and stimulate their existing knowledge about water.

She talked about what is capillary action & why ice floats on water. She, demonstrated experiments related to the topic including electrolysis of acidic water.

The session demonstrated how questioning can be used effectively as a teaching tool to initiate curiosity, identify misconceptions and encourage students to think scientifically.



2f: What Happens in Diseases? How Do Vaccines Work?

Resource Person:

Dr. Suparna Kamath, Vice President, IWSA and former Lecturer, SIES College, Sion

Dr. Suparna Kamath ended module 2 by taking the participants from the outer world into the inner world, inside the body of human and explained the different types of microorganisms and the diseases they cause. She reminded the teachers to emphasize the size of various classes of microbes such as viruses, bacteria, protozoa and parasites. The students could

then correlate the disease symptoms with size of the microbes and thus learning microbes with more clarity.

She then listed out the different types of vaccines and their action on different disease-causing microorganisms and major vaccine platforms. She took the participants on a quick journey of how these vaccines developed.

She explained what happens in the body during disease and introduced the basic principles of vaccination and how vaccines help the body to develop protection against infectious diseases.



The post-lunch module focused on converting scientific concepts into **inquiry-based classroom experiences**. The module emphasized that effective science teaching should encourage learners to **ask questions, investigate, experiment, observe evidence and draw conclusions**.

3a: Hands-on Activities Using Low-Cost Materials

Resource Person: Dr. Jayant Joshi, Engineer, UGC-DAE Consortium for Scientific Research, BARC and Science Popularizer

Dr. Jayant Joshi conducted a highly interactive session demonstrating how every day and low-cost materials can be transformed into effective teaching-learning aids.

Through simple hands-on demonstrations, participants explored several concepts of Physics, including **Pascal's Law** using a water bottle and syringe, **Multiple reflections** using a bulb and two mirrors, **Persistence of vision** using hand-painted images, **rectilinear propagation of light**, **Laws of reflection**, **Different types of forces & correlation of forces to the famous Gujarati art form Garba & the Maharashtrian Fugdi and Faraday's Law**. Dr. Joshi also discussed various formulae in Physics that are applied to daily activities.

The session demonstrated that effective science education does not necessarily require sophisticated laboratory equipment. Everyday materials can be used to create **curiosity, surprise and inquiry**, making scientific concepts more memorable for learners.



3b: Safety in Science Laboratories

Resource Person: Dr. G. M. Tewari, Auditor for laboratories, Former Food Technologist at BARC, Cadbury, Britannia & Coca Cola.

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The concluding session of Day 1 focused on **laboratory safety**. Dr. Tewari discussed Basics of Laboratory, Types of laboratories, Lab Safety rules to be followed, Safety aspects which need attention, safety equipment & personal safety in laboratories.

The session highlighted safety aspects requiring particular attention while conducting experiments.

Dr. Tewari highlighted the importance of creating a safe environment in which experiments can be carried out confidently while following appropriate safety protocols.



Day 2--- 12th August 2026 - INNOVATIVE TEACHING STRATEGIES AND ASSESSMENT.

Objective: Equip teachers with innovative pedagogy, improve assessment methods and integrate technology in science teaching

MODULE 4: Activity Based and Project Based Learning

Time: 9.30 -11.00 am

4a: Designing simple STEM projects

Resource person: **Dr. Paramjit Anthappan**, EC Member and Retired Head & Professor, Microbiology Department, Bhavan's College, Mumbai

Dr. Paramjit Anthappan started her session emphasising the importance of STEM based learning in the middle school (5th to 7th standards) itself, where curiosity is at its peak. She explained and differentiated Activity Based Learning and Project Based Learning. She elaborated on the various roles the teacher has to take, as a questioner, resource person, facilitator, cheer leader, documenter etc. She gave many examples of projects, which can be done by students in that age group; Waste Management & Plastic Pollution, Urban flooding & Drainage, Heat islands & Lack of green cover, Air Pollution & Traffic etc., to name a few. Since the project may involve several cycles of failures and improvements, the assessment should not be based on the success, but should be done by presentation at a suitable time and place, maybe at a parent teacher meeting. In short, she covered the necessity and the methods for STEM based teaching in middle school, the role of a teacher and the methods of assessment in such activity based and project-based methods.



