

# Strengthening Practice in and Research on the Professional Education and Development of Teachers of Mathematics: Next Steps

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This Study brought together 147 scholars and practitioners from 35 countries to discuss the professional formation of teachers of mathematics. Their individual contributions have been assembled to create a volume filled with descriptions of programs and projects, as well as concepts and data. Readers interested in the development of teachers of mathematics will find in this book many ideas and people relevant to their own work, much as was discovered by those who participated in the Study. The conference was lively and intense as ideas and people from around the world interacted around this fundamental problem: Mathematics education works virtually nowhere as well as it needs to if we are to prepare students for life in world where practical, intellectual, and critical quantitative competence will matter more than ever before, and for more people. Although our systems, resources, and results differ, no country is satisfied with the quality or the reach of contemporary mathematics education.

This Study was founded on the premise that teachers are central to the improvement of mathematics education, a premise that should be obvious, but too often is not. Since what students learn is a function of the opportunities they have and how those opportunities are managed, improvements that aim solely on curriculum or standards are unlikely to make the sorts of impact on students' learning that some assume. Despite the importance of teachers, however, the approaches to their education often do not help them develop the skills and insights needed for practice. This Study began an international conversation about what we do and the questions we have. Equally important will be the next steps that follow. We suggest below three main problems that could profit from stronger and more systematic international connections focused on improving the education and professional development of teachers.

First is *the need to focus teachers' education on practice*—and the problem of doing it effectively. This was a focus of the Study—to learn what is done around the world, and what the challenges are. On one hand, it should be obvious that teaching is a practice and that, therefore, teachers' education must provide sustained, systemic opportunities for teachers to learn and develop their effectiveness with

that practice—with the complex tasks of their work. Many Study participants provided examples of teachers working in and on practice to develop their knowledge and skill. In some cases, the practice on which teachers worked was their own. In others, teachers studied cases, watched videotapes, or examined students' work. In still others, they co-planned lessons and observed the enactment of lessons across classrooms with different pupils. On the other hand, lacking is a shared articulation of a "curriculum" that would underlie teachers' opportunities to learn in and from their practice. Often mentioned was that teachers need time to work on practice with colleagues. However, although time to meet is important, time is not enough. As important is more specificity about how practice can be harnessed for teachers' learning and what is important to learn in and from practice. The international community could work to develop ways to support teachers learning in and from practice, through making this a focus of discussion, collegial exchanges, and a topic at international meetings.

One crucial agenda for future work is that, for a focus on practice to be more consistently possible, teachers need robust examples with which to work, either from their own classrooms, or collected systematically from others. To be useful, artifacts of practice require careful collection and development. This is an area in great need of support if teachers' professional learning—as that of other professionals—is to be grounded in problems and cases of professional practice. Study presentations included rich examples of cases, and other "captures" of practice for teachers' observation and study. But no system exists for considering what makes an example robust enough to use effectively. No scheme was offered for typologies of cases, nor how to compare different media—written cases, student work, videos, to name a few.

Another challenge is the need to develop approaches to *teaching* practice. Although video can provide a concrete and vivid resource for professional study, unfocused viewing is like reading a text without a purpose. Productive study of classroom teaching depends on questions that frame the work. What are the features of tasks that support teachers' investigation and learning of practice?

A second significant issue on which the international community could focus and build collective capacity is the identification and *development of teacher developers*. In different countries, a wide range of professionals is responsible for supporting teachers' learning, and yet often these individuals have little preparation for their work. Inconsistent is whether or not they have taught, studied mathematics in depth, or have substantial insight into students' thinking. We learned of projects that directly support the development of teacher leaders, but around the globe, there is little rule about what qualifies someone to take on the role of teacher developer. Moreover, there is little support for their ongoing learning.

There is, to begin with, a problem of conceptual diffusion. No single word or phrase exists to describe the professionals who work with teachers: two- and four-year college teachers of mathematics; university mathematicians; university mathematics educators; district and school personnel responsible for the pre-service and in-service education of teachers of mathematics; doctoral students preparing to become mathematicians or mathematics educators in colleges and universities; and

professional developers who contract with schools or districts to provide workshops, institutes, or other programs for K-12 teachers of mathematics. In addition, there is no clear role group or identity. Neither university mathematicians nor faculty members who teach content or methods courses in mathematics for prospective teachers ordinarily think of themselves as “professional developers”—and yet they are. Consider that in both sorts of courses, prospective teachers explicitly learn disciplinary knowledge that forms the basis of the content they will teach to students. They also develop ideas about how that content is taught. The same can be said of school-based teacher developers who help teachers learn the content of new curricula, improve their skills, or study new topics. These different sorts of professionals have rarely been considered collectively as “teacher developers” or “teacher educators.” The lack of focus on these people weakens international efforts to improve teacher education and professional development.

