Editorial: Addressing Beliefs about Mathematics and Improving Teacher Noticing

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Mathematics teaching is complex and can be particularly challenging for graduating and early career teachers. Teachers, who often work on their own, must provide an educative environment for a classroom of students with varying backgrounds and ability, so that each student can develop an understanding of a range of learning subjects, including mathematics.

How can we prepare pre-service teachers (PSTs) for their future teaching of mathematics? PSTs spend time in schools gaining practical experience while under the guidance of mentor teachers. However, these experiences alone may not be enough for students to examine their own attitudes towards and beliefs about mathematics. These attitudes and beliefs are often entrenched by the time the students finish their schooling. In addition, PSTs may not always be aware of how to notice aspects of their mentor teachers' practice that make up the art of teaching (Van Es & Sherin, 2021).

In their article, "Secondary Preservice Teachers' Anticipated Objectives and Practices for Teaching Mathematics", Vale and Herbert point to the decline in mathematics achievement and attitudes to mathematics that has occurred in Australian school students over recent years. Realising that little research has been undertaken to determine PSTs' objectives and aims for their future mathematics students, they explored the aims and beliefs that PSTs hold towards teaching mathematics. They found that although the PSTs planned to use activities that were based on constructivist ideas, and stated that mathematical understanding was important, they mainly focussed on the practice of skills.

In the article "Examining Preservice Elementary Teachers' Epistemological Beliefs, Views about Mathematics", Lee et al., also consider PSTs' epistemological beliefs (EBs) about mathematics and views about mathematics (VM) to see if there were any correlations between them. The authors also investigated if the number of mathematics courses previously undertaken by the PSTs influenced their EBs and VMs. They determined that the PSTs were likely to believe that successful students were born smart and understood things quickly. Many of the PSTs also tended to believe that knowledge is constructed by authority rather than by evidence and reasoning. In contrast, those PSTs who believed that mathematics takes effort and is useful were more likely to prioritise understanding over getting the right answer, and less likely to believe that successful students understood things quickly. Of interest, there was no relationship between either EB or VM with the number of mathematics courses undertaken.

The next two articles address the issue of PSTs' preconceived ideas about mathematics and its teaching. Suppa and Hohensee, in their article, "Struggles Pre-Service Teachers Experience When Taking a Pre-Symbolic Algebra Content Course", investigated elementary PSTs' reactions

after learning about pre-symbolic algebra for the first time. They discovered that the PSTs underwent a "conscious reflective struggle" (Beach, 1999, p.130) in that they found it difficult to adapt to a way of doing algebra that was different from that they had previously learnt. The authors point out the importance of PSTs needing to realise that they will need to teach mathematics differently from the way they themselves were taught.

In the article "The Lesson Play Experience: Professional Development of a Teacher", Stenner and Zazkis describe how lesson play was used to examine how a teacher taught various mathematics concepts. Lesson play (Zazkis & Zazkis, 2014) involves writing a script of a mathematics lesson that includes a student-teacher dialogue about an area of mathematics that is anticipated to be difficult for the students. The topic of each lesson play written by the participant was then taught to school students after which the participant discussed the lesson with the researchers. They found that the participant became aware that she was teaching in the way she had been taught in her own schooling. She also became more aware of the conceptual and procedural aspects of the lesson, and began to allow more time for students to explain their ideas with others.

Foster and Lee, in their article, "Prospective Teachers' Pedagogical Considerations of Mathematical Connections: A Framework to Motivate Attention to and Awareness of Connections", point out that conceptual understanding of mathematics is improved if both the teachers and students are aware of the connections between the different areas of mathematics. Their study examined how secondary mathematics PSTs attended to and made sense of mathematics connections when working with small groups in schools. Singletary's Mathematics Connection Framework (2012) proposes five ways of making connections: *connection through comparison*, *connecting specifics to generalities*, *connecting methods*, *connecting through logical implication,* and *connecting to the real world*. It was found that whereas the PSTs used all these forms of connection, *connection through comparison* was used the most.

The final three articles in this issue examine methods of assisting PSTs to gain the experience required to improve their teacher noticing. In their article, "Making Learning Visible: Cases of Teacher Candidates Learning to Respond to Errors Through Multiple Approximations of Practice", Baldinger and Campbell suggest that if approximations of practice take place in a low-stakes environment, they are considerably effective in improving PSTs' learning. In this article they described two approximations of practice, coached rehearsals, where the PSTs teach to their peers, and scripting tasks, where the PSTs were presented with a written classroom scenario to which they needed to continue the script. Through these means the PSTs increased their knowledge of questioning and developed an awareness of the challenges encountered when responding to student errors.

In their paper, "Pre-service Teachers' Learning from Significant Opportunities for Improvement in a Positive Error Culture", Groth and Bergner also addressed the importance of giving PSTs opportunities to practice teaching in a low-stakes environment. In this article the authors based their work on the concept of Significant Opportunities for Improvement (SOI). SOIs refer to the recognised and unrecognised opportunities that occur in everyday classroom settings. The research required PSTs to practice lessons with each other, teach the lessons to students in a classroom, and then participate in post-lesson reflections. This process assisted the PSTs' ability to recognise SOIs, and to notice student comprehension, thereby improving their instructional practice. Some PSTs, who held strong traditional views on teaching, did not gain as much from

these experiences – another demonstration of the influence of pre-held views on teaching practice.

In the final article, "360 video as an Immersive Representation of Practice: Interactions between Reported Benefits and Teacher Noticing", Kosko et al point out that teacher noticing of students' mathematics can be improved with experience and suitable professional development. In their article they describe how 360 Videos (video cameras that record lessons in all directions) were used to allow both in-service and PSTs to explore aspects of the recorded lesson, including the teacher's actions and the students work. By these means both the in-service teachers and PSTs were able to improve their noticing of students' mathematics and their reasoning.

It is important that all teachers and teacher educators recognise that we hold assumptions about the nature of mathematics and how mathematics should be taught, and that these influence our practice. It is also important that PSTs and in-service teachers are given opportunities to develop their ability to observe teaching in action, and to observe students' mathematical thinking. We commend these articles to you.

References

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