LEARNING TO CONNECT PROFESSIONAL DEVELOPMENT FOR TEACHERS AND CHANGE INITIATIVES IN SCHOOL MATHEMATICS

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Many providers of professional development (PD) for teachers of mathematics are experienced teachers who had acquired a reputation for being excellent teachers. However, being a good teacher does not necessarily imply the ability to help others develop their teaching, just as being a good mathematician does not necessarily imply the ability to help others learn mathematics. Thus, it is quite surprising that the preparation of providers of PD for teachers of mathematics is rather neglected and hardly examined. This paper addresses this issue, using the MANOR Program for the preparation of providers of PD for secondary school teachers of mathematics as the focus of investigation and illustration. The paper examines one aspect of the MANOR Program, namely, preparing PD providers to connect PD for teachers with the initiation of change in school mathematics.

The Preparation of Practitioners of a Complex Practice

PD for teachers usually focuses on developing teacher knowledge. However, complex practices like teaching are not about knowledge per se, but rather about using knowledge in context. Consequently, if PD for teachers is to have an impact on the practice of teaching, there is a need to develop and connect knowledge and practice when conducting PD activities. This is not a simple task. It is even less so when PD for teachers is to be connected to change initiatives in school mathematics, because educational initiatives usually focus on changing school practice, and not on developing teachers. Nevertheless, preparing PD providers to integrate PD for teachers with change initiatives in school mathematics was the focus of one component of the MANOR Program. The rationale for this was based on Fullan's (1994) claim that neither top-down nor bottom-up strategies for educational reform are effective. Top-down strategies are problematic because educational change is too complex and involves too many unpredictable processes. On the other hand, providing PD and empowering teachers does not necessarily lead to change in the organization (Loucks-Horsley, et al., 1998). Rather, internal development and external involvement must go together. Thus, the aim was for the MANOR Program graduate to become a PD provider who is able, in this role, to initiate and lead changes in school mathematics teaching and learning.

Teaching is not the only complex practice. A main tenet guiding the two-year MANOR Program was that the practice of providing PD for teachers of mathematics is also a complex practice, and, thus, the preparation of practitioners of this practice entails a focus on the integration between knowledge and practice. Drawing on ideas of situated learning (Lave & Wenger, 1991) and cognitive apprenticeship (Collins, Brown, & Newman, 1987) the aim was for the MANOR Program participants to participate in the practice of providing PD for teachers, on a regular basis, with support from experts and other members of the community, to learn to use knowledge in context, and to further develop their knowledge and practice. Thus, in addition to weekly group meetings at the Weizmann Institute, each participant conducted weekly two-hour PD activities for a

group of secondary school teachers of mathematics in a school or in a regional teacher center. Our previous experience suggested that mere experience in conducting PD activities is not enough to improve knowledge and practice needed for providing PD, just as the mere experience in teaching is not enough to improve teaching knowledge and the practice of teaching. Rather, it is the thinking, examination, analysis and reflection on and about the experiences that could improve knowledge and practice. Therefore, during their participation in the MANOR Program, the participants were required to regularly describe and reflect in writing on the PD activities they conducted. MANOR Program staff provided written feedback on these reports and used them also for assessing the participants' progress and for planning supporting activities. These reports of PD activities were often shared with the other Program participants and served for studying others' and one's own practice (for more information on MANOR see Even, 1999, 2005).

Below is a brief examination of some aspects related to preparing PD providers to connect PD for teachers with the initiation of change in school mathematics, which highlights also learning opportunities offered to MANOR Program participants. The examination is based on analysis of several questionnaires administered to the participants of the first cohort of the MANOR Program, individual interviews with a sample of the participants of the first cohort, group interviews with participants of all three cohorts graduated so far, video-documentation of selected Program meetings, documentation of the regular Program staff meetings, participants' weekly reports on the PD activities they conducted, staff observations of several PD activities conducted by the participants, and the participants' portfolios. We first attend to the issue of learning to provide PD for teachers and then to connecting it with the initiation of change in school mathematics.

Learning to Provide PD for Teachers

Learning any complex practice requires opportunities to unpack its components in order to see what underlies competence performance (Boaler, Ball, & Even, 2003). Providing PD for teachers comprises domains, such as, setting aims for the PD, planning a workshop, making a presentation, reflecting on a PD activity, and so on. Focusing on these practices of providing PD for teachers was an important part of the MANOR Program. For example, during the first year of the Program the participants usually could not explain the aims of the PD activities they conducted. They used general vague statements to describe their aims, sometimes mixing up aims and strategies. The following are examples for such "aims": "Statistics", "An activity that includes denoting points in different distances", "Didactic workshop", "Parallel lines", "Worksheets". The Program staff decided to remark on this in their individual written feedback on the weekly reports, and to work on better explanation of aims for PD activities during small group work at the Weizmann Institute, using the PD activities the participants conducted as working material. Gradually, during the last year of the Program, the participants started to state in their reports the aims of the PD activities they conducted in clearer, more focused and specific ways. For example, "Discussion of the matriculation exams from the viewpoints of coverage and planning", "Planning the

semester: curricula, learning materials, work methods, groups and grouping", "Presenting a different view on absolute value", "Discussion of the results of the 9th grade test: thoughts, ideas and conclusions for the future". Discussions with the participants during the Program meetings at the Weizmann Institute indicated that this change in the ways the aims of the PD activities were stated was not a matter of superficial language use. Rather, it represented a genuine qualitative difference in the way the participants themselves approached the PD they provided for teachers. At the beginning they often knew *what* they would do at the PD session, but could not explain *why* they would do it. Only later did they start to think about what was it that they wanted the teachers to gain or learn from the PD and what was the rationale for their decisions.

