

EDUCATING PRACTICING MATHEMATICS TEACHERS: WHAT IS MISSING IN THE LITERATURE?¹

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This paper presents three problematic aspects in the current literature on the continued professional development of teachers: (1) the ill-defined nature of the field of offering education to practicing mathematics teachers, (2) the lack of information on the practice of mathematics teacher educators working with practicing teachers, and (3) the missing of research on the education of mathematics teacher educators.

The ill-defined nature of the field of offering education to practicing mathematics teachers

One of the problems that underlies the challenge of offering education to practicing mathematics teachers is the ill-defined nature of the field, both the scholarly field, and the practice itself. This is reflected, for example, in the lacking of a common word or phrase to refer to educators working with practicing teachers. Common terms are providers of professional development (PD), professional developers, teacher developers, facilitators, teachers of teachers, teacher-leaders, teacher educators, and in-service teacher educators. In many cases, the different terms used reflect different views regarding desired practice of educating practicing teachers. For example, the term ‘facilitator’ conveys a specific meaning regarding the practice, of assisting teachers by encouraging them to find their own solutions to problems or tasks whereas ‘professional development provider’ sounds more business like, and infers lesser participation in the process of defining and achieving the goals of the participating teachers.

In addition, the group of mathematics teacher educators itself is not well defined. In many countries, the group of educators who work with practicing teachers includes

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university faculty as well as school teachers; educators whose major occupation is to work with practicing teachers and those who do it only as an add-on part-time temporary activity; those who work also with prospective teachers and those who work solely with practicing teachers.

Moreover, the nature of the educational opportunities for practicing teachers is ill-defined. In many cases, there is no professional development “system”. For example, Wilson and Berne (1999) describe the nature of professional development for in-service teachers in the USA: “Some teachers pursue any opportunity to learn with passion, while others attend workshops when mandates arrive in their school mailbox” (p. 197). The case in Israel is similar, in spite of attempts to build a semi-formal professional development system in the 1990’s. The literature provides little information on the nature of this “random, sometimes voluntary, sometimes mandated, always fragmented system” (Wilson & Berne, 1999, p. 197), in the case of mathematics teachers, and whether there are differences that may exist among various countries. The apparently institutionalised professional development for practicing teachers in elementary schools in Japan in the form of a lesson study (Yoshida, 1999) suggests that there may be differences among countries. It also suggests that there may be differences between the nature of educational opportunities for practicing teachers who teach different grade levels in the same country.

Lack of information on the practice of mathematics teacher educators

The mathematics education literature suggests numerous ideas of how to design professional education experiences for practicing teachers of mathematics so that they have an impact on mathematics teaching and learning in school. However, a cursory review of the focus of the papers in the international *Journal of Mathematics Teacher Education* indicated that current empirical work tends to focus on the learning of (prospective and practicing) teachers who participated in professional education activities, and not on the nature of the practice of offering professional education. Accordingly, the literature offers only limited empirical information about the practice

of mathematics teacher educators working with practicing teachers. Moreover, the findings of a recent survey of research in mathematics teacher education (Adler, Ball, Krainer, Lin, & Novotna, 2005) showed that almost all of the empirical research related to teacher professional education consists of self-reports of teacher educators on their own work, and thus represent only a fraction of such work – solely that conducted by teacher educators who also publish in scholarly publications (some are internationally renowned university-based researchers). The survey further showed that almost all publications on research in mathematics teacher education came from countries where English is the national language, again limiting the information about teacher professional education around the world.

A glimpse at the nature of the practice of offering professional education for practicing mathematics teachers by people who are not university based, and at who they might be, is presented in Even, Robinson and Carmeli (2003). The study describes the work of two experienced junior-high school teachers who worked with 7th grade teachers in Israel on implementing a new mathematics curriculum programme – one of the 15 specific professional development strategies or learning experiences described by Loucks-Horsley, Hewson, Love, and Stiles (1998). Both teachers were in their last year of participation in a three-year program that prepared them to be educators of practicing teachers of mathematics – the MANOR Program (Even, 1999a, 2005). Although their background and work conditions were quite different from each other the study revealed that there were similar characteristics in their work practices with teachers. The most salient ones were acting out lessons, analyzing principles of the new curriculum programme, encouraging the teachers to explicate their concerns, and asking teachers to solve concrete practical problems related to the reservations they had about specific components of the new curriculum programme. Stein, Smith and Silver (1999) reported similar but also other practices of university-based educators who attempted to help teachers learn new paradigms of teaching and learning mathematics, such as, confronting teachers with conflicts between new ideas and their existing beliefs and practices. The empirical literature does not inform us whether these or other are common

practices of offering professional education for teachers of mathematics. Previous rhetoric suggests that there is a need to change traditional ways of offering professional education for teachers of mathematics (Loucks-Horsley, et al., 1998; Wilson & Berne, 1999), but these claims are often based on beliefs, and not on systematic empirical research on the nature of the practice of educating practicing mathematics teachers.

Missing research on the education of teacher educators

The past two decades have seen substantial increase in scholarship on mathematics teacher education. Still, although publication of peer-reviewed articles, book chapters, and books about the education of prospective and practicing teachers of mathematics is on the rise, the education of mathematics teacher educators is rarely discussed in the scholarly literature, as exemplified by Elliot (2005).

