

## *Editorial*

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# The Challenge of Sustaining and Scaling Up Teacher Professional Learning and Development in Mathematics

Joanna Higgins and Linda Bonne

*Victoria University of Wellington*

This special issue of MTED focuses on sustaining and scaling up teacher professional learning and development in mathematics. In the current context of politically-driven increased accountability for student outcomes, and ongoing curriculum reform in many countries, it is particularly timely. In both New Zealand and Australia, for instance, recent government initiatives have focused on reporting student achievement across schools, with an underlying implication that student achievement is strongly associated with teacher capability. Therefore, examining models of effective professional learning and development is essential.

The papers presented here address the broad issue of sustaining and scaling up professional development through examining characteristics of mathematics professional development programs from a range of initiatives in five countries: Australia, New Zealand, the USA, Japan, and the UK. Several of the projects have been implemented widely over a number of years, have been the focus of multiple research projects, and are beyond the proof-of-concept phase described by Borko (2004) as Phase 1. As well-specified PD programs, they fit Borko's Phase 2: scalable models implemented in different settings and/or by different PD providers. Japanese Lesson Study differs from these projects in that it has been undertaken by teachers in Japan for a number of years, with no outside funding. No longer restricted to the Japanese context, it has spread to Western education systems as a model of professional development for teachers. Research on all these initiatives contributes to the knowledge base about scaling up and sustainability, particularly when they are considered as a group.

An overarching theme throughout this issue is the consideration of Borko's (2004) two major questions: "What do we know about professional development programs and their impact on teacher learning?" and "What are important directions and strategies for extending our knowledge?" (p.3). More specifically, the themes emerging from the papers focus on three different, and central, perspectives on education – practice, research, and policy. The first theme is the elements of professional development models that make scaling up possible, such as the development of specific tools and networks of practice, and situating the development in a school-based context. A second theme involves the challenges

researchers face when examining the effectiveness of efforts to scale up interventions through the use of multi-level design to measure the impact on facilitators, teachers and students. A third theme relates to features of a system infrastructure that facilitate the scaling-up of a school-based professional development project, and the preparation, development, and support of mathematics teacher educators.

In the first article in this issue Cobb and Jackson propose an empirically-grounded theory of action for improving the quality of mathematics teaching at scale. Drawing from ongoing work in four collaborating districts, the authors describe five key components for investigating and supporting the improvement of classroom instructional practice. They argue for the coordination of all five components to achieve instructional improvement at scale. One component of their theory of action, a coherent instructional system, aims to develop “ambitious teaching practices” through “both formal and job-embedded teacher professional development”. The system they suggest comprised seven coordinated elements: explicit goals for students’ mathematical learning; detailed vision of high-quality mathematics instruction; instructional materials and associated tools designed to support teachers’ development of these practices; district teacher professional development; school-based professional learning communities; assessments aligned with the goals for students’ mathematical learning; and additional supports for struggling students. Cobb and Jackson’s process of developing a theory of action underscores the importance of enabling “research to inform the design and implementation of comprehensive systems of supports aimed at building and sustaining district and school capacity for instructional improvement”.

Examining a theory-based system-wide reform, Count Me In Too (CMIT), Bobis identifies key mechanisms and tools important to sustainability and scaling up of the reform. The paper draws on three research studies of a professional development program in New South Wales, Australia that were re-examined for elements that supported the sustainability and scaling up of this reform. Using Coburn’s (2003) multi-dimensional conceptualisation of scale as an analytical frame, Bobis identifies recurring aspects across the studies, and discusses the findings for each of Coburn’s necessary conditions in turn. In discussing evidence of depth, she concludes that both the positioning of the core element of the Learning Framework in Number (LFIN), as well as participants’ deep knowledge of it, are important to sustainability of the program. In the next section about sustainability she reviews the incremental changes in terms of support mechanisms made to the program over time with a key change being a school-based facilitator model. Including the spread of norms, principles and beliefs within a school is an important aspect of the school-based facilitator role that is explored. Bobis argues that another dimension of spread not frequently considered is that of school community involvement. For the last dimension of shift in reform ownership, Bobis, in highlighting “capacity-building strategies” that centre around the facilitator, points out there are likely to be other interrelated factors that are important. Overall she concludes that “sustainability

is dependent on the interaction of a variety of elements – no one element can be highlighted as singularly influential.”