4b: Integrating Mathematics & Environment Studies

Resource Person: **Dr Anisa Chorwadwala**, Professor, IISER, Pune

Dr Anisa started with a very interesting question and activity: "Why are soap bubbles or rain drops approximately spherical?" Each participant was asked to make different shapes, triangle, circle, rectangle etc. on a graph paper using a twine of given length and to measure the area and compare. She showed how with a given perimeter, circle has the highest surface area and vice versa, i.e., with a given surface area the circle has the lowest perimeter. This was extended to spheres having the highest volume for smallest surface area. This activity was related to efficient packing selected by



nature, be it bubbles, a cat sleeping for maximum warmth, reindeers getting into a circular shape during a wolf attack, shape of honeycomb etc. This was followed by many more demonstrations, how the shape, length etc. influences the sound, and some more activities. She conveyed how such activities can make the study of mathematics interesting and also connected with real life.



4c. Group task: Prepare a mini science project plan

Resource Person: **Dr. Jayant Joshi**, Engineer,
UGC –DAE Consortium for Scientific Research, BARC

Dr Joshi showed some activities with very common and cheap materials, which can be used in the class to demonstrate scientific principles. Each group was asked to do some such activities. Eg. Each group was asked to make toy telephone using paper cups and long twine thread, and a combination of all the six telephones was used to demonstrate many properties of sound. He further elaborated on different types of mini projects. In addition to making a working model, data collection and statistical analysis, verifying a scientific principle also can be planned as projects.



He emphasized that children should be given freedom and sufficient time to think about the project and the teacher or parent should only be taking the role of a guide or facilitator. He stressed the importance of using materials around us and finding alternatives wherever required. It is also very important not to encourage readymade projects. Even if the project is not 100% successful, content and the learning outcome is important and assessment should be based on that.



MODULE 5: Use of Technology in Science Teaching

Time: 11.00 am -1.00 pm

Teaching Virtual labs, Simulations, Educational videos and AI tools for lesson planning

Resource Persons: **Dr Vijayalakshmi Ravi**, IWSA Member and HOD for design and Computer Science and **Dr Seema Purohit**, Jt. Secretary, IWSA and Global Professor of Practice, Global Gate University, California

This session demonstrated the importance of technology in inquiry-based science teaching, within the framework of 5E instructional model, i.e., Engage, Explore, Explain, Elaborate and Evaluate as the 5 steps. Educational videos give a better experience but it is necessary not to use too long ones and to pause every 5 min.



Dr Seema Purohit, Dr Vijayalakshmi Ravi

The speakers differentiated between simulations based virtual labs, which already existed and the more recent AI powered virtual labs which is more dynamic. Further, how AI tools can be used for more effective lesson planning and the different tools, Diffit, MagicSchool, Khanmigo, Claude/ChatGPT etc. were discussed. This was followed by a very interesting demonstration of PhET, a site with interactive lessons for Physics, Maths, Chemistry, Earth & Space and Biology followed by other such sites and tools.



MODULE 6 – Assessment Techniques- Rubrics for projects

Time: 2.00 pm -3.15 pm

Designing HOTS and competency-based questions

Resource Person: **Ms. Kinnari Kotecha**, Global Educator, Educational leader trainer, and curriculum development expert

The importance of assessment using HOTS (Higher Order Thinking Skills) questions and competency-based questions was important as per NEP 2020 approach, as compared to the earlier LOTS (Lower Order Thinking Skills), and direct questions based on memory. The speaker gave many exercises how a LOTS question can be converted to a HOTS question, which may not have a single standard answer, but have multiple answers.



Further, she described how RUBRICS for assessment of projects can be designed and also explained how AI can help in this process. The tools like Magicschool, Teachy, Kuraplan etc. are very useful in this, to define the criteria of assessment, to decide grades based on the levels of performance.



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MODULE 7: Panel Discussion**Time: 2.00 pm -3.15 pm**

Moderators: **Dr. Rita Mukhopadhyaya**, Trustee, IWSA and Retired scientist, BARC
and
Dr. Mary Devakumar, I/C Principal, Sree Narayana Guru College of Education

The topic for panel discussion was **“Prospects & Challenges for Innovative and Inquiry-based Science Teaching”**. All the participants were divided into 6 groups (5 participants in each). Each group discussed among themselves and one representative from each group presented their points. This was a very interactive and useful session, where the participants could share their unique experiences.