Similarly, during the first year of their participating in the MANOR Program the participants ignored completely the part in the form they completed every week where they were asked to write, in hindsight, what they would have changed in the PD session they conducted, had they done it again. Correspondingly, during meetings at the Weizmann Institute, when asked to explain some of their actions and decisions when a small group discussed the PD activities they conducted, many of the participants were unable to do so, often feeling that they were under attack. It was only much later in the Program that the nature of discourse gradually changed and the participants began to discuss their own practice without feeling threatened and the need to defend their actions. The participants started both to be able to reflect and analyze their PD actions and decisions during meetings at the Weizmann Institute, and to verbalize their reflections and critics on the weekly form. For example, one of the participants was invited by a mathematics school coordinator to present a new curriculum to the mathematics team at that school. After a detailed description of the two-hour session she conducted and the problems occurred, this participant reflected on the PD activity. She claimed that her choice of examples for the beginning of the session was not good as the mathematics topic with which they dealt was not problematic for teaching. This caused lack of interest. Therefore, she said, it would have been better to start the session with a mathematics topic with which the teachers encounter difficulties to teach. She also remarked that she should have given more room for the teachers to talk about the specific characteristics of the student population for which the new curriculum aimed (low achievers) instead of her giving them a lecture. Finally, she stated that she should have met with the mathematics school coordinator much before preparing the session so that the preparation could have taken into consideration the specific characteristics of the teachers and the classes in that school. This Program participant also remarked that she was satisfied that she sensed that there was a problem at the beginning of the PD activity and found a way to overcome it, and that the fact that the mathematics school coordinator asked her to organize a longer and more elaborated in-service program indicated that overall the session was good.

Connecting PD with Change Initiative in School Mathematics

In the first year of their studies in the MANOR Program, the participants were asked to choose an aspect of school mathematics to be the focus for a change initiative

(e.g., building a mathematics room, helping to prevent at-risk high school students from dropping out and not matriculating, developing a program for student projects, using new technologies). They first experienced work on this aspect as teachers. Then, the following year, the participants were required to combine some of the PD they conducted for teachers with change initiative related to the aspect they chose, and work on it as PD providers (i.e., they did not work directly with students but only with teachers). From the beginning, those who chose the same topic formed a team coordinated by a staff member or one of the participants. Emphasis was put on connecting what was learned in the other Program components with the issue of actual change in school mathematics. Each team member had to work in the framework of the team topic, but had the autonomy to plan, conduct and evaluate his or her own project, according to his or her work conditions, the teachers involved, the student population, the context, and personal preferences. Team members met to discuss their work, planed activities, consulted with one another, shared and discussed ideas, supported each other, and explored ways of implementing their plans and evaluating them. In addition, several whole group meetings of the MANOR Program were devoted to theoretical aspects of initiating change in school mathematics. These sessions focused on the planning of change initiatives, the critical role of the teacher in the success of long-term educational change, ways of work with other people in the educational system, fundamental barriers to change related to the nature of teaching, and various ways of evaluating change initiatives. To encourage the participants to reflect on their experiences, they were required to submit detailed individual and collective (team) reports as part of their annual portfolios.

When starting their change initiative work with teachers, many set very ambitious objectives and expected to reach them quickly and smoothly, even though during the meetings at the Weizmann they seemed to acquire the theoretical knowledge that change in school mathematics is a slow and complex process. As a result, many felt frustrated and unsuccessful. It was not until they used their knowledge in practice, examined what could the idea that change in school mathematics is a slow and complex process mean, with a specific group of teachers working on a specific change initiative in a specific school context, that connections between knowledge and practice were made. Eventually, during the year, they learned to set, in addition to the overall objectives, short-term and more manageable operative objectives, to appreciate small progress, and to better understand what such an endeavor entails.

The participants seemed to learn that initiating change at school is not a one-person project, and, thus, more attention must be paid to teamwork. But providing PD for teachers remained rather problematic when connected to change initiatives. At the beginning of the year, quite a few of the participants embraced the common didactic approach and tried to tell the teachers what to do and how to do it. After overcoming the stage of complaining about the teachers' lack of cooperation, they learned that it was important for the teachers to have a sense of ownership, and the participants started to encourage the teachers to participate in the planning, decision making, assignment of roles, setting of time-tables, and sharing of responsibilities – key points for successful PD work with teachers (Loucks-Horsley et al., 1998). Still, although many

used a less didactic approach with the teachers, in cases where noticeable results were expected, it was hard for the participants to approach the teachers as thoughtful learners. Instead, they tended to focus on achieving the goals they set, which were in many cases too ambitious for the time and resources available. In general, the balance between the need to support teacher learning and the need to initiate change at school appeared to be a problematic issue that remained a challenge to both the participants and the Program staff.

Final Remarks

The fact that providers of PD for teachers need adequate preparation is often neglected and the literature has little to offer about possible ways to construct such programs. This short paper exemplifies learning opportunities offered to MANOR Program participants for studying both other PD providers' practice and one's own as a means to develop knowledge, skills, dispositions and practices situated in the practice of PD providers. The activities allowed the participants in the MANOR Program to be both members in the community of practice and learners. These activities enabled and encouraged different ways and different levels of participation in the complex practice of PD providers, with support from experts (the Program staff and guests), peers, and other members in the community.

It is commonly acknowledged today that one of the most effective ways to raise the quality of mathematical provision in schools would be to expand substantially professional development (PD) for teachers of mathematics. However, there are no simple and straightforward connections between the two. As this paper demonstrates, the pressure to show desired change creates a tension, which often interferes with the provision of adequate PD.

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