

Mathematics teacher education as a multifaceted field of study

João Pedro da Ponte

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Mathematics teacher education, the field of study of this journal, is a multifaceted phenomenon with links and connections to many other fields within and outside mathematics education. Teacher education takes place in many settings, deals with all stages and roles of the profession involving prospective and practicing teachers, the induction phase, and teacher educators, and includes the informal learning processes that take place during the life span of a teacher's career. It also is concerned with the programs, curricula, and resources used for the practice and the study of teacher education, as well as national and international policies and assessments for teacher education. The three articles in this issue of the journal depict in interesting ways many of such features of this field.

The education of prospective teachers is not just a step in the preparation of new teachers but it is also a fundamental element in the constitution of teaching as a profession. In a quasi-experimental study that draws on the perspective of practice-based teacher education, Rossella Santagata and Cathery Yeh analyze the impact of a video- and practice-based teacher education course in prospective elementary school teachers' capacity to teach following a student-centered approach. In a university course that took place at the same time as field-based activities unfolded, the prospective teachers were presented with images of teaching that value students' thinking and were encouraged to use reasoning based on evidence to assess the effectiveness of their own teaching. The authors sought to develop such skills in prospective teachers by engaging them in activities such as role playing, planning, teaching, and analyzing teaching. As a result, the prospective teachers improved their ability to analyze the teaching of others and also learned to analyze their own teaching as well as to teach in ways that enable the analysis of student thinking. In addition, they used in their classroom teaching and in the analysis of their own teaching the knowledge that they learned in the university course. The authors conclude that structured opportunities for developing the ability to focus on students' thinking during teaching and

J. P. da Ponte (✉)
Instituto de Educação, Universidade de Lisboa, Lisbon, Portugal
e-mail: jpponte@ie.ulisboa.pt

on analyzing teaching must be embedded in prospective teacher education programs in a systematic way.

Identifying and understanding the tacit craft knowledge of experienced teachers has long been a major line of research in mathematics teacher education. Drawing on focus groups that undertook virtual breaching experiments, following open-ended agendas, and supporting the work by a theoretical framework of functional linguistics, Patricio Herbst and Karl Kosco seek to compare the value of two kinds of representations of teaching practice (animations and videos) to study teacher knowledge. The authors analyze how using these media tend to elicit modal statements, that is, statements in which propositions or proposals about teaching practice are qualified or tempered in one way or another. They conclude that videos and animations appear to be equally useful to elicit modal statements about instructional practice from a group of teachers, as both yielded the production of modal statements in a similar way. However, the videos were more associated with statements of inclination, whereas the animations were more associated with issues of appropriateness leading to statements of probability and obligation which assume a stronger and more collective stance. This led the authors to suggest that conversations based on animations may more clearly elicit teachers' norms of instruction. These results suggest that producing animations that represent in a systematic way conflicting situations may be a very useful resource to study mathematics teachers' tacit knowledge. The authors further suggest that professional development initiatives may use animations as well as videos and other written representations of teaching practice in order to study such practice, taking into account each specific teacher development goal.

Besides the learning that takes place in formal teacher education settings, many other personal and professional experiences also contribute toward teacher development. The phenomenological study of Susan Peters, drawing on perspectives of adult learning, raises interesting issues regarding the process of teacher development. The author shows how a deep understanding of statistical concepts is a long-term endeavor and involves many experiences besides taking pre- and in-service formal statistics courses, as teachers interact with other teachers in a number of ways, especially when they assume leadership roles and other responsibilities. Regarding formal professional development settings, this study underlines the value of rational discourse and the opportunity for critical reflection that it provides. It suggests that interactions with experts create a context for questioning assumptions concerning this subject in ways much deeper than what is promoted by the usual interactions with colleagues and with students. This study also suggests that teachers who completed introductory courses theoretically oriented still may hold faulty reasoning in several grounds. The author suggests that an alternative for a deep understanding of content at an introductory phase may be exploratory and based on data, giving central attention to design and using this to create interest for exploratory data analysis and for statistical inference. A similar argument may be made for other mathematics curriculum topics such as geometry and algebra or for transversal capacities such as problem solving and modeling.

Albeit covering a very wide set of issues, these three articles highlight important themes, such as the central role of practice as both the aim for teacher development and as a major resource for analysis and teacher learning. Practice may be represented in different ways—videos, animations, and oral and written representations—and may draw on contemporary or past experience, but it is a critical element for reflection to be carried out in a systematic or open-ended way, leading hopefully to critical reflection and to teachers' transformative learning. The use of powerful representations of practice as a basis for reflection is an important key to understand teaching and to foster teacher development, leading to a more resourceful and effective mathematics teaching practice, and ultimately to student learning.