

## *Editorial*

# Mathematics teacher education: Coping with multiple demands

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We are delighted to bring you our second issue of the journal. In the six articles included in the issue you will find many ideas important to consider in the initial and professional development of teachers of mathematics. The issue brings together articles from a range of countries that describe and seek to find ways to address diverse areas of challenge using a variety of methodologies to explore their question of interest. We trust you will find much in this issue to consider, reflect on, and to inform thinking and practice in relation to creating strong and equitable opportunities for mathematics learning. The first four articles describe research studies carried out within primary initial teacher education. The final two articles focus on aspects of professional development of practising teachers. Welcome to the issue.

In the first article Son and Lee describe the competence of 60 pre-service teachers from a university in the United States of America in relation to the multiplication of fractions, finding a wide range of capabilities. Problems involving multiplication of fractions were given as a word problem, using symbolic notation, and a format requiring visual representation. Some participants were unable to solve any given problem while others were capable of flexibly demonstrating understanding of fraction multiplication across multiple contexts. Various types of pre-service teacher errors are documented, illustrating the types of development that may be needed to support pre-service teachers' personal knowledge of mathematics. Son and Lee highlight that many pre-service teachers had not developed suitable understanding of multiplying fractions for teaching, with only 40% able to recognise the word problem involved multiplication of fractions, use representations appropriately, and translate the problem into a suitable multiplication expression.

In an English study, Murphy explored preservice primary teacher reflections on microteaching experiences which were focussed on encouraging mathematical exploratory talk (Mercer, 1995) by children working together in small groups. Pre-service teachers selected problem solving tasks that they believed would encourage talk and collaboration, and the microteaching was intended to support their awareness and capabilities in relation to in-the-moment mathematical pedagogy. Findings included that preservice teachers' responses to the microteaching problem solving activity experience varied, from seemingly changing their beliefs about how they wanted to be able to teach mathematics, to having minimal effect, to being clearer on the challenges of teaching using problem solving. In addition, evidence emerged that pre-



service teachers may not have been able to identify or focus on the learning inherent in children working together on the problem solving activities.

Clinical interviewing of children has been found to help develop pre-service and qualified teachers' understanding of children's mathematical thinking and how to elicit this thinking through questioning. Interviewing of children using pre-determined scripts and the reflective analysis of associated interview videos and artefacts, carried out by four pre-service teachers towards developing their interview questioning techniques, is the focus of the research in the article by Groth, Bergner, and Burgess. Findings included that pre-service teachers had difficulties in interviewing in two areas: communicating the purpose of the interview to children and probing for more information. Through their involvement in the project, participants were able to identify when they had missed opportunities to find out more about children's mathematical thinking and when they were leading the interviewee unnecessarily. Implications of such interviewing for the development of knowledge of content and students (Ball, Thames, & Phelps, 2008) are discussed.

Preparing elementary pre-service teachers in relation to ensuring equitable opportunities for learning mathematics for special education learners is the focus of van Ingen, Eskelson, and Allsopp's article. Based in the United States of America, this study examined how pre-service teachers used consultations focussed on identifying problems and developing recommendations carried out with students training to be special education professionals to identify the learning needs and engagement styles of a student with special education needs. Findings included that the prospective teachers' questions and the responses to these lacked attention to the mathematics context and had insufficient focus on student engagement in mathematical practices. The authors provide suggestions to improve the effectiveness of such consultations for establishing mathematics learning needs, highlighting that few education programmes focus on assisting pre-service teachers with carrying out such consultations focused in particular on mathematics learning.

From another study carried out within the United States, Glassmeyer and Edwards describe how algebraic reasoning was considered by 19 middle school mathematics teachers during and after a two-week professional development course. They found temporary growth in teachers' algebraic reasoning during the course. Teachers moved from procedural to relational understanding during the professional development, effected through the use of open-ended activities requiring conceptual knowledge to solve problems using multiple solutions, solution strategies, or representations. Beginning understandings of generalization and functions being associated with algebraic reasoning were also achieved during the professional development but were not sustained following the course.

