

TEACHERS WORKING AND LEARNING THROUGH COLLABORATION

ICME SURVEY TEAM

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Central to the learning of mathematics around the world is the work that teachers do in institutional settings and beyond, bringing mathematics to their students and supporting their students' learning. It has long been recognized that teaching mathematics is a complex enterprise devolving from the nature of mathematics itself and drawing on a wide range of knowledge and skills. Teachers have not only to know mathematics but also to demonstrate didactical, pedagogical, technological, social and ethical knowledge in working with their students at any level. They have to work according to societal, political and institutional demands which shape and challenge their professional, personal, social and cultural identities. Teaching itself is a learning process in which reflections on teaching, in practice or in professional development activity, lead to new understandings of mathematics teaching and its development. Our knowledge of this complex scene has developed considerably in recent years, supported by a new journal JMTE (Journal of Mathematics Teacher Education) introduced in 1998, an ICMI Study (The Professional Education and Development of Teachers of Mathematics) involving a conference in Brazil in 2005 and an associated study volume (Even and Loewenberg Ball 2009), a Handbook of Mathematics Teacher Education (Wood, Jaworski, Krainer, Sullivan and Tirosch, 2008), a book deriving from a TSG at ICME 11 which focused on different experiences lived by teachers of mathematics during their career and their contribution to professional development (Bednarz, Fiorentini and Rongjin Huang, 2011), and a volume addressing teachers' activity with digital technology (Clark-Wilson, Robutti and Sinclair, 2014). Research in this survey shows a burgeoning of published papers and journal special issues illuminating this field.

In this survey, the team was charged with a focus on teachers *working and learning through collaboration*. This particular emphasis zooms in on the wider professional development scene to focus on the learning that occurs when teachers of mathematics work together *collaboratively*, and moreover its implications for the mathematics learning of students which motivates their teaching. The notion of *mathematics teachers' working and learning through collaboration* is not new, but gains more and more attention in educational research and practice, particularly after the report about Lesson Study in Japan from the TIMSS classroom video study (Stigler et al. 1999). Collaboration implies co-working and co-learning (working together and learning together); it involves teachers in joint activity, common purpose, critical dialogue and inquiry, and mutual support in addressing issues that challenge them professionally; it helps them in reflecting on their role in school and in society. Across education systems, mathematics teachers work and learn through various forms of collaboration which contribute to learning and development in differing ways. Efforts to understand what teachers do in and for improving their teaching and expertise have led to ever-increased interest in exploring and examining different activities, processes, and the nature of differing collaborations through which mathematics teachers work and learn.

At the same time, new theoretical perspectives have also been developed and proposed about mathematics

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teachers working and learning (e.g., practice-based professional education of teachers, communities of teachers working with communities of researchers and evolving in their professional practices, working and learning in collaborative groups, spontaneous or institutionally based). In the light of these developments, it becomes important for the international mathematics education community to survey and synthesize current research and development on the working and learning of mathematics teachers through collaboration. Understanding the current landscape will be an important step to pointing out future directions.

The survey team is charged with this important task. The team consists of researchers from different education systems around the world whose work is related to the topic of the survey. Team members are, or have been, teachers themselves, have worked extensively with other teachers in professional development settings and have themselves experienced and valued collaborative practice and gained professionally from working collaboratively with others in the field. In addition, they have synthesized, theorized and published from their experiences and research findings. Their task in this survey has been to reveal and explore the nature, extent, purpose and outcomes of collaborative activity in mathematics teaching around the world.

This task has involved collecting and synthesizing examples of practices that have been developing over the last decade in different education systems, drawing on the research literature and team-members' knowledge of collaborative initiatives. The literature from different parts of the world, education systems and developmental work has been consulted and practices discerned. This has involved consulting journals and conference proceedings in the field of mathematics teaching and teacher education, to distil key elements of collaborative activity in teaching practice and the professional development of teachers. Various search mechanisms have been employed and the papers found have been subjected to a scrutiny of practices, processes, theoretical foundations and learning at a range of levels, for teachers, their students and the professional educators who promote development.

This searching has proved to be a major task, revealing a huge literature base and challenging the team to be clear about what to include and what to leave out, as well as how to organize and synthesize what is included. However, the team has become strongly aware that, despite the wide extent of what this systematic search has revealed, it is nevertheless only a small part of the activity around the world that could be included. Groups of teachers, large and small, engage in collaborative activity that is never reported in the research or professional literature, but that is nevertheless highly significant in promoting teaching development and students' learning of mathematics. Team members have made what efforts they can to gain access to projects, activity and professional practice that show the extent of collaborative work among teachers and the depth of associated practices and issues. Such information has been gleaned through invitations to participants in collaborations around the world to write a 'narrative' of their activity, their experience and its outcomes. Thus, it has been possible to some extent to see into collaborative practices through the words of practitioners as well as through accounts in journals. Of course, the ways in which collaborative practices are constituted around the world is highly dependent on location, custom and culture; gaining insight into these is itself a challenge.

This research has revealed important insights into collaborative practices; it has also raised many questions and issues which the team is addressing. The following list provides a taste of the kinds of issues and questions involved, and perhaps encourages further interest and involvement.

1. Are "working" and "learning" separate, or complexly bound up in each other? Can one work without learning?
2. Regarding "collaboration" – do we see the 'normal' practice in schools to involve collaboration? Who is collaborating with whom? Teachers with teachers? Teachers with school leaders? Teachers with teacher-educators/didacticians/researchers? Are we going to address also the 'working and learning' of these collaborators as they work with teachers?
3. What does it mean to work *through* collaboration? We have to be very clear how we are looking at 'working', 'learning' and 'collaboration' in order to address 'working and learning *through* collaboration'. What are the aspects of collaboration that influence or promote learning?
4. Are we looking for programmes and projects in which teachers specifically engage together in thinking about and reflecting on their practice in order to develop it? If so, how do such programmes originate? Who leads them? Are they intrinsic to educational systems and practices within schools and the school system, or are they suggested/invited/imposed by external groups of

researchers/educators/curriculum-developers etc.?

5. When we talk of teachers, where in the world are the teachers we are talking about? What are the norms and practices in their schools, regions or countries regarding how they work and learn together?
6. In all of this, we determine the field of exploration through theoretical eyes. In what ways do we see working, learning, collaborating etc. to be influenced fundamentally by the theoretical perspectives we bring to our studies?

The team's work in both the systematic searching of the literature and through the gathering of narratives is ongoing. A preliminary account is being prepared for a special issue of ZDM which will precede ICME 13. At the ICME 13 conference there will be a 90 minute presentation in which the team will offer their findings to those who are involved and interested in this field. The team's aim is to present findings in both a scholarly way and through offering brief but vivid insights from practice. It is clear that it is a great challenge to provide a comprehensive picture in 90 minutes. It is hoped, therefore, that the ICME presentation will encourage a broader sharing of expertise and experience leading to further activity to reveal aspects of collaborative working and learning in mathematics teaching around the world.

The survey team invites you to participate in the ICME 13 presentation, to communicate with the team, and to get involved in further activity stemming from this team survey.

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