Frameworks for evaluating the work of teachers and teacher educators.

Robyn Reaburn and Tracey Muir, Carol Murphy, Noleine Fitzallen
University of Tasmania

This edition of *Mathematics Teacher Education and Development* is the first edited by a new team: Associate Professor Tracey Muir, Dr Carol Murphy, Dr Noleine Fitzallen, and Dr Robyn Reaburn, all from the University of Tasmania. We would like to thank the previous editorial team for their hard work: Associate Professor Fiona Ell, Dr Jodie Hunter, and Associate Professor Robin Averill. Under their leadership, the journal has increased its reputation, and has continued to foster research from all over the world. We also thank them for their assistance in the transition period.

I doubt that there is a mathematics teacher educator who is not driven by the desire to give school students the best mathematics teachers possible, and this is a focus of much of our teaching with preservice teachers (PSTs). For the same reason mathematics teacher educators often present professional development to practicing teachers. It is not always easy, however, to know what these PSTs or practicing teachers take away from what we do. Many of the papers in this issue provide frameworks in which we, as teacher educators, can assess the effectiveness and impact of our work.

LaRochelle, Nickerson, Lamb, Hawthorne, Philipp, and Ross, for example, analysed the responses of practicing secondary teachers to children's solutions to a pattern-generalisation task through the lens of professional noticing (Jacobs, Lamb, & Philipp, 2010). This paper illustrates how the use of professional noticing [framework] can enhance the design and analysis of professional development. This paper also provides useful information about pattern generalisation tasks.

Professional noticing was also used by Wieman and Webel to analyse preservice and practising teachers' responses to the *launch* of a lesson - the introduction of a lesson with a problem that will not only fire students' imagination but also embody the mathematical principles that the teacher wishes the students to learn. Often the students will ask clarifying questions, but how can a teacher respond without reducing the cognitive demand of the problem? This question is addressed in the Wieman and Webel paper by comparing the responses of secondary and primary teachers and PSTs.

As the lesson progresses teachers also need to decide on the nature of their explanations and choice of examples. While making these decisions, teachers may use resources provided by others such as textbooks and the Internet. In this issue Amador describes how she provided PSTs with a series of resources for teaching a fraction concept, and then asked them to write a lesson plan including the rationale for their decisions. These decisions were then analysed using the *Pedagogical Design Capacity* framework (Brown, 2009)—offloading, adapting, improvising—to determine how these PSTs made their decisions. This study not only provided useful experience for the PSTs but assists mathematics educators to understand how PSTs make decisions about planning.

Published online April 2019

Dahl, Enge, Hansen, and Valenta examined PSTs' lesson plans that were written in the form of *lesson plays*. Writing a lesson play involves imagining discussions between a teacher and a student. These lesson plays were analysed using the Knowledge Quartet Framework: *foundation*, *transformation*, *connection* and *contingency* (Rowland, Huckstep, & Thwaites, 2005). The lesson plays give insights into the PSTs' mathematical knowledge, their reasoning for the development of a lesson, and their ability to provide clear explanations.

Fractions are also the focus of the paper by Thurtell, Forrester and Chinnappan, who examined PSTs' perceptions of their understanding of fractions. The study focused on PSTs who had demonstrated poor conceptual understanding of fractions. These PSTs then underwent an intervention that the authors have called the Representational Reasoning Teaching and Learning (RRTL) approach, based on the idea that learners demonstrate mathematical understanding when they construct, utilise, justify and make connections within multiple representations of a mathematical idea. Overall, PSTs showed increased conceptual and procedural understanding of subtraction and multiplication questions to do with fractions.

Another framework for analysing what teachers do is that of *Ambitious Teaching Practices,* which are practices that enhance student learning of complex ideas (Lampert, Beasley, Ghousseini, Kazemi, & Franke, 2010). In this issue Fauskanger and Bjuland describe a study where In Service Teachers (ISTs), with the help of an instructor, wrote lessons about the commutative and associative properties of multiplication. They then presented these lessons to other ISTs and to their students in schools. This paper not only describes a framework that may be of use to other researchers it also illustrates the complexity of learning and teaching mathematical concepts.

The other two papers in the issue address specific difficulties that PSTs may have. One is mathematical anxiety. This is of special concern to educators, as it is also known that teachers can pass mathematical anxiety on to their students. Sanderson, Nielsen, Sandison, and Forrester describe an intervention for PSTs who did not gain the required minimum grade on a diagnostic skills test. The PSTs attended weekly mathematics workshops in a room that was lined with whiteboards. It might be expected that mathematics anxious students would find working in such a public environment difficult, but this study demonstrates that the collaborative environment in this room, where instant feedback was provided, was beneficial for participants.

In recent years there has been much emphasis on Problem Solving, one of the proficiencies Identified in the *Australian Curriculum: Mathematics* (Australian Curriculum, Assessment, & Reporting Authority, 2019). But can teachers write or recognise effective problems, and what criteria do they use to make judgements? Can teachers be expected to teach using problem solving effectively if they have never experienced this when they were students? In this issue King describes how PSTs' understanding of using problem solving increased after experiencing instruction that included modelling of the desired instructional methods, the development of a rubric for determining the effectiveness of a problem, and encouraging reflection through journal writing.

The papers in this issue provide possible solutions to the perennial problems of mathematics educators: mathematics anxiety, the development of content knowledge, and how we can determine that our PSTs are learning effective strategies to enhance student learning. We hope you enjoy reading the papers and find them relevant to your particular teaching context.

References

Australian Curriculum, Assessment, & Reporting Authority (2019). The Australian Curriculum, Mathematics. Retrieved from https://www.australiancurriculum.edu.au/f-10-curriculum/mathematics/

Brown, M. W. (2009). The teacher-tool relationship: Theorizing the design and use of curriculum materials. In J. T. Remillard, B. A. Herbel-Eisenmann, & G. M. Lloyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (pp. 17–36). New York: Routledge.

Jacobs, V. R., Lamb, L. L. C., & Philipp, R. A. (2010). Professional noticing of children's mathematical thinking. *Journal for Research in Mathematics Education*, *41*(2), 169–202.

Lampert, M., Beasley, H., Ghousseini, H., Kazemi, E., & Franke, M. (2010). Using designed instructional activities to enable novices to manage ambitious mathematics teaching. In M. K. Stein & L. Kucan (Eds.), Instructional explanations in the disciplines (pp. 129–141). New York, NY: Springer.

Rowland, T., Huckstep, P., & Thwaites, A. (2005). "Elementary teachers'" mathematics subject knowledge: The Knowledge Quartet and the case of Naomi. Journal of Mathematics Teacher Education, 8(3), 255–281.