INTERVIEW
WITH SAURAV SHOME

Saurav Shome works in an Azim Premji School at Uttarkashi, Uttarakhand. In this interview, he shares his experiences and insights on a life in science.

Saurav, to start with, tell us something about your current role

I am associated with an Azim Premji School at Uttarkashi, Uttarakhand. Azim Premji Schools are places of experiment, and demonstrate what pedagogies work in real classroom settings. I am engaged in coordinating and consolidating our learning in the school. I teach students and facilitate the school-based professional development of my team members.

Shaping a career in science education

Could you tell us some of your earliest experiences as an educator?

As a student (from school to university), I was a science enthusiast, and used to volunteer to teach science in local schools. I worked for a year at a national science museum, where I would explain the models and exhibits to visitors. As a graduate student at the Homi Bhabha Centre for Science Education (TIFR), Mumbai, I began to engage with science communication for school students and teachers. It was here that I developed an understanding of science education and science education research. Regular science teaching at the middle-school level, and workshops for teachers started only after I joined Azim Premji Foundation in 2014, and an Azim Premji School in 2018.

What are some qualities that may help chart a career in science education?

The ability to handle knowledge uncertainty, see coherence and connectedness between different domains of knowledge, as well as a strong sense of integrity in negotiating content, classroom pedagogy, and in all human conduct. Also, a fondness for getting your hands dirty!

Life as a Science Educator

What is a typical day at work like?

It is almost the same as my colleagues. I plan out the topics I intend to teach. Every day, I look around for objects that can be used as resources in science classes. I teach, document students' and teachers' ideas, look for possibilities for pedagogic improvisations, try to read and write a little in order to reflect on my work, design and try out some experiments. You will find me talking to my colleagues, school teachers, and students a lot. I also talk to my six-year-old son to understand how he looks at nature and the universe.

Could you walk us through the process of planning a class?

Mostly, I plan my teaching with my colleagues. This process starts with brainstorming sessions where we arrive at a tentative sequence to transact a topic in the classroom, think of alternatives, and design activity problems around this plan. We go through related literature and resources, identify and discuss common alternative conceptions associated with a concept, the opportunities it provides for subject integration, as well as possibilities for group work and assessment. Before class, we anticipate the resources we need to put our plan into action and ensure that they are kept ready for use. After class, we record/document our experience, reflect on classroom practice in the same group that we planned the topic with, and begin planning for the next day's topic. This cycle is repeated, with the occasional omission of one or two elements.

If one walked into your classroom, what are they most likely to observe?

Usually, I am part of a co-teaching team at school. On a typical day, you'll find students in my science class solving problems. They will be engaged in planning, discussing, and sharing their design ideas, executing their plan, and evaluating their own work. You will find me acting as a moderator in this process. I try my best to encourage students to simulate the specific details and context of the problem task (including an experiment) so that they can arrive at a conclusion. I also include narratives of relevant discoveries and inventions, and some interesting historical anecdotes in the classroom discourse.

As a science educator, do you remember any 'teacher as a learner' moments?

Certainly. I have encountered many moments where my understanding of science was challenged by students or teachers. For example, a teacher in a workshop asked me how the velocity of an electromagnetic wave differs in different mediums. My conceptual clarity was inadequate to meaningfully tackle the question. But, I must admit, students' questions are more difficult to answer than those of adults.

What are some of the biggest rewards and challenges of your profession?

My colleagues, many students, and several teachers appreciate my teaching. These are the rewards I have received till date in my profession.

On many occasions, I have had to engage with perspectives and ideas in the classroom that have challenged my personal views and ideology. This is particularly tough in interactions with people who are resistant to dialogue on long-held views. Another challenge is that many of us have a poorly formed understanding of science concepts, pedagogy, and ideas about science. This is true of even many experienced science educators. Talking about anything radical becomes quite challenging in such spaces.

And some of the most important ethical aspects of your profession?

I think the principle of non-discrimination. Believe in everyone's capability to excel in science at least till the higher secondary level, and create learning environments accordingly. I also

strongly believe that science education must be planned and designed in such a way that it reflects the values needed in order to create an egalitarian, democratic society.

School science education

Your perspective on school science education?

In general, school science education is still imprisoned in the obsession of completing content. This needs more careful planning. It is important to inculcate a culture of science among students with a judicious balance of content, concepts, and skills. The six criteria (cognitive, content, process, historical, environmental, and ethical) set for the validity of the science curriculum in the National Curriculum Framework 2005 are the best to my knowledge.

