Elementary Science: Left Behind?

In the United States, beginning with Sputnik in the late 1950s to the current reports of the Third International Mathematics and Science Study (TIMSS), uninspiring and bland levels of students’ achievements in science have been an impetus for reform in science education. As such, stakeholders in and outside the educational realm have been concerned about the future of science and have made considerable strides to improve science curricula, teaching, and student learning through research exploring inquiry-based pedagogies.

However, the strides made to improve science through “meaningful learning” and inquiry-based pedagogy stand in stark contrast to the present politically charged climate, where science teachers at all grade levels and schools are facing strong directives to improve basic reading, writing, and mathematics skills. As a result, science class time, especially in the elementary grades, has been reduced to a vestigial organ whereby science is taught using traditional approaches or, in the worst cases, has been excised from the curricular body. As science educators working with elementary school teachers, our observations confirm this. Our concern rises exponentially when we hear teachers say, “My principal wants class time spent on reading, writing, and mathematics. If I have time after that, then I can teach science—if I want to.”

With the social and political demand of “back to basics” accountability, fixed standards, and improved high-stakes test scores, what will be the long-term impact of the marginalization of elementary science in the nation’s schools? What will happen to the momentum of educational reform aimed at inquiry-based pedagogy? What happens as the small reserve of future American scientists continues to diminish? Finally, what becomes of the goal of fostering a scientifically literate population?

Given the single-minded focus of national policy centered on students’ achievements, one is led to ask what research findings say about inquiry-based science teaching and student achievement? Why is science in the elementary grades so marginalized? Studies quantifying student achievement and the impact of inquiry-based science programs are limited at this point. While qualitative findings provide rich insights, this editorial highlights a few quantitative studies related to student achievement and inquiry-based pedagogies.

From a brief examination of the research, it is clear that consensus has not been reached on whether or not inquiry-based pedagogy increases student achievement in science. In fact, different studies often show contrasting results. For instance, Supovitz and Turner (2000) and, more recently, Shymansky, Yore, and Anderson (2004) showed that there were no significant students’ achievement gains in science as a result of professional development in a longitudinal study of science inquiry and literacy in the elementary grades (third and fourth). In contrast, however, the
following works have found that students exposed to inquiry-based pedagogy do better than those having text-based methods (Chang & Mao, 1999; Gerber, Marek, & Cavallo, 1997; Hunt, 1996; Johnson & Lawson, 1998; Musheno & Lawson, 1999; Von Secker & Lissitz, 1999). Recently, the superintendent of the Valle Imperial Project in Science (VIPS) in Imperial County, California, reported that, after 4 years of implementing inquiry-based (kit) instruction combined with intense professional development using literacy strategies, the project data suggest that the longer the students were involved in the inquiry-based program the higher the science achievement scores. Furthermore, students’ reading, writing, and mathematics scores improved as well (National Science Resources Center, 2001).

The point is that the vote is still out and important data are still coming in. In the meantime, teachers and administrators are leaving science instruction out of the elementary curriculum while literacy dominates the daily classroom experience. The result is an elementary curriculum that is fractured, unconnected to context, and out of balance. This disconnect of science to math, social studies, and literacy and its marginalization in the elementary curriculum shows its subversive effects ranging out from low state scores on SAT exams to the low performance of American students on the TIMSS and Program for International Student Assessment (PISA) reports. So, while administrators and teachers are focused on frantically trying to improve reading, writing, and mathematics scores on high-stakes testing, as prescribed by the No Child Left Behind Act, it is important to recall that science in the elementary grades is being left behind. Despite the lack of consensus regarding the impact of inquiry-based science teaching on student achievement at this time, it is important for science educators to pause and consider what is happening to elementary science education and inquiry-based reform during this interim. Furthermore, there is a need to consider where the continued political push for high-stakes standardized testing may lead? In other words, in an “age of constant assessment and accountability,” all aspects of science education should be the “object of substantial, continuing, and cumulative knowledge based on the best research practices” (Bybee & Stage, 2005, p. 74). In light of this, what will careful examination of our own research agendas, research practices and reform efforts related to the impact and future of inquiry-based science education reveal?

References

