Reform efforts in science education have emphasized the increasing importance of preparing effective teachers. In *The Future of Science in Elementary Schools: Educating Prospective Teachers*, Raizen and Michelsohn (1994) stress a number of qualities associated with effective science teachers. Among them are:

- an appreciation of scientific reasoning skills (e.g., posing questions, designing investigations) and “habits of mind” (e.g., desire for knowledge, skepticism), as well as an understanding of how to foster them among students;
- a specialized knowledge of appropriate ways to represent science to children (e.g., analogies, experiments, demonstrations);
- an awareness of children’s informal ideas, prior knowledge and experience, especially as it relates to science concepts with which they are likely to experience difficulty; and
- the ability to orchestrate science learning through the use of various organization structures, including cooperative groups.

In a review of Raizen and Michelsohn’s work, Penick (1994) suggests that these recommendations fall short of what needs to be done. He asserts:

(Raizen and Michelsohn) should advocate a real program, one with cohorts of students who stay together for years, long enough to really form a cohort. Within those cohorts, weave modeling of desired instruction, science and education, all within a research-based rationale and framework. Rather than merely praising reflective teaching, why not discuss theory and goal driven reflections. We rarely see what we are not looking for. Our teacher education programs must make clear the roles and goals of students as well as teachers. Without specific understanding and awareness, our teachers will see little when they look at their own teaching.

In this chapter, we will describe a program that implemented several of Penick’s suggestions. This elementary science teacher preparation program was crafted using the various components of pedagogical content knowledge (PCK) as guideposts to coursework, assignments, field placement experiences, and program structure while attempting to meet the professional development needs of preservice teachers. We begin by establishing the context for the chapter with an overview of the teacher preparation program. Next, we look specifically at program components and correlate them with the knowledge bases for teaching, particularly PCK. This is followed by a review of recent research findings that report the impact of the teacher preparation program on preservice teachers’ first experiences teaching...
science to elementary school children. Finally, we draw on the apparent successes and challenges of the teacher preparation program to make suggestions regarding further applications of the construct of PCK in science teacher preparation.

OVERVIEW OF PROGRAM

The two-year teacher preparation program described here was funded by a grant from the National Science Foundation. In this chapter we provide an overview of the program; however, more information about the program is available elsewhere (see Krajcik, Blumenfeld, Starr, Palinesar, Coppola & Soloway, 1993; Krajcik, Starr & Zembal-Saul, 1997). In general, elementary education majors entered the program in their junior year at the university and complete the program with student teaching four semesters later. The preservice teachers progressed through the program as a cohort, taking the majority of their classes together. In this chapter we will focus on the first two semesters of the preservice teachers’ coursework and teaching experiences. The data that are included here were drawn from two consecutive cohorts of preservice teachers, those who began their preparation in the fall of 1991 and those who began in the fall of 1992.

Program Features

The elementary science teacher preparation program was organized around several key features -- (1) integrated coursework in science content, science methods, educational foundations, and practicum; (2) assignments and experiences designed to integrate key concepts from coursework, and (3) multiple opportunities to teach. Each of these features was situated in a consistent framework of inquiry-based science teaching and learning (Magnusson, Krajcik, Borko, this volume).

Coursework. Program coursework was highly integrated in an effort to help the preservice teachers synthesize their developing understanding of teaching science. The preservice teachers were enrolled in a chemistry course during the first semester of the program and a physics course in the second semester. Both were closely coordinated with a year-long science methods course in which they were concurrently enrolled. The science methods course helped the preservice teachers represent concepts that they were learning in chemistry and physics in ways that were meaningful to elementary school children. The preservice teachers were also enrolled in foundation courses -- Educational Psychology and Introduction to the Elementary Classroom. Educational Psychology emphasized instruction, learning, and assessment, while Introduction to the Elementary Classroom focused on classroom operation, management of various participation structures, individual differences among learners, and general issues associated with education.