In general, everyone felt the need for STEAM based experiential learning, but the challenges were mainly time constraints, lack of training, lack of discipline and interest from the students, generation gaps etc. Some lacked the freedom and space to explore and be creative. Many found that implementing these novel methods within a traditional setup and a class of 60 or more students is very difficult. However, some shared how they had managed such issues and tried to bring new methods and to teach sensitive lessons also very effectively in spite of the students showing reluctance. Some schools encourage interaction among teachers to exchange and share their ideas and experiences such as this workshop at a scheduled time regularly, whereas many teachers didn't have such an opportunity. The need for more such workshops with more time for the participants to get a hands-on experience was also expressed by many. There were many questions and suggestions from participants and the audience. The moderators summarised and emphasised that teachers need to connect with the students and also encouraged them to find ways to implement these innovative methods in spite of the difficulties.



Ashvini Chaitanya Worlikar, Siddhi Yatin Gosavi and Ansari Aeenaz Mudassir



Raeesa Ismail Kasu, Arwa Zojaw Latifiwala and Qureshi Gausiya Ibrahim



Dr Rita Mukhopadhyaya, Dr Mary Devakumar

DAY 3 --- 13th August, 2026—RESEARCH ORIENTATION, ENVIRONMENT & LEADERSHIP
Objective: Encourage Research mindset, promote environmental awareness, teacher leadership

Module 8: Developing Research Skills in Students

Time: 9.30 – 11.00 am

8a: How to guide Science Exhibitions

Resource Person: Dr. Dhanya Suresh
 EC Member and Retd. Scientist BARC

Dr. Dhanya Suresh stressed the importance of introducing the school children to actively engage and participate in science themed exhibitions with support and guidance of their teachers. She shared examples of the various exhibitions organized annually at IWSA with the impact outreach and outcomes achieved, besides success stories of student progression with accolades in future. Useful tips for organizing such exhibitions involving motivation of school students and teachers in terms of collection of entries, active participation during display, assessment, encouragement with participation certificates and prizes were guided. Also, value addition to such events through invited displays of current innovations & recent trends by reputed organisations for enhanced outreach was suggested. The talk was well appreciated by teacher trainees.



Dr. Lalitha Dhareshwar & Dr. Devaki Ramanathan sharing additional inputs to Dr. Dhanya Suresh's session for guiding Science exhibitions

8b: Preparing Hypothesis based Projects, Documentation & Presentation Skills

Resource Person: Dr. Paramjit Anthappan, EC Member and Retired Head and Professor,
 Microbiology Department, Bhavan's College, Mumbai

Dr. Paramjit Anthappan's presentation was aimed at dual goals to equip teachers to build both *a research mindset in children* and *teacher leadership in science*. Aligned with NEP 2020, the session introduced the "ASK-TEST-TELL" framework to design low-cost, hypothesis-based environmental projects using everyday materials. Teachers were shown how to guide students to ask verifiable questions — "If...then...because...", test ideas on local issues like water, waste, energy and biodiversity. The talk also focused on documentation and presentation skills to help students share data and drive action in school and community. The speaker shared lucid examples of IWSA



Ms Zara, alumna IWSA intern sharing her experiential learnings with guidance received at the session with impact on her forward journey in academics overseas.

internship Projects successfully carried out in online, hybrid and onsite mode with IWSA and invited expert mentors. Ms. Zara, an alumnus intern also shared her valuable feedback with the teacher participants.



Module 9 : Environmental and Sustainable Science

Time: 11.00 am -1.00 pm

9a: Climate change basics, school-level environmental audits

Resource Person : Dr. Smita Kekatpure Visiting Faculty for Environment Management, Sustainability & Climate Change, Alumni- National Environmental Engineering Research Institute (NEERI)

Climate Change – Basics

Dr. Smita Kekatpure explained **climate change and the greenhouse effect** to teachers of middle school & high school students through simple and engaging methods. Key concepts like the difference between weather and climate was explained by involving the teachers in an activity. Zero budget **greenhouse effect demonstration** and the **blanket analogy** were introduced as effective classroom tools for simplifying scientific concepts. The session also connected climate change to **regional issues across Maharashtra**, including floods and landslides in Konkan, drought in Marathwada, rain-shadow conditions in Western Maharashtra, heat waves in Vidarbha, and irregular rainfall and water stress in North Maharashtra.