The main reason for the limited literature on the education of mathematics teacher educators is that the need for adequate preparation for mathematics teacher educators is often neglected and until recent years, there were essentially no formal programmes that prepared mathematics educators to work with teachers in general, and with practicing teachers in particular (Zaslavsky, Chapman, & Leikin, 2003). Tzur's (2001) personal account on how he became a mathematics teacher educator through his practice highlights this lack of institutional and professional support. Thus, the literature has little to offer about possible ways to construct such programmes.

A pioneering programme for the education of educators to prepare them to work with practicing mathematics teachers is the MANOR programme in Israel, which was established in 1993 and operated until 2003. Not having an adequate theoretical or conceptual framework to serve as the basis for the design of learning experiences for teacher educators, MANOR drew on several theoretical and conceptual orientations that focus on learning knowledge and practice in general and teacher education in particular (Even, 2005). One is an approach that has been promoted in recent years for *student learning of mathematics*, and was adopted in MANOR to the case of *learning to educate*

teachers of mathematics. This approach reflects an amalgamation of a constructivist/cognitivist approach to learning with a socio-cultural approach. Another theoretical orientation on which MANOR drew is related to the learning of a practice, mainly the situated learning approach (Lave & Wenger, 1991).

The main findings of the research that was conducted within MANOR (e.g., Even, 1999a, 1999b, 2005) are related to the identification and examination of the types of educator development that are significant in and for the practice, aspects of curriculum design for the preparation of educators of practicing mathematics teachers, problems that are likely to be encountered and ways of addressing them. For example, the MANOR activity ‘What is a good problem in school mathematics?’ (Even, 1999a) offered the opportunity to work on solving an authentic problem of teaching mathematics, and to study closely an important teaching practice. Examining, explaining reasoning to others, learning what others had experienced, and reflecting on unexpected outcomes, encouraged awareness of the need for careful consideration when choosing or designing activities for students, and attention to the different activities that may emerge from a written mathematics problem. Similarly, the ‘Mini study’ activity (Even, 1999b), in which participants “replicated” a study with students and with teachers, and compared their findings with the findings of the original study, offered the opportunity to work on solving a different problem of teaching mathematics, namely, students’ learning processes, and on solving a problem of educating teachers of mathematics. This activity encouraged an appreciation of the idea that students construct their knowledge in ways which are not necessarily identical to the instruction. The activity challenged existing conceptions and beliefs about student learning of mathematics, and fostered the development of better understanding about what the constructivist view might mean in a mathematics classroom. For example, some realized that learning processes are complicated, no matter how "clear" the instruction; others learned that, against expectation, students were able to deal with sophisticated mathematical ideas. Moreover, the activity provided opportunities to focus on issues which commonly were not attended to by the participants, like teacher knowledge of mathematics and of students.

Furthermore, the ‘Change initiatives’ activity (Even, 1999a) that required each participant to choose an aspect of school mathematics, and to work with a group of teachers on planning, conducting, and evaluating change initiatives related to this topic, offered participants the opportunity to collaborate on solving problems of teaching mathematics and of teaching teachers of mathematics, suggest alternative solutions, explain their reasoning to their peers, examine each other’s solutions, and construct meanings, new knowledge and ideas related to mathematics, to teaching mathematics, and to educating teachers of mathematics.

Other emerging studies on professional opportunities and programmes for educators of practicing teachers were conducted within Developing Mathematical Ideas (DMI) (Davenport & Ebby, 2000), the QUASAR project (Stein, et al., 1999), and the Leadership Curriculum for Mathematics Professional Development (LCMPD) (Elliot, 2005) in the United States; the *Tomorrow 98* Project at the Technion (Zaslavsky & Leikin, 2004) in Israel; a special M.Ed. Programme in Pakistan (Jaworski, 2001); and the Learning Communities in Mathematics (LCM) in Norway (Goodchild, 2007). Taking into consideration the focus on the education of prospective and practicing mathematics teachers in the last two decades, it is remarkable that the education of teacher educators has been almost neglected until now. In a way, the recent focus on mathematics teacher education with lack of attention to the teacher educators mirrors, to some degree, the early research in mathematics education, which centered on student learning but lacked attention to teachers, teaching and teacher learning.

CONCLUDING REMARKS

The ill-defined nature of the field of educating practicing mathematics teachers together with lack of systematic investigation of the practice of educators of practicing mathematics teachers combined with the limited opportunities to learn about the development of educators of practicing teachers, present a genuine problem. We need to develop better understanding about the field of educating practicing teachers of mathematics. We need information about the heterogeneous group of people who might

be regarded as educators of practicing mathematics teachers, and to understand better the characteristics of different professional development systems and the nature of productive practice of educating practicing mathematics teachers. Similarly, we need to understand better what mathematics educators who work with practicing teachers do. Expecting the education of practicing teachers to play a critical role in improving the quality of mathematics teaching and learning at school requires greater attention to educators of practicing teachers. With the expanding current interest in this issue in different countries, and the emergence of pioneering work in structuring the education of mathematics teacher educators, the timing is right for a more comprehensive research effort on the education of mathematics teacher educators for practicing teachers, that would address various aspects of curriculum, pedagogy and structure of preparation programmes, as well as issues of theoretical and conceptual frameworks.

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