Science for All Americans: Timely or Timeless?

By Jo Ellen Roseman, PhD

Two decades ago, the United States was struggling to maintain its place in a rapidly changing and increasingly competitive global economy. The nation's leaders called for a new approach to education, particularly in science and mathematics. In 1989, the American Association for the Advancement of Science (AAAS) published *Science for All Americans*, and it was hailed as an important and pioneering first step, offering a coherent explanation of science literacy. Today, as the nation faces new economic challenges, strategies to improve science education are once again at the forefront. As we consider the next steps in science education reform, perhaps it's worth looking back to see where that first step has taken us.

The vision articulated in *Science for All Americans* was not the only way science literacy could have been defined and described: Indeed, *Science for All Americans* was shaped by competing visions and ultimately, by the compromises of the scientists, mathematicians, and engineers who contributed to it. What truly set *Science for All Americans* apart was its emphasis on the interconnectedness of knowledge: It linked ideas in the natural and social sciences, mathematics, and technology and related the history of scientific discovery to the nature of the scientific enterprise. It also identified common themes and habits of mind spanning all the disciplines that could serve as tools for thinking about them. Out of this effort emerged a coherent vision of the knowledge and skills every high school graduate would need for living and working in the 21st century.

This vision for high school graduates provided little guidance on precisely what elementary, middle, or high school students should know as they progress toward science literacy. To start using the richly interconnected stories in *Science for All Americans*, it was necessary to tease them apart into statements of specific ideas and skills students would need to learn at each grade level. *Benchmarks for Science Literacy* was the result, and the national and state science standards following it took a similar approach.

With its bulleted lists of precisely what students should know and be able to do in grades K–12, *Benchmarks* was designed to help identify instructional materials that could help students become science literate and assessments to help teachers monitor progress. To compensate, at least in part, for the starkness of the lists, *Benchmarks* included brief essays to provide more context for the ideas to be learned.

Acting on *Benchmarks'* recommendations proved challenging: Few if any existing instructional materials had been designed to teach its ideas, teachers lacked the time or resources for developing lessons from scratch, and existing assessment items were not suitable for probing students' conceptual understanding of these ideas or for monitoring students' progress. Though *Benchmarks* and the national science standards emphasized depth of understanding over breadth and eliminated unnecessary topics, details, and vocabulary that were fixtures in the traditional science curriculum, it was still possible to lose sight of the larger science literacy goals while focusing on each bulleted idea. With the publication of *Atlas of Science Literacy* and its conceptual strand maps, teachers and other educators could consider the interconnectedness of this knowledge and how students' understanding might grow from grade to grade.

Neither *Benchmarks* nor *Atlas* specified how a set of related ideas might transform into a coherent story or how connections between ideas might be made clear to students. These difficult tasks are typically the responsibility of curriculum developers, textbook publishers, and the teachers who use them. Research has shown science knowledge exists as bits and pieces of ideas for many students, who do not appear to fill in the gaps on their own. What is more, textbooks and teachers must help students connect general principles and abstract ideas to the world around them through experiences with natural phenomena and activities that guide them in making those connections. We have recognized this need and are developing models illustrating how this might be done for different topics.

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Of course, all this requires a consensus on the science ideas we want students to learn and a steadfast focus on those ideas in textbooks, teaching, and testing. It is sobering to reflect on the significant resources already invested toward that end, yet heartening to realize how far we've come. Whether today's problems require an entirely new strategy or new standards remains to be seen. But the coherent vision of science literacy for all presented in *Science for All Americans* is surely as relevant and useful now as it was 20 years ago.

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