Editorial

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Mathematics teacher education is an exercise in connection. Mathematics education connects the realms of mathematics with the tasks of learning; when we add in teachers and teaching we include pedagogy as well. Mathematics teacher education attempts to draw together mathematics, learning and learners, teaching and teachers in order to improve engagement with, and achievement in, mathematics for all learners. This is a difficult task.

Researchers, practitioners, policy makers and commentators are quick to point out the disconnections between mathematics, learning and teaching. The small impact of research findings on the practice of teaching mathematics in schools, the lack of mathematical knowledge in teachers, teachers knowing how to do mathematics themselves but not being able to explain it to learners, researchers not answering key classroom questions about learner trajectories and the role of procedural fluency in mathematics learning, and the big ideas of mathematics being inadequately conveyed to learners are a few of the many disconnections perceived by participants in mathematics education at all levels. Which disconnections are of most concern depends on one's role in the system (teacher, parent, policy maker, student) but all participants can name a disconnection from their perspective that, if mended and connected, could make a big difference for the learning and teaching of mathematics.

Mathematics teacher education research has a key role to play in making connections to improve learning. Sound research evidence is needed in order to know what will make a difference, and our research agendas are often positioned in the gaps, or disconnections between mathematics, teaching and learning. By conducting and disseminating research that links these elements, our research can make a difference for teachers and learners and mathematics itself.

The seven papers in this edition of MTED all address a disconnect in mathematics teacher education, and they all propose helpful ideas for ways to address the disconnects they are exploring. Goos, Bennison and Proffitt-White describe the effects of a large scale professional development programme that addresses the disconnect between research and practice. Diamond, Kalinec-Craig and Shih investigate the gap between what preservice teachers know and what teachers need to know when they look at children solving problems. Yee Lai and Clark similarly look at the disconnect between everyday knowledge and the specialist content knowledge needed for teaching. Wilson and McChesney study preservice teacher planning, which is an activity that occurs in the space between teacher education institutions and classrooms where preservice teachers are placed for practicum. Rapke and Karrass present a teacher education pedagogy that is designed to bridge the gap between research and practice – in this case the practice of both teaching and researching. Suppa, DiNapoli and Mixell replicate a study by Heibert, Miller and Berk (2017) which investigated the relationship between what was learned in teacher education and the ability to analyse videos of students' mathematics responses and determine what they should do next, up to four years after teacher education – working in the methodologically difficult disconnect between teacher education and ongoing classroom practice. Norton and Zhang compare the mathematics knowledge of teacher education students in China and Australia, exploring the disconnect between Eastern and Western approaches to teaching and learning mathematics, and also the gap between knowing mathematics as a learner and knowing mathematics to teach.

In exploring these different disconnects and gaps, these researchers offer evidence of possible ways to make connections. Yee Lai and Clark and Diamond, Kalinec-Craig and Shih both propose frameworks as ways to map out an area of mathematics teaching and learning, and thereby make it easier to understand, develop and assess. These frameworks can be a connector for teacher educators and those with whom they work between novice understandings and more expert understandings.

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Goos, Bennison and Proffitt-White reveal the importance of the facilitator in their description of a successful scaled-up professional learning initiative. The facilitator connects the teachers to their learners and to mathematics, and is seen as a bridge between theory and practice for the teachers. Rapke and Karrass suggest a deliberate pedagogy for working with teachers who are exploring mathematics education research. Their "learning about teaching through research" methodology bridges the gap between practice and theory in mathematics education, and between learning more about teaching and learning more about how research is conducted. Wilson and McChesney and Suppa, DiNapoli and Mixell investigate the space between what is learned in initial teacher education settings and what teacher candidates do in practice. Wilson and McChesney focus on student teacher planning, looking at how the student teachers tackled planning for "real" students on practicum and how their preparation for planning impacted their ability to do this. Their investigation reveals ways in which the university-based components of teacher education could support student teachers to bridge the gap between what they have been shown on their course and the task of planning for a class. Suppa, DiNapoli and Mixell assess the mathematical, pedagogical and analytical abilities of teachers who graduated from an initial teacher education programme 4 years before. Their results suggest that some of the ideas presented in teacher education have crossed the preparation-practice divide and continue to support the teachers to be more competent in areas that they studied rather than areas they did not studied. Norton and Zhang discuss the role that fluency with mathematical procedures plays in being able to teach mathematics well. Using cognitive load theory, they suggest that automaticity and fluency with procedures help to bridge the divide between knowing how to do mathematics and knowing how to teach it. Student teachers with higher levels of fluency may have more cognitive capacity to "add on" ideas about explanation and representation of mathematics than those who are coming to terms with the mathematics themselves.

Another feature of these papers that will be of interest to mathematics teacher education researchers and teacher educators is the ways that the studies, or the programmes they describe, have tried to tackle the gap between classroom practice and teacher learning settings (be they preservice or in-service). Goos, Bennison and Proffitt-White write about cross-school year-level groups of teachers working together in professional learning, bringing their experience from different settings together to learn from each other. Another effective feature of the professional learning in this study was the teaching of classes in the schools involved, as a demonstration of what was possible, to bridge between the teachers' learning and their classes. Diamond, Kalinec-Craig and Shih, Yee Lai and Clark, Rapke and Karrass, and Suppa, DiNapoli and Mixell all use video of children solving mathematics problems in different ways to either teach about children's responses or to evaluate teachers' understandings. Video of children bridges the gap between dealing with hypothetical situations and interpreting reality, simplifying the task of noticing what children are doing by providing focused examples for analysis.

As mathematics teacher education researchers we have an important role to play in providing evidence about the persistent disconnect that people perceive between mathematics, the learning of mathematics and the teaching of mathematics. These papers contribute by providing both practical implications for mathematics teacher educators and methodological inspiration for researchers.

References

Heibert, J., Miller, E. & Berk, D. (2017). Relationships between mathematics teacher preparation and graduates' analyses of classroom teaching. *The Elementary School Journal, 117* (4), 687-707.