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COMMENTARY

Improving Elementary Science Instruction Through Professional Development

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The status of science education, particularly in elementary schools in the U.S., is weak. National standards specify that science education should begin in the early grades, yet the amount of instructional time spent on science has declined over the past decade. Elementary teachers report feeling less qualified to teach science than other academic subjects, in terms of both content and subject-specific pedagogy. Until science is a central component of classroom instruction, we cannot anticipate improved student learning in science. Reform strategies in science education increasingly focus on teacher professional development as a central component for promoting change.

Judith Haymore Sandholtz and Cathy Ringstaff are conducting a longitudinal research project investigating the extent to which teacher professional development leads to changes in science instruction in early elementary classrooms. The research focuses on participants in a three-year professional development program that provided science assistance for K–2 teachers in 16 small and rural school districts in California. Given that implementation of instructional strategies is a gradual process, the researchers did not expect to find substantial changes early in the professional development program. However, their research found significant changes in teachers' content knowledge, self-efficacy, and instructional practices in science by the end of the first year (see "*Reversing the Downward Spiral of Science Instruction in K-2 Classrooms*"). These unexpected findings led them to question whether these short-term changes would decline or be sustained during the second year.

In "*Assessing the Impact of Teacher Professional Development on Science Instruction in the Early Elementary Grades in Rural U.S. Schools*," the authors report that the changes after the first year were largely sustained in the second year. Teachers experienced a significant increase in their content knowledge each year of the professional development (physical science in year one and earth science in year two). As teachers gained more content knowledge, their confidence in their ability to teach science also improved. Their overall self-efficacy scores increased significantly after each year of the program. In the second year, teachers continued to devote more instructional time to science as compared to pre-program. Rather than teacher-centered strategies, teachers adopted more student-centered approaches and incorporated more science demonstrations, investigations, and experiments. They also significantly increased the extent to which they integrated science with other subjects. Differences in school-level policies and resources influenced science instruction in participating teachers' classrooms. For example, schools differed in the extent to which teachers could integrate science into mandated mathematics and language arts programs and in the amount of time available for teachers to work with peers on science curriculum. Factors in the broader context, such as the emphasis on mathematics and language arts in standardized testing, also influenced the amount of instructional time teachers allotted to science.

These research findings suggest that teacher professional development has the potential to build teachers' knowledge and skills in science, which can lead to improvements in teaching practices. The targeted design of the professional development program likely contributed to the gains that were achieved in the early stages of the program. However, variations and shifts in school-level support suggest that contextual factors will be critical in sustaining changes in teachers' instructional practices over time. With a grant from the National Science Foundation, the authors will be examining the longevity of the professional development program's effects on teachers and the persistence of changes in classroom practice beyond the three-year funded program. Understanding the duration of professional development effects on science instruction and the barriers to long-term changes has practical implications for science education reform.

The full study is here: Sandholtz, J.H. & Ringstaff, C. (2013). Assessing the impact of teacher professional development on science instruction in the early elementary grades in rural U.S. schools. *Professional Development in Education*, DOI: 10.1080/19415257.2012.751044

The first year of the study is discussed in Sandholtz, J.H. & Ringstaff, C. (2011). Reversing the downward spiral of science instruction in K–2 classrooms. *Journal of Science Teacher Education, 22*(6), 513–533.

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