Describing results from an investigation into why teachers choose 'not sure' in multiple-choice questions used to explore their mathematical knowledge for teaching in Norway, Fauskanger and Mosvold highlight three types of responses in relation to Tchoshanov's (2011) types of teacher content knowledge. Their results, drawn from responses of three in-service teachers, show that that 'not sure' can be chosen for a range of reasons, including the participant holding insufficient mathematical knowledge for teaching, having knowledge of facts and procedures, or of concepts and connections, with the latter group (knowledge of concepts and connections) believed to be a predictor of teaching that positively impacts student learning. The results of the study indicate that including a 'not sure' category in such multiple choice questions is problematic and care should be taken in interpreting 'not sure' type responses.

A diversity of data gathering approaches have been taken in the research reported in this issue. Methods used across the articles include analysis of participants' written responses to mathematical problems, multiple choice and open questions, oral responses, group discussions, written consultation questions and responses, observation of small and large group discussion, document analysis of teacher reflections, interviewing and analysis of interview videos and artefacts, surveys, and written accounts on microteaching experiences. Such a diversity of methods illustrates the creativity and versatility needed to probe and explore questions of interest in teacher education.

A striking concern in contemplating the articles in this issue together as a group, is the very wide scope of what we are needing to do in preparing pre-service teachers and in the professional development of qualified teachers. It is difficult to see how any teacher preparation or professional development programme can have sufficient time to achieve everything that is essential for ensuring proficiency in excellent mathematics teaching pedagogies and practices. One way forward may be to look for common themes that may be transferable across areas and assisting teachers with transferring this learning across contexts and topics. Two common features across the diverse articles in this issue are that of knowledge for teaching and of teacher reflection. The importance of understanding the role of different types of content and pedagogical knowledge (e.g., Ball, Thames, & Phelps, 2008; Blair & Rich, 2011; Shulman, 1987) in ensuring effective teaching, and ways of enhancing these types of knowledge, is touched on in several articles. Focus across articles is also given to reflection on practice (e.g., Ricks, 2011; Schön, 1983) highlighting the value of ensuring reflection techniques are able to be understood and used well by teachers across diverse aspects of mathematics teaching practice. Strong understanding and transferable use of such powerful teacher development tools are likely to assist in maximising the effectiveness of the limited time in teacher education programmes.

While all of the articles focus on issues important for mathematics teachers and teacher educators to consider towards improving mathematics learning of individuals and groups, only two in this issue give specific focus on the development of particular mathematical thinking, concepts, understandings, or ideas. We are keen to publish articles on all aspects of mathematics teacher education and particularly welcome submissions of articles which foreground demonstration of how the learning of specific mathematical concepts can be enhanced.

We would like to thank all of our able reviewers who have assisted greatly in providing detailed and very useful feedback to the authors of the articles included here and those in process for the next issues. Thank you very much for your willingness, time and expertise.

Ngā mihi nui ki a koutou  
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## References

- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59, 389-407. doi: 10.1177/0022487108324554
- Blair, S. L., & Rich, B. S. (2011). Characterizing the development of specialized mathematical content knowledge for teaching in algebraic reasoning and number theory. *Mathematical Thinking and Learning*, 13(4), 292-321.

- Ricks, T. E. (2011). Process reflection during Japanese Lesson Study experiences by prospective secondary mathematics teachers. *Journal of Mathematics Teacher Education*, 14, 251-267. doi: 10.1007/s10857-010-9155-7
- Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon, UK: Multilingual Matters Ltd.
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.
- Silverman, J., & Thompson, P. W. (2008). Toward a framework for the development of mathematical knowledge for teaching. *Journal of Mathematics Teacher Education*, 11, 499-511. doi: 10.1007/s10857-008-9089-5
- Tchoshanov, M. A. (2011). Relationship between teacher knowledge of concepts and connections, teaching practice, and student achievement in middle grades mathematics. *Educational Studies in Mathematics*, 76(2), 141-16



