

Chapter 1.3.3

Educators Reflecting on (Researching) Their Own Practice

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This section of the book highlights the education of the mathematics teacher educator in several ways. In this chapter, the focus is on the education of the educator through his or her involvement in reflecting on or researching his or her own practice. Two ways are considered in addressing this focus: educators as reflective practitioners and educators as researchers.

1. Educators as Reflective Practitioners

Mathematics teacher educators' reflection on their own practice can be viewed as a basis of their learning in the context of educators as reflective practitioners. The works of Dewey (1933) and Schon (1987) promote the importance of reflection or thoughtful actions by practitioners. Dewey defines such reflective action as that which involves active, persistent, and careful consideration of any belief or practice in light of the reasons that support it and the further consequences to which it leads. Schon stresses the importance of reflective practitioners framing and re-framing problems in light of information gained from the setting in which they work. According to Schon, reflection-in- and on-action are the mechanisms reflective practitioners use that permit them to continually develop and learn from their experiences. From these perspectives, the process of understanding and improving one's own teaching must start from reflection on one's own experience.

In the context of a reflective practitioner, then, the educators' reflection on their teaching is an inherent aspect of their work and also allows for their development and growth. Such reflection includes the educator: examining, framing, and attempting to solve the dilemmas of classroom practice; and being aware of and questioning the assumptions and values he or she brings to teaching. Thus, viewing educators as reflective practitioners assumes that they pose and solve problems related to their educational practice on an ongoing basis. Through this reflective process, they could develop new patterns of thinking with which to approach the complexities of teaching teachers. The development of reflective patterns could enable them to step back from their routine ways and consider alternative instructional choices and the impact those choices might be expected to have on their students' learning. They could

learn about what ideas students have developed about a topic, how they understand or misunderstand the material being taught, and how different strategies work with specific groups of students—all of which can be used to guide future planning and instruction.

2. Educators as Researchers

In considering educators as researchers, the focus is now on the formal and systematic study of their teaching or the students they teach. Teacher educators can use their own teaching or students as a basis for understanding pre-service teachers' knowledge and learning and the teaching approaches they use in order to effectively facilitate pre-service teachers' learning. Such studies could be grouped into at least two broad categories:

1. Those in which the educators study their students' characteristics, for example, their mathematical and pedagogical knowledge, attitude, and classroom behavior during field experiences, in order to understand the pre-service teachers, but not explicitly their own teaching.
2. Those in which the educators study their teaching approaches, for example, a course, a program, or specific activities/tasks given to their students, in order to determine their effectiveness or the relationship between the approaches and effective or meaningful learning.

This paper deals with the second category as a basis of discussing educators researching their own practice. In particular, only studies in which the educator is involved in teaching the participants as a regular part of their teacher education programs and all of the students in the educator's class are included in the analysis, that is, not studies in which one or two students are considered. This constraint seems necessary to consider the studies to be about the educator's teaching and not merely particular students. Based on this category of research, a review of related research literature for the last ten years suggests that there are few studies that deal with mathematics educators conducting research on their own teaching. In fact, the studies reported at the 15th study conference offered nothing to this sub-theme of the book. However, of the studies identified as relevant, they provided insights into two key questions associated with the educators' learning: What did they research and how did they research it? What did they learn or could learn from these studies?

3. What is Being Researched?

The sample of studies reviewed involved pre-service teachers enrolled mainly in mathematics education courses taught by the researchers. These studies indicate that educators researching their teaching focused on investigating ways of facilitating pre-service teachers' development of mathematics knowledge and, to a lesser

extent, their instructional knowledge. Each study involved a different instructional approach. **Table 1.3.3.1** summarizes these components for a sample of these studies.

Table 1.3.3.1 Studies of Educators' Practice

Mathematics concept/procedure	Instructional Approach	Educator/researcher
Ratio and proportion	Four-component model	Ilany, Keret, & Ben-Chaim, 2004
Statistical investigation	Two investigation tasks	Heaton & Mickelson, 2002
Integer addition and subtraction	Instructional explanations	Kinach, 2002
Arithmetic operations	Investigating arithmetic word problems	Chapman, 2004
Change	Investigations with technology	Bowers & Doerr, 2001
Problem solving	Reflection and inquiry tasks	Chapman, 2005
	Two courses centered on problem-solving experiences	Roddick, Becker, & Pence, 2000
<u>Pedagogical knowledge</u>		
Discourse	Mathematical discourse	Blanton, 2002
Pedagogical problem solving	Problem-based learning	Taplin & Chan, 2001

For these self-studies of practice, with the central goals of understanding and guiding practice, qualitative methods seem to be more appealing in terms of dealing with small samples and exploring in depth what was happening in the courses and how it can be improved. While the details of the research process used in these studies varied, the common structure consisted of involvement in a teaching situation, some form of records of the situation, making sense of the records, and making meaningful conclusions for future use.

4. What is Learned?

Educators researching their practice are likely to learn much more about it than tends to be reported in the research literature. For the sample of studies identified previously, what the educators learned was connected to their evaluation of their teaching approaches in terms of whether they were effective in facilitating the pre-service teachers' learning. Most of these studies reported findings that indicated the instructors' teaching approaches were effective. Examples of these findings follow.

