Professional Development of K-12 Science Teachers: History of Reform and Effects of a Science-Technology-Society (STS) Approach in Bringing About the Reform

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Professional Development: Need and Role in Science Education Reform

Several recent science education reform efforts around the world (for example, Project 2061, American Association for the Advancement of Science, 1994; Millar & Osborne, 1998) reflect a common concern for providing science education that is relevant to the lives of all students. Achieving such reform is a complicated task that includes providing specific professional development opportunities to teachers. Traditional 'in-service days' as the norm in professional development has been criticized as inadequate and inappropriate in the context of current educational reform efforts, and as being out of step with current research about teacher learning (Darling-Hammond & McLaughlin, 1995). A new perspective on professional development of teachers has become a crucial first step in the reform process. Lieberman (1995, p. 592) notes, "The conventional view of staff development as a transferable package of knowledge to be distributed to teachers in bite-sized pieces needs radical rethinking."

Making science relevant to the lives of students requires, among a variety of other factors, a classroom environment in which the students can be actively involved in making meaning of the information within a relevant context. Teachers need to learn to create a suitable instructional environment and employ strategies that encourage active questioning and identification of issues and answers by students. They need to be able to encourage students to challenge the information presented and discuss its personal relevance. Development of these abilities require carefully designed, sustained, long-term professional development opportunities that actively involve teachers in the learning process.

Professional Development or In-service Education: What's the Difference?

Staff development activities have traditionally been packaged into short-term, discrete, in-service sessions or workshops. Most of these workshops tend to follow a somewhat standardized format-an outside expert (or consultant) 'blows in, blows up, and blows out' while teachers are expected to passively receive whatever was 'blown up' and try to make use of it in their teaching practice. Training-based discrete in-service workshops may be useful for delivering certain types of information such as methods for organizing portfolio assessment of students' work (Little, 1993) or teaching specific skills such as the use of a particular computer software package (Grant, 1997). However, their usefulness as the dominant channel of professional development in diverse contexts has been widely criticized.

The recent criticism of the "training" paradigm and the form of professional development associated with it (Darling-Hammond & McLaughlin, 1995), advances in research on adult learning (Wood & Thompson, 1980) and the change process (Fullan, 1993), and identification of new needs for science education reform have led to new views about professional development and its role in improving education. New guidelines have emerged for the professional development of science teachers in order to facilitate the desired reform. These are best illustrated by the Standards for Professional Development for Teachers of Science, which are guided by a spirit of "change throughout the system" (National Research Council, 1996, p. 72). Accordingly, the standards encompass shift in several areas of emphases in the professional development of science teachers, which reflect the changing conception of the role of professional development in educational reform as well as the role of teachers in the professional development and reform process.

Moving from In-service Education to Professional Development: An STS Based Approach

School education in the sciences must change to reflect the changing nature of science as well as the changing notions of desirable science education. Two developments-the changing notion of in-service education and the changing notion of the desirable science education-have led to an urgent need for effective professional development programs that address both of these developments. However, one does not find an abundance of such programs with proven track records.

Using an STS approach (NSTA, 1990-91, pp.47-48) to both science instruction and professional development of science teachers, the Iowa Chautauqua Program (ICP), developed at the University of Iowa (Iowa City, Iowa, USA) during the early 1980s, emerged as an exemplary model of professional development for K-12 in-service science teachers. It was recognized and validated by the U. S. Department of Education as a model professional development program worthy of dissemination and emulation. Consequently, the ICP model has been emulated in several states in the USA and in several countries worldwide during the last decade (Dass & Yager, 1999). The key elements of the program, which make ICP an exemplary model of professional development reform, include learning experiences based on research compatible ideas actively involving teachers, expectation from teachers to practice what they learn, feedback and follow-up support, and an on-going approach involving collaborative efforts. Central to these key elements is the STS instructional approach-using real-life situations, questions, concerns, and problems as the context and starting points for studying science.

The ICP model is based upon the idea that "in-service education is both a strategy for specific instructional change as well as a strategy for basic organizational change in the way teachers work and learn together" (Blunck, 1993, p. 132). This basis of the ICP model is congruent with the current notion of professional development for continuous enhancement and ongoing learning of teachers. The STS approach is poised to provide real-life relevance to school science education. Thus, an engagement with the STS approach through the ICP model addresses both of the developments mentioned above. Further, ICP model and the STS approach embedded within it have a track record that proves their effectiveness in bringing about the desired reform both in general professional growth of teachers and in specific science instruction in their classes (Blunck & Yager, 1996). The fact that this 'package' (STS and ICP) of professional development model has been emulated successfully in several different settings worldwide attests to its adaptability to local educational realities and priorities. Thus, the STS approach presented through the ICP model of professional development offers undeniable promise of contributing to educational reform much desired around the world during the present century.

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