i wonder...
REDISCOVERING SCHOOL SCIENCE

Image Credits

Front cover: Spacewalk with oxygen supply chest pack. Credits: NASA's Marshall Space Flight Center. URL: https://www.flickr.com/photos/nasamarshall/17803598593/in/photostream/. License: CC-BY-NC.

Back cover: Sparkler. Credits: KAVOWO. URL: https://pixabay.com/photos/sparkler-spark-fireworks-light-4724867/. License: CC0.

Advisors
Manoj P, Rajaram Nityananda, S Giridhar, and Sudheesh Venkatesh

Publication Coordinators
Shantha K
Shahanaz Begum

Illustrations
Vidya Kamalesh

Magazine Design
Zinc & Broccoli
www.zandb.in

Printers
SCPL Bangalore
www.scpl.net

Editorial

How do we teach science? Our most common approach is to focus on introducing children to a core of carefully chosen foundational concepts, theories, models, and ideas that have marked our progress in science. Support this with a description of the experiments that validate this knowledge. Share how these undergird natural explanations for real-world phenomena in and around us. Also highlight how this knowledge helps us make increasingly accurate predictions, develop new technologies, connect different domains, and solve complex problems. The implicit hope is that this is sufficient to enable students to extract an understanding of how we know what we know and why we believe it. Also, that it will equip students with thinking and reasoning skills that they will choose to apply not just to their practice of science, but also to a wide range of practical problems outside it. Many studies suggest that this is rarely the case.

What do children learn from this approach? They encounter our best understanding of the natural world as a dehumanised, decontextualised skeleton of facts. Facts that are often quite distant from what children can perceive of the natural world through their own senses. To children, they may seem more like the effects of magic than the tentative yet reliable results of a rigorous social process of constructing knowledge from careful observation, experimentation, and interpretation. Even when children succeed in memorising many of these facts, they may not know them with the exactness and intimacy that nourishes the ability and courage to make 'free', well-reasoned choices in action and thought. How do they relate to scientists? Seen mainly through the singular lens of their achievements, children may think of scientists as being extraordinary yet one-dimensional characters rather than flawed yet whole humans, like themselves, who often struggle and persevere in the face of personal and societal obstacles. For children who come from underrepresented groups in science, the gulf can be even wider. What about the process of inquiry? Often, children are first introduced to this process through observations and experiments involving instruments and reagents that are expensive and unsafe to play around with. When so, children may welcome the certainty of being told what to do and how to do it. And may see the experience mainly as a test of how closely their own results lend themselves to certain predetermined absolute and certain conclusions. This can interfere with their ability to experience the curiosity, creativity, frustrations, errors, failures, inspiration, and uncertainty of discovery.

Many articles in this issue highlight this challenge and explore interesting possibilities. Uma Sudhir suggests that when teachers connect their own misconceptions about the atomic theory with the instruction they received in school, they are better equipped to examine and choose the resources and approaches that they use to teach it. Arvind Kumar suggests that children develop a more critical understanding of the content of science when allowed to retrace the human choices that have shaped its history or discover it through their own inquiry. Vijay Upadhyay retraces the discovery of oxygen through the many people, ideas, and experiments that led up to it. Steven Carr and Durgadas Kasbekar share how disagreements between scientists strengthen scientific reasoning; and how readily well-reasoned theories from eminent scientists are abandoned when countered by evidence. Varun Sharma reminds us how the remarkable naturalist and fearless conservationist M Krishnan was an average student with a keen curiosity and deep empathy for the natural world. Susheela Srinivas shares how Dorothy Andersen, who made ground-breaking contributions to our understanding of cystic fibrosis, remained undaunted by gender stereotypes in both her professional and personal life. Anand Narayanan suggests that children can infer the implausibility of a 'flat earth', on their own, through simple observations and experiments with inexpensive and easily available materials. Dhanya K shares how a well-designed inquiry-based approach into germination can help transform labs into spaces where children develop a more first-hand and direct knowledge of this process as well as the practice of science. Charles Eisenstein alerts us to the necessity to attend to what we know of local places through our care for them and our own capacity for reasoning rather than being guided solely by our culture's dominant problem-solving approaches. And Deborah Dutta shows how the simple act of growing food can connect classrooms with communities, allowing children to experience a relationship with the natural world that brings their many selves together.

How do **you** engage with this challenge? What possibilities have you explored in your practice? Share your experiences with us at iwonder@apu.edu.in.

Chitra Ravi
Editor