Teachers were guided to replicate ideas and learnings from the workshop for implementing Environment education in schools which were well received by the teachers.

School Level Environmental Audit

In this part of the module Dr. Smita introduced teachers to a practical and experiential approach to environmental education through **School Environmental Audits**. This audit enables students to assess their school environment through observation, measurement and data collection. The teachers were asked to carry out a simple audit of the surroundings by dividing them into groups. It covered **water management, waste and sanitation, and energy conservation**, using structured checklists and team-



based activities. Teachers were introduced to the four-step process of **Plan, Walk, Measure and Report**, along with tools such as a school action plan, rating system and student evaluation *rubric*. The approach aims to connect classroom learning with real-life environmental issues while developing students' scientific thinking, problem-solving, teamwork and sense of environmental responsibility.

9b: Waste management activities, water and energy conservation projects

Resource Person: **Ms. Vijayalakshmi Tilak** EC Member and Retd from BARC

Ms. Vijayalakshmi Tilak shared the challenges faced while implementing Waste management activities, water and energy conservation projects at IWSA campus like solar panels set up, onsite composting, biogas production, drip irrigation, grey water treatment, etc. She stressed on vigilance and monitoring required for sustainable practices giving the example of using an empty bottle placement for collection of chocolate wrappers post consumption by children. Also, review analysis of strengths, weaknesses along with opportunities and threats should be focused in leadership and mentoring the projects.



Module 10: Leadership and Mentoring

Time: 2.00 -3.15 pm

Building Science clubs, mentoring students in STEM careers

Resource Person: **Dr. Bakhtaver S. Mahajan** Advisor, IWSA and Retd. Program Coordinator, HEAL, Homi Bhabha Centre for Science Education, TIFR

In this post lunch session Dr. Bakhtaver Mahajan initiated audience engagement with lively body stretch movements. This was followed with her thought-provoking advice to participants in our **fast-changing world**; to help students navigate, think beyond class rooms, keep in mind the importance of middle school, separate skill empowerment with academic learning, inculcate scientific temper, encourage questioning, the way to think, give students courage and don't blindly believe. She concluded her talk with 3 points to ponder: 1) check sustainability models
2) avoid the Bakasur trap and 3) have happy children!



Resource Person: **Dr. Neha Mishra** Founder & CEO at Ehaa Earth PVT LTD & Adjunct Prof. in SP Jain College of Global Management in Kurla, Wadala and Dubai Campus

Dr. Neha Mishra's talk focused on the role of **teachers as STEM leaders** with explicit sharing of her own journey while pursuing her PhD Project work. The challenges encountered on the way especially during scale up and application, the hurdles surpassed with determination, grit, core beliefs and resilience. She also shared the importance of family support, networking, collaborations, capacity building, passion and drive required to touch the finishing line and successfully transfer the project outcomes towards application and business ventures along with filing patents.



Valedictory Session

Time: 3.30 -4.30 pm

Chief Guest : Dr. Vidyullata Kolhe, Principal, Gurukrupa College of Education and Research, Kalyan (West), Maharashtra

The valedictory session was initiated with Dr. Nootan Bhakal welcoming the Chief Guest for gracing the occasion. Dr. Vidyullata Kolhe shared the prelude for initiation of the workshop with prevalent strengths of knowledge cum expertise of IWSA human resources besides their passionate energy for volunteering the outreach of the same for societal benefit. She stressed the need for collaborative engagement to implement and monitor the programs education research, life skills and sustainable developments.



Finally, the 30 teacher participants from 26 schools located in 5 wards (AB, CD, EFS, FN and Gsn) who were deputed by the Education Inspector, South Zone, Lower Parel, Mumbai, to undertake training at IWSA, received their certificates of completion at the hands of Chief guest, IWSA trustees and EC members, besides invited alumni trainees and resource persons. Ms Madhu Pahwa, Trustee, IWSA, summed up the idea of the workshop by reciting her beautiful poem, encouraging the teachers to work together as a team with IWSA, adapt to these innovative methods and achieve great results. The session concluded with Vote of thanks proposed by Dr. Seema Das, Joint Secretary of IWSA.



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The session concluded with Vote of thanks proposed by Dr. Seema Das, Joint Secretary of IWSA. Looking ahead towards interactions with hope for successful implementation of the learnings and sharings for progressive and impact outreach.



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