Chapter 1.3.1
Mathematics Educators’ Knowledge and Development

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This chapter focuses on mathematics educators. Generally, mathematics educators include educators who facilitate the learning of mathematics, as well as educators who facilitate the teaching of (or learning to teach) mathematics. There is much in common between the knowledge and development of mathematics teachers and that of their educators, yet there are some distinctive characteristics of teacher educators’ knowledge which are worthwhile to examine (Zaslavsky & Peled, 2007).

1. Models of Educators’ Development

Zaslavsky & Peled (2007) point to a number of trends in recent years with respect to studies related to teacher education. One of these trends has to do with entering mathematics teacher educators into the picture. Researchers have started to conceptualize teacher educators’ role and knowledge for mathematics teacher education. Some papers deal with what is entailed in becoming a mathematics teacher educator, by self-reports and reflective accounts (e.g., Tzur, 2001), and others describe special courses for providers of professional development activities for mathematics teachers (e.g., Even, 1999) or programmes enhancing growth of mathematics teacher educators through their practice (e.g., Zaslavsky & Leikin, 2004).

Teacher educators can be seen both as learners and as facilitators of learning. The “content” related to their learning involves beliefs, knowledge, and practice as well as some meta-cognitive skills, such as exhibiting awareness and employing reflection. A major concern of providers of professional development activities is the need to foster teachers’ reflective practice. Theories of reflective practice follow Dewey’s emphasis on the reflective activity of both the teacher and the student as a means for advancing their thinking (Dewey, 1933; Schön, 1983, 1987). The notions of reflection on-action and reflection in-action have been acknowledged as significant components contributing to the development of teachers as well as teacher educators’ knowledge and practice. The importance of reflecting on one’s own practice and learning experiences is expressed by Lerman (2001): “Reflective practice offers a view of how teachers act in the classroom as informed, concerned professionals and how they continue to learn about teaching and about learning,
about themselves as teachers, and about their pupils as learners” (p. 39). Thus, teachers and teacher educators can be seen as constant learners who should continuously reflect on their work and make sense of their experiences. From a social-practice theory, which stems from Vygotsky’s theory on the social nature of the learning process (Vygotsky, 1978), mathematics teachers and mathematics teacher educators are often regarded as two interrelated communities of practice enhancing each other’s development.

A key issue to be addressed in professional development of mathematics educators is the learning of mathematics. Cooney (1994, 2001) discusses two central constructs for mathematics educators—mathematical power and pedagogical power, which deal with teachers’ abilities to draw on the knowledge needed to solve problems in context (mathematical or pedagogical). Jaworski (2001) adds a third construct—educative power, which characterizes the roles that teacher educators may play in the process of enhancing teachers’ learning. This construct can be taken to include the ability of teacher educators to draw on knowledge that is needed for facilitating teachers’ mathematical and pedagogical problem solving.

Various models have been suggested by scholars attempting to describe teacher practices as well as teacher learning. In this chapter I describe models that have been useful to me in my own work. A model that provides a lens through which to examine mathematics educators’ practices is suggested by Jaworski (1992, 1994) in her Teaching Triad, which is consistent with constructivist perspectives of learning and teaching. Her triad includes three elements, which are often inseparable: the management of student learning, sensitivity to students, and the mathematical challenge. According to Jaworski, “this triad forms a powerful tool for making sense of the practice of teaching mathematics” (1992, p. 8). By substituting “students” with “learners”, and “mathematical challenge” with “challenging tasks”, a more general triad is obtained (Zaslavsky & Peled, 2007) that may be applied to other learners, for example, mathematics teachers, in the context of their learning.

Jaworski’s Teaching Triad can be used not only for making sense of classroom practices, but also for highlighting the different kinds of knowledge teachers need for teaching mathematics, which concur to a large extent with some of Shulman’s categories (1986).

Steinbring (1998) offers a model that provides insight to the mechanisms that facilitate learning of both students and teachers in the course of a mathematics lesson. His model looks at the learning of students and their teacher as two autonomous systems that build on each other. In this model, reflection plays a critical role in both student and teacher learning. While students learn by engaging in a task, interpreting and making sense of their solutions, and reflecting on and generalizing them, the teacher learns from observing the processes students encounter, varying the learning offers, and reflecting upon the entire process. Similar to the modification of Jaworski’s model, by substituting in Steinbring’s model “students” with “learners” and “teacher” with “facilitator”, this mechanism can be useful for making sense of how various mathematics educators learn from their practice, including mathematics teachers, mathematics teacher educators, and mathematics teacher educator educators. As shown in Fig. 1.3.1.2, facilitators’ learning occurs as an