Because we do not think of them as a professional group, there has been little work on what “teachers of teachers” have to know and be able to do to support teachers’ learning. What mathematical knowledge is needed for this work? How do they have to be able to use practice as a resource for teachers’ learning? What is there to learn about the design and delivery of particular approaches to the professional development of teachers of mathematics? These questions are complicated in different ways by the professional background of different types of teacher educators. What mathematicians might need to learn to be effective with teachers is likely different from the learning needs of teachers who move into leadership roles. What might be common and what is special?

Programs of and approaches to supporting teacher developers’ learning could be better shared across nations. The improvement of teacher education depends on the quality of those responsible for its delivery; much could be gained through greater exchange of ideas and approaches.

Third, with the increasing demand for evidence of results, a growing need exists for *valid and reliable assessments of teachers’ learning*. Again, whereas some Study participants provided insight into the outcomes of particular programs, the international community has not mobilized collective effort to build useful tools and methods for teacher assessment. In an era of increasing accountability, relying on teacher-learners’ reflections on their learning is inadequate. Yet, given the need to improve teachers’ practice, tests of pure mathematical content knowledge are also insufficient. Crucial are “measures” and other means of the quality and effectiveness of teachers’ mathematics instruction. Such assessments are important to assess the outcomes of professional education and to compare the effects of different approaches. With greater capacity to do this, the international community would build knowledge about how to make teachers’ education more effective. Measures and assessments of instructional practice are also important to be able to investigate the effects of teaching on students’ learning, and to trace the complex connections between teachers’ knowledge and skill and their students’ growth.

We need to know more about ways to assess practice and the learning of practice. And we need to understand what aspects of such assessment are culturally specific and which are internationally shareable. How does the fact that teaching is a cultural

activity (Stigler, & Hiebert, 1999) affect efforts to assess it? Cross-cultural work on the assessment of practice could contribute both to our understanding of how deeply different teaching is or is not, and what the specific and crucial differences are. Such cross-national work would also elaborate our sense of teaching as practice across cultures. In different countries, the political environments, societal and cultural factors, and the place of formal schooling and therefore of school professionals, varies. Additionally, curricular differences, variation in teachers' responsibilities, and differences in the pupils they teach, shape practice. Still only partly understood is the depth of these differences in terms of the demands and nature of teachers' practice. This area of assessment is of urgent need, especially in countries where the policy environment is threatening to overwhelm professional judgment and expertise with political structure. If mathematics education professionals do not seize the lead on issues of rigorous assessment of practice, others will, and their perspectives on this will likely dominate. This is a time to assert that teaching practice can be assessed validly, and that teaching requires professional knowledge and skill. To argue otherwise is to rescind authority for our own profession, and crucial levers for its improvement.

These three areas were ones that participants spoke about and that the Study included. Yet, quite clear is that these are also areas for fruitful further work. To take advantage of the active interest in teacher development and teacher learning and the fascinating differences within and across countries, the international community could mobilize to focus more on teachers' opportunities to learn. In particular, we see great potential to focus sharply and deliberately on ways to center such opportunities on learning in and for practice; to investigate and strengthen the preparation and support of "teacher developers"; and to work together to build professionally valid and reliable approaches to assessing teachers' learning and the practice they are able to deliver as a result.

How might more opportunities for international and cross-cultural work on teacher education and professional development be supported? One is clearly in the creation of more international meetings and conferences focused on teacher formation. A second lies in publishing, in journals and books, as well as in electronic web-based forms. Such publishing needs to include the publishing of artifacts and tools as well as descriptions and results. But a third approach is to make teachers' education and development a more regular part of other mathematics education conferences, meetings, projects, and programs. Often we organize programs focused centrally on curriculum content and on student learning, and although these are at the heart of mathematics education, too often we overlook the role of teachers and their capacities, or the key role of skillful instruction in students' learning. At times we lapse into discussions that make student learning seem to arise entirely on its own, or by design, without nuanced structure, guidance, or interaction. A greater emphasis is needed on understanding the connected demands on teaching practice and the consequent requirements for professional education. This Study demonstrated the enormous potential of the international community to build capacity in the practice of teacher education, teachers' formation, and the study of both. Instruction is central to students' learning of mathematics; thus, how teachers

and their instructors are prepared, and the tools and methods we have for studying alternative approaches, are also central. The most important outcome of this, the first ICMI study conference on teacher development around the world, is to install the education and continuing development of teachers of mathematics as a central problem of mathematics education, rather than as a domain of casual exchange and a parenthesis to the “main” work of our field.

## Reference

Stigler, J., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: Simon & Schuster.