
Editorial

Exploring and critiquing practice-based approaches in teacher education

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In recent years, there have been ongoing calls from educational reformers that advocate the use of 'responsible' or 'ambitious' pedagogies (Janssen, Grossman, & Westbroek, 2015). Such pedagogies engage students actively in inquiring and justifying their reasoning within learning communities. In this frame, teaching is viewed as both an interactional and improvisational work centred on students' mathematical thinking and reasoning. Managing the contingent nature of ambitious teaching requires that both novices and experienced teachers learn a range of core high-leverage practices including eliciting and interpreting student thinking, leading class discussions, and facilitating small group work, to name some examples (Kazemi, Franke, Lampert, 2009). To master these core practices, prospective teachers must not only learn about the practices but also have opportunities to become skilled in these practices in a safe environment with support and guidance. This requires different forms of teacher education which focus on the enactment of teaching practice rather than the traditional focus on academic or theoretical topics. This special issue of *Mathematics Teacher Education and Development* explores a range of practice-based approaches in teacher education. It aims to identify both the affordances and constraints of differing types of practice-based approaches.

Drawing on a wider project involving the implementation of practice-based pedagogies (see Anthony et al., 2015), the paper, *Supporting prospective teachers to notice students' mathematical thinking through rehearsal activities*, by Anthony, Hunter, and Hunter examined the range of opportunities for preservice teachers (PSTs) to practise and explore the role of professional noticing within rehearsal activities. The authors illustrate how public rehearsals of instructional activities (IAs) within their primary mathematics methods course afforded opportunities to highlight components of professional noticing, namely, making students' thinking visible, eliciting and responding to student thinking, and connecting to mathematical ideas. Selected exemplars involving interactions between PSTs and their mathematics teacher educators (MTEs) illustrate how the coaching moves supported learning. Anthony et al. argue that the rehearsals provide more than just models of representations and decomposition of practice. The community's collective exchanges within the rehearsals—through discussions, and opportunities to rewind and trial alternative teaching moves—affirmed not only the desired teaching orientation towards professional noticing but also made explicit the 'how', 'why' and to 'what effect' such an orientation has on diverse mathematics learners. This work contributes to our understanding of how professional noticing can become part of beginning teachers' repertoire of instructional strategies—a central issue for mathematics education reforms that honour the contributions of students and bring students' sense making into the forefront of classroom conversations. However, like other articles in this issue by Averill, Anderson, and



Drake and Kazemi, and by Waege, these authors note the importance of exploring how these opportunities for learning ultimately relate to the quality of their teaching.

Professional noticing is also a key focus in the paper, *Animating preservice teachers' noticing*, by de Araujo, Amador, Estapa, Weston, Aming-Attai, and Kosko. Specifically, the authors investigated the use of animation of classroom scenes as a means of supporting PSTs' noticing. In recent times, changes to technology mean that there are opportunities to further extend different forms of practice-based teacher education. Computer programming structures and online software platforms can be used to create animated classroom scenes that can act as a valuable means of approximating practice. The key focus of de Araujo et al.'s paper is on the affordances and constraints of animation use in teacher preparation programmes for supporting teacher noticing when PSTs are the animation creators. A second layer is an analysis of how the created animations supported the MTEs to notice the PSTs' understanding of elements of ambitious teaching. The PSTs in this study were asked to watch a video of a classroom episode and then record their noticings in writing and animation. The findings of the study showed that in their written noticings the PSTs focused on generalities. The animation software shifted this noticing to focus on specific instances. For the MTEs this offered greater insight into the PSTs' mathematical conceptions and aspects of teaching such as questioning that could then be used as a basis for rich class discussions. The authors argue that a key affordance of animations is that they are a closer approximation of practice than writing. The constraints of using PSTs' written responses of classroom episodes analysis was also noted later by Biza, Nardi, and Joel. de Araujo et al.'s study highlights both the affordances and constraints of this type of technology in practice-based teacher education. Importantly, it adds to our understanding of how the creation and use of animated scenes as a practice-based routine may support teacher learning.

The paper by Ineson, Voutsina, Fielding, Barber, and Rowland, *Deconstructing good practice teaching videos: an analysis of pre-service teachers' reflections*, investigates the use of video episodes to activate PSTs' noticing of mathematical reasoning and instructional practices. In this study PSTs were asked to watch and then discuss a UK government sponsored video clip of teaching aligned with the introduction of a new curriculum focused on procedural methods to calculation. An aim was to support the PSTs in learning how to critique this type of material. The authors acknowledged that for video material to be useful as an example of classroom practice, teachers must see the material as relevant to their own classroom context. Additionally the teaching competence of the teacher portrayed in the video should not be too distant from their own perceived competence. The study concluded that the opportunities for discussion following the viewing of videos assisted the development of critical thinking and the appreciation of differing viewpoints. Most commonly, the PSTs commented on the pedagogy used in the video clip that progressed students from a familiar method of calculation to the traditional standard algorithm. While many students commented positively on the teacher actions, other students critiqued the emphasis on the teachers' chosen method. Viewing and critiquing the video involved PSTs critiquing both the teaching practice and identifying the need to develop their own mathematical content knowledge and pedagogical content knowledge.

