ABSTRACT. A professional development program for 18 teachers was conducted over a two-year period. The participating teachers taught in intermediate schools (students aged 11–13) and secondary schools. The teachers worked collaboratively to improve their mathematics teaching, with encouragement to reflect on their practice but with minimal instruction from the researchers. Results, as defined by change in teaching practices, beliefs, and reflections, and student achievement, indicated that the collaborative program was particularly useful for experienced secondary school teachers but less useful for intermediate school teachers. We concluded that this type of professional development was most useful for teachers who had sufficient knowledge of mathematics; these teachers were able to focus on pedagogy and to draw connections between aspects of the mathematics they taught, without recourse to a specialist’s advice.

The professional development program described here arose from two issues. The first issue, addressed in different ways in other professional development projects, was the need to enable teachers to make lasting changes to their teaching, a process that would take considerable time and professional involvement. The second issue addressed the difference between teaching in intermediate schools and in secondary schools. We believed that offering a program with teachers from both levels would give the teachers the opportunity to learn aspects of pedagogy from one another and to better understand the transition students faced.

Our project required teachers to decide what changes they wanted to make to their teaching, to evaluate these changes, and to discuss changes with other teachers as well as with the researchers. The aspects of this project that we discuss here include changes in teachers’ beliefs and classroom practices, the effect of teachers’ integrated or connected knowledge of mathematics, and the role of professional conversation in these changes. Other aspects are discussed in Britt, Irwin, Ellis, and Ritchie (1993).
A LOOK AT PROFESSIONAL DEVELOPMENT PROGRAMS

Teachers’ Beliefs and Classroom Practices

Professional development programs for teaching mathematics have helped bring about change in teachers’ beliefs and classroom practices. Most of these programs have been conducted with either elementary, middle (intermediate), or secondary school teachers, but seldom with teachers from more than one school level. Programs for elementary school teachers include those of Carpenter, Fennema, Peterson, and Franke (e.g., Franke, Carpenter, Fennema, Ansell & Behrend, 1998), Schifter and Simon (e.g., Schifter, 1998), and of Cobb and colleagues (e.g., Cobb et al., 1991). Programs for middle school teachers include those of Snead (1998), Sowder, Philipp, Armstrong, and Schapelle (1998), and Swafford, Jones, Thornton, Stump, and Miller (1999). Programs for secondary school teachers include those of Jaworski (e.g., 1994) and Shulman and Grossman (1988, cited in Brown & Borko, 1992). Programs at elementary as well as secondary levels have focussed on improving teaching by developing teachers’ knowledge of students’ mathematical concepts and by encouraging teachers to reflect on the effects of different aspects of their teaching.

Schifter and Simon’s (1992) program, at the elementary level, emphasized that teachers learn or expand specific mathematical concepts and then reflect on the processes of that learning. Like Schifter and Simon, Cobb et al. (1991) emphasized the importance that teachers negotiate their own changes in classroom practice, with ongoing support from researchers and colleagues. Snead (1998) as well as Sowder, Philipp, Armstrong & Schapelle (1998) demonstrated the benefit of one- or two-year courses and discussions on content and pedagogical content knowledge on classroom practice. In Jaworski’s study (1994), teachers and researcher focused on the balance needed between mathematical challenge, sensitivity to students, and management of learning.

In none of the programs did the researchers tell the teachers what to do; rather, they trusted the teachers to find their own ways of improving the teaching of mathematics. Several of the studies found that once teachers started to observe their students carefully and to reflect on the effect of their teaching, they moved from a focus on transmission of knowledge to a focus on guiding students toward better understanding. Cobb et al. (1991) especially noted a change in a teacher’s beliefs as being crucial to the process of pedagogical change, an aspect also discussed by Carpenter Fennema, and Franke (1996), Schifter (1998), and Jaworski (1994).