In New Zealand, Higgins and Parsons look back over almost a decade of mathematics education reform, with a focus on the role of external expertise in the implementation of a national numeracy initiative that aimed at changing teacher practice and raising student achievement. Their work highlights the “complex and nuanced” nature of facilitators working with teachers in their classrooms to develop teachers’ mathematics teaching practice. This situated approach was a feature of the Numeracy Development Projects (NDP) professional development model, of which in-class support was an important component. Specific features of facilitators’ practice that appeared to influence Spillane and Jennings’ (1997) notion of *difficult-to-reach* dimensions of teachers’ practice are discussed, along with the pedagogical tools that supported the implementation of the NDP initiative. Higgins and Parsons describe the mediating role between policy and practice played by facilitators and teachers in the NDP’s implementation. They conclude by highlighting the challenge of sustaining and further developing “an effective cadre of inservice teacher educators/facilitators so that schools and teachers have access to sufficient external expertise” – a challenge that surely extends beyond New Zealand’s mathematics education community.

Lesson Study, an alternative model of professional development, is the subject of two papers in this special issue. Largely driven by teachers, this intensive study of a research lesson is used widely in Japan, and more recently its application in Western countries has been explored (see, for example, Thomas, Tagg, & Ward, 2003). “Opportunities to experiment with classroom practice and analyse it in detail” are a feature of Japanese Lesson Study in mathematics, discussed in Doig and Groves’ paper. Rather than the purpose of Lesson Study being to perfect a single mathematics lesson, the aim is to develop “teachers’ ideas and experiences of different approaches to teaching”. Doig and Groves unpack the four phases of Lesson Study: goal-setting and lesson-planning; teaching the research lesson; post-lesson discussion; and the resulting consolidation of learning. One of the assumptions on which Lesson Study is based, is that when deciding on the focus for long-term goals, teachers are willing and able to identify the area of “biggest gap” – where the discrepancy between student qualities (which might be students’ dispositions for learning, or a particular area of mathematics content) and teacher ideals is the greatest. The group’s long-term goals can sometimes span several years, as they are not dependent on outside agencies to sustain this model of professional development. Photographs and accompanying explanations in the paper highlight some striking differences between mathematics teaching in Japanese and Australasian primary classrooms, including the public nature of the enterprise of teaching in Japan (illustrated by the typically large number of observers in a classroom), and the extensive use of the blackboard to capture the development of ideas during a lesson.

The second paper on Lesson Study examines whether it is a useful process

for sustainable professional development of a group of teachers in the UK. Using a sociocultural perspective, Hunter and Back begin by examining the complex process of Lesson Study as a form of Continuing Professional Development (CPD), aimed at engaging teachers in teaching and learning processes through collaborative planning over a series of meetings. From the literature, key aspects of effective mathematics pedagogy are identified, along with elements found to be central to developing the capacity for reflection on practice. The heart of the paper discusses how the teachers involved in Lesson Study were enabled through the process to notice key aspects of mathematics pedagogy. Five central inter-linked themes related to the development of effective mathematical pedagogy emerged from the data analysis. Hunter and Back conclude by advocating for Lesson Study as a mechanism by which teachers can drive their own professional development and develop their identities as teachers of mathematics through opportunities to explore effective mathematics pedagogy using a collaborative group process.

In the final article in this issue, Koellner, Jacobs, and Borko focus on three particular features of teacher professional development programs. The central role is highlighted of: developing professional learning communities; building the particular knowledge that teachers need to effectively teach mathematics; and adjusting a professional development program to match local needs. Of special interest is the way a balance of adherence to the overall program design and adapting the program to local needs was met with this Problem-Solving Cycle (PSC) model of professional development. Also highlighted was the complexity involved when facilitators help teacher leaders from US middle schools to develop their own understanding of how to teach mathematics to students, so that they can then help teachers in their schools to develop that knowledge – acknowledging the layered, dual-role considerations when facilitators are teaching teachers to, in turn, teach their own teachers. Supported by other research literature and integral to this professional development implementation were five specific processes: modeling, fostering discussions, thinking metacognitively, self-reflection, and coaching. These processes supported the three features listed above. Findings from their longitudinal study contribute to our understanding of how different professional development models can help to sustain teachers' learning in mathematics over time, as well as indicate possibilities for scaling up such developments.

The challenges of sustaining and scaling up teacher professional learning and development in mathematics are complex, as is illustrated by each of these papers, which together include considerations of:

- Evaluation of different models of professional development;
- The role of leadership – school-based and/or system-level;
- The development, use, and impact of networks of practice;
- Pedagogical tools and processes used to build teacher capability;
- Using evidence of practice and student achievement in professional learning and development.

Collectively, the papers in this special issue contribute to what “we know about

professional development programs and their impact on teacher learning” and suggest some “important directions and strategies for extending our knowledge” (Borko, 2004, p. 3). The research described in this special issue indicates possibilities for practice, research and policy that can support scaling up of professional development in mathematics, and for judging the effectiveness of sustainability over time, providing a strong platform on which future studies may build.

## References

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