

Elementary Science Education in the K–12 System

Page Keeley, NSTA President



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“Any collection of things that have some influence on one another can be thought of as a system. Thinking of a collection of things as a system draws our attention to what needs to be included among the parts to make sense of it, to how its parts interact with one another, and to how the system as a whole relates to other systems.”—American Association for the Advancement of Science (AAAS) 1989, p. 166.

An essential component of higher-level thinking is the ability to think about systems—how parts relate to one another and to the whole. Systems thinking can help us see and understand science education in new ways. This is why one of the goals of my presidency, a goal also shared by President-Elect Pat Shane, is to take a K–12 system approach to supporting the need for high quality elementary science education in every school district.

Elementary science is a critical part of the K–12 science education system. Tragically, the enactment of No Child Left Behind (NCLB) has greatly diminished the time spent on teaching science in many elementary schools. In some schools that have not attained adequate yearly progress (AYP) status, science is not taught at all, and teachers are told point blank not to teach science so they can spend more time on reading and mathematics. The good intentions of NCLB eroded the fundamental foundation for science in our K–12 education system. One of the crucial parts for a fully functioning system is missing or damaged.

Learning in science begins in early childhood. This is a time when young minds are curious about science and ready to engage in the practices and language of science that form a foundation to be built upon and strengthened throughout a student’s K–12 education. Young children bring to science views of the natural world and ways of thinking that have a major impact on their learning as they progress from one grade level to the next. Ignoring these ideas and delaying the development of science language and practices until students formally encounter science in middle school certainly violates what we know about systems: If one part is missing, it affects the other parts of the system.

“Something may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected.”—(AAAS 1994, p. 264).

We know science education is not working well for many students in the United States. We also know our system of education is strongly connected to our ability to compete in an increasingly global economy dependent on highly skilled workers in the science, technology, engineering, and mathematics (STEM) fields. One solution in the past few years has been to funnel more funds into Advanced Placement and International Baccalaureate courses in high schools, undergraduate and graduate education, recruiting qualified secondary science teachers, and increasing the rigor of middle level classes. These strategies might work if they match well with the other parts of the system. However, we can’t expect students who have missed six years of science to suddenly be prepared to take on more demanding opportunities to learn science in middle and high school. All the parts of the system that should include the K–6 years of knowledge and skill building are not there to support the cumulative steps that contribute to high levels of learning.

When we look at the progression of learning over time, starting with fundamental ideas and skills developed in preK–2 and built throughout the elementary years, teachers are often surprised to find middle school and high school students have major misconceptions about fundamental ideas developed early on that went unchallenged through school. They are also dismayed to find there are often large gaps in students’ conceptual understanding of even basic ideas in science. Is it reasonable for a school district to eliminate science for six

years and then expect students to fill in the blanks in middle and high school? Science learning is a cumulative process. It is time to give science a foothold equal to that of reading and mathematics in the K–6 curriculum.

We all have a responsibility to advocate for high quality elementary science programs, increased time spent on teaching elementary science, and opportunities for elementary teachers to get the professional development they need to teach science well. The burden for elementary science advocacy can't be placed solely on the elementary teachers who like to teach science. Middle school and high school teachers, I implore you to speak out to your administrators and help them understand the ripple effect the demise of elementary science has had on student learning in your grades. Your teaching is affected significantly by the loss of elementary science!

You can also push for more elementary science professional development. Bring a team including elementary, middle, and high school teachers from your district to an NSTA conference. Stay tuned for more information about an upcoming NSTA Research Dissemination Conference (RDC) on linking research to practice in elementary science, to be held at the 2010 NSTA National Conference in Philadelphia. Encourage the formation of elementary science professional learning communities to learn how to best restore science to the curriculum and advance K–6 science learning. Encourage a K–6 team to attend NSTA's August 2009 summer institute on Professional Learning Communities in Science.

Public support for early science education is important as well. Parental involvement is key to increasing the public's understanding of why science education must begin in the early grades. The new NSTA Science Matters website is a great a source of material for helping parents understand the importance of elementary science.

Even though not all of us teach elementary science, we have a collective responsibility to ensure every student in every grade has the best possible science education. That is why we as individuals must act as a system. A simple K–2 systems learning goal says, "When parts are put together, they can do things that they couldn't do by themselves" (AAAS 1994, p. 264). Imagine what the output could be at the end of grade 12 if we all band together to strengthen our K–12 science education system to include six years of rigorous, high quality elementary science. After all, each part of the system, including elementary science, contributes to the whole. We can't continue assuming we will increase our schools' output of students who will become our next generation of scientists and engineers without ensuring an input of elementary science learning into the K–12 system.

References

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[Elizabeth Snoke Harris](#), Editor