Could you share three insights on how children learn science?

a. In a broader sense, students learn science like they learn any other subject. What is crucial to remember is that students encounter many science concepts at an early age. A child's engagement with concepts like space, mass, time, motion, light, heat, evaporation, etc., is closely connected to her cognitive development and understanding of her natural and social worlds.

b. Science learning in the classroom is more effective when it starts with problematizing a familiar context. So, you use the students' social context to create a situation of cognitive conflict, and provide students with resources to resolve that conflict. You facilitate a process of enquiry by encouraging self- and peer-evaluation, providing opportunities for discussion on what children learn as well as any new theories or conclusions they arrive at, and helping them identify opportunities for further study. This should be seen as a continuous process.

c. It is important to welcome all kinds of responses in the classroom. Give equal weightage to the validity testing of all ideas that students offer, and help students select more accurate responses based on the evidence **they** come up with. We need to avoid giving ready-made answers, especially during the early stages of science learning.

What kind of science education is important at the middle-school level for students who don't intend to engage with it academically after high school?

In the emerging context, democratic societies are becoming very complex. There is an increasing threat of technological dominance, information overload, and unequal power and resource distribution across the globe. At this stage, we need to create citizens capable of taking active part in a democratic society. The process of teaching and learning of science has some intrinsic values associated with these broader values. Good quality science teaching, even till high school, can help achieve this goal.

Your thoughts on some students having a 'natural aptitude' for science?

Since humans are inherently curious, I believe that if taught well, science can be made interesting to all or, at least, most children. Such teaching acknowledges and respects each students' alternative conceptions. So, we pose problems relevant to the students' real-world experiences, and build

context from their existing knowledge base. We choose practices that empower each child in engaging with the process of science, encourage the inclusion of a variety of creative elements, and help students find their own voice. Also, we present science as a social endeavor, not a product of just a few brilliant minds.

Your perspective on a science teacher's role.

A teachers' role is crucial. To help children cultivate an interest in science, science teachers need to present science in a social context, encourage students to participate in the culture of science, and generate science knowledge.

They also need to provide a culture of disciplined thinking, help students see coherence in concepts, and encourage creativity. Teachers can help students develop the ability to design experiments, an integrity in conducting them and towards available evidence, the willingness to hold ideas or even conclusions tentatively rather than dogmatically, and an empathy towards one's surroundings. I think it is a science educator's responsibility to instill these values in students, and design her pedagogy accordingly.

What are some of the most important challenges that science teachers face?

a. The biggest challenge is dealing with students' misconceptions. While good content knowledge has no substitute, knowing the most widely accepted answer is not enough for a science teacher. Teachers need to be familiar with the potential misconceptions that students associate with a science concept, as well as specific pedagogical interventions to address these misconceptions. Interestingly, you will find that these misconceptions are relics of history — even some of the most well-known scientists have held similar views in the past.

Some aspects of this challenge can be addressed by planning a teaching sequence that allows you to gradually build an understanding of the key concepts in a topic. In this way, you can minimize the need for children to make a huge leap at the end of the lesson.

b. Another challenge is integration. It is important to look at science without fragmentation, but how do you achieve this in the classroom? Giving a word problem on finding the running speed of a Cheetah does not integrate biology with physics. In contrast, if you want to understand the functioning of the heart, you need to understand the essence of force, pressure, Pascal's law, etc. This requires an integration of concepts in physics with concepts in biology.

c. It may not be possible to teach or introduce any science concept at the middle-school level in a 'complete' way. Attempts to do this tend to be unproductive. You will find that most students in your class don't understand these concepts and, often, ask very fundamental questions that we can't answer.

A development in science education that you find exciting?

While no single method or strategy is effective across diverse contexts of science teaching and learning, project-based or problem-based teaching effectively addresses the goals of science education till middle school. I also think if students find appropriate and relevant science articles/reference materials, they will definitely read them. Humans, by nature, want to 'know'. A teacher needs to motivate this desire to know more by providing challenging problems or contexts. Design and technology education may be another exciting emerging direction in science education.

Thank you, Saurav. A thought or question you'd like to leave our readers with?

Yes. A point that directly touches my profession is that the goals of science education are viewed very narrowly. But what if we were to engage with science education in alignment with the idea of Deweyan democracy? In other words, if democracy is seen as an ethical ideal for societies to operate on, and the essence of democracy is participation, what does the perspective and process of science offer to this goal? If the purpose of all education is to prepare citizens to actively engage with and participate in democratic decision-making processes, what would we choose to teach in science? And how would we teach it?