This first set of studies deals with facilitating pre-service teachers' learning of specific mathematics concepts. Ilany et al. (2004) found that the four-component model they developed for teaching pre-service teachers ratio and proportion topics was successful in producing changes in the pre-service teachers' understanding

of ratio and proportion. Kinach (2002) found that engaging secondary pre-service teachers in instructional explanations of integer addition and subtraction tasks was effective in deepening their knowledge of these concepts. Chapman (2004) found that engaging pre-service elementary teachers in analyzing and representing arithmetic word problems in a variety of ways resulted in more depth in their understanding of the arithmetic operations and word problems. Bowers & Doerr (2001) found that engaging pre-service secondary teachers in activities that introduced perturbations in their knowledge of the mathematics of change and the use of technology to assist in resolving them led to their development of a deeper understanding of the underlying quantities represented in velocity and position graphs, a more meaningful interpretation of the mean value theorem, and the importance of appropriate contexts. Finally, Heaton & Mickelson (2002) found that, for their approach to help pre-service elementary teachers develop knowledge about statistical investigations, some of the pre-service teachers mentioned learning statistical content and process but showed little progress on the more ambitious aims of the unit. For example, formulating a question that can be addressed quantitatively was problematic for them.

This second set of studies deals with facilitating pre-service teachers' learning about mathematical or pedagogical problem solving. Chapman (2005) found that engaging pre-service secondary teachers in self-reflection and inquiry activities involving problem solving resulted in their understanding and development of more realistic models of genuine problem solving. Roddick, Becker, & Pence, (2000) found that providing pre-service secondary teachers with rich and varied problem-solving experiences resulted in the participants falling on a continuum ranging from not much discernible implementation of problem solving to substantial integration of it in their teaching. Taplin & Chan (2001) found that using problem-based learning to develop pre-service primary-school mathematics teachers' skills and understanding of themselves as pedagogical problem solvers helped the participants to maintain or improve their attitude towards problem-based learning. Finally, Blanton (2002) found that using classroom discourse in an undergraduate mathematics course to challenge pre-service secondary mathematics teachers' notions about mathematical discourse resulted in their transition towards an image of discourse as an active process to build mathematical understanding and development of their ability to participate in such discourse.

In addition to the effectiveness of the instructional approaches studied, some authors offered general guidelines resulting from their investigations of their practice. For example, Taplin & Chan (2001) suggest that their approach of problem-based learning can be an effective way of facilitating teachers' development, provided that the tasks have classroom relevance and applicability; the teachers have some early experience of success to build their confidence; there is plenty of opportunity for collegial discussions; and support is given when they experience negative emotions in their attempts to implement new ideas. Blanton (2002) suggests that the undergraduate mathematics classroom (as opposed to the methods classroom) offers a powerful and unique forum in which pre-service secondary teachers can practice, articulate, and collectively reflect on reform-minded ways of teaching.

In general, this sample of studies gives some indication of what educators can learn from researching their own practice and what others can learn from their experiences in terms of understanding how to effectively and efficiently use specific classroom techniques/approaches. Such studies can expose differences between instructors' intentions and actions and what students experience or how they perceive instructors' intentions. They can provide insights of how to model a reflective approach to teaching for the pre-service teachers.

5. Conclusion

Writing about educators' reflection on, or research of, their own practice is difficult because this deals with their learning for understanding and enactment, which, for the most part, is likely to be and remain as a personal endeavor with little presence in the research literature. However, these activities (reflecting/researching) are important means of mathematics educators' education and, perhaps, deserve research to understand, for example, the questions and problems the educators pose, the perspectives they use to interpret and improve their practice, and how the processes shape and restructure their personal knowledge about teacher education and their practice. For the studies discussed in this chapter, there was no clear indication of how the educators' thinking changed and subsequent actions taken by them in relation to their practice.

The process of reflecting on, or researching, one's own practice is dependent on the context, the perspective and richness of repertoire that one brings to that context, and one's ability to draw on a level of reflection appropriate to that context. It also depends on one's ability to notice, "to be awake to possibilities, to be sensitive to the situation and to respond appropriately" (Mason, 2002, p. 7). Hence, the nature of the description resulting from these studies is necessarily incomplete and occasionally fragmented. Caution is required when attempting to generalize across settings in studies of this nature or using them as a basis of other educators' learning. On the other hand, because of educators' direct involvement in the classroom, they can bring a perspective to understanding the complexities of teacher education that cannot be matched by external researchers, no matter what methods of study they employ. They can offer to other educators information of how others really think about the situations studied and meaningful examples for other educators to use to stimulate their own reflections on their own practice.

To conclude, as a basis of their education, mathematics teacher educators' reflection on their practice can take place in the context of being a reflective practitioner or a researcher. Both of these contexts involve reflection as an integral aspect of the processes of studying one's own practice. Reflection is often initiated when the individual educator encounters some problematic aspect of practice and attempts to make sense of it. It is a process of reviewing an experience of practice in order to describe, analyze, evaluate, and inform learning about practice. It enables the practitioner to assess, understand, and learn through his/her experiences. It is a personal

process that usually results in some change for the individual in his/her perspective of a situation or creates new learning for him/her. This process of reflection, if then related into practice, can assist the individual in gaining the required knowledge, leading to a potential improvement in the quality of the learning opportunities provided to students. However, reflecting on one's own practice can be empowering in terms of accomplishing growth in one's practice but also constraining in terms of being bounded by one's taken-for-granted perspectives. The latter situation can be minimized if reflection is viewed also as a collective activity. Without the medium of relationships, reflection can lack the genuine discourse necessary for thoughtful and in-depth changes in behavior.

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