With a different focus on noticing, the paper by Averill, Anderson, and Drake, *Developing culturally responsive teaching through professional noticing within teacher educator modelling*, provides an analysis of public rehearsals of IAs used in a mathematics methods course for primary and secondary teachers. They ask the question as to whether in-the-moment coaching of rehearsals of practice can support the PSTs' awareness and knowledge of culturally responsive practice. Drawing on a framework of cultural competencies for teachers of



indigenous Māori learners (Ministry of Education, 2011), Averill et al. examined opportunities for professional noticing of culturally responsive teaching practices across seven rehearsals of practice in which MTE pairs modelled and coached mathematics teaching. The analysis provides examples within rehearsal routines of professional noticing and pedagogical discussions that show consistencies with the cultural competencies *wānanga* (participating with learners and communities in robust dialogue for the benefit of Māori learners' achievement) and *ako* (taking responsibility for their own learning and that of Māori learners). Averill et al. claim that the nature of the coaching within the rehearsal process exemplified *wānanga* in action, in that preservice teachers experienced their coach talking with them about their learning, listening to their ideas, and showing care for their learning progress. However, like other papers in this issue, the authors note that noticing representations of practice is but the first step in learning this critical aspect of teaching. In this regard, they call for further and urgent work on how rehearsal can more strongly represent cultural competencies. They raise an interesting question as to how MTEs can and should prioritise the many aspects of pedagogical practice that are valuable for teachers to notice, reflect on, and discuss within representations and enactment of practice.

The paper, *Practice-based inservice teacher education: Generating local theory about the pedagogy of group work*, by Higgins and Eden draws on a study of practice-based learning situated in the classroom to develop local theories about what best works for Māori students in the New Zealand context. The paper starts with the premise that grouping as an arrangement within mathematics classrooms needs to be challenged within the socio-political justice agenda because it is the predominant "structure that sorts and labels children" in terms of their capacity to learn (McDonald, Kazemi, & Kavanagh, 2013, p. 381). The authors then provide an account of the development of local theory about group work illustrated by three examples of local theory co-generated in English-medium education settings with predominantly Māori learners. They identify the emergence of an expanded set of practices that illuminate multiple internal contradictions within government, school-based, and practice-based discourses about group work. Based on the collective or *whānau*—a Māori concept broadly denoting family—the varied organisational structures of the examples all illustrate the importance of the relationship between individual and collective in which individuals are positioned as part of the collective rather than as individuals within a group. In highlighting local theories about what works best for Māori (Bishop, Berryman, Wearmouth, Peter, & Clapham, 2012), Higgins and Eden add to the discussions concerning identification of high-leverage practices within teacher education. Higgins and Eden's examination of student-initiated collective group work structures for learning mathematics adds to the discussions of high-leverage practices for teaching mathematics, reminding us that culturally responsive pedagogies are by necessity complex, holistic, and flexible pedagogies.

Prieto and her colleagues in the paper titled, *Quality teaching rounds in mathematics teacher education*, focus our attention on the use of a well-considered Australian Quality Teaching Model. This model formed the basis for PSTs' discussion and reflection termed Quality Teaching (QT) rounds within a practice-based teaching experience. The authors describe how a group of PSTs drew on the QT model and used it in QT rounds of detailed and focussed discussion in after a practice-based teaching experience in a high school. The findings illustrate that this process was effective in developing PSTs' knowledge of quality teaching and pedagogical content knowledge (PCK) development but that the extent of PCK development in the QT rounds was mediated by the mathematical content knowledge (MCK) of the participants. This paper adds to the literature which challenges MTEs to consider how to meet



the need of PSTs in practice-based teacher education when they have insufficient mathematics content knowledge.

The paper by Bailey and Taylor, *Experiencing a mathematical problem solving teaching approach: Opportunities to identify ambitious teaching practices*, focuses on PSTs' learning of core high-leverage teaching practices through engaging in a problem solving approach. Their findings highlight the power of PSTs experiencing a problem-solving approach as a way to learn about high-leverage teaching practices such as justifying reasoning, emphasizing conceptual understanding, and catering for all learners. Bailey and Taylor also call for attention to the importance of attending to the affective domain when using practice-based pedagogy. Many of the participants in their study commented on the positive experience of engaging in problem solving in relation to their attitudes towards teaching mathematics. However, an area for attention highlighted by Bailey and Taylor is that for some students doing the mathematics during the experience meant that they did not focus on the teaching that was being modelled. This emphasises the challenge of supporting PSTs to maintain attention concurrently to mathematics and to high-leverage teaching practices.

Kazemi and Waege in their paper, *Learning to teach within practice based methods courses*, reported on a practice-based teacher education elementary methods course that involved a strong university-school partnership. Building on a two day introductory course at the university the remainder of the weekly class sessions took place in a school setting. The school sessions involved cycles of investigation and enactment of IAs with groups of children. The paper, focused on the opportunities to learn teaching practices afforded by the design of the course, provides insights into three PSTs' collaborative planning, rehearsing, enacting, and reflecting on routine IAs. Like Anthony et al. in this issue, Kazemi and Waege found that all three teachers grew in their capacity to lead goal-directed lessons by eliciting and responding to students' thinking. However, in following these teachers in their field-based teaching it was noted that only one of the teachers pursued questioning practices that requested students to develop mathematical justifications. While acknowledging that there is still much to learn about practice-based opportunities to learn, Kazemi and Waege claim that the PSTs' development was supported by the intentional community-based structural supports that accompanied their practice-based experiences. Supports included taking part in reflective dialogues, observing peers and teacher educators teaching, and coaching support by MTEs. In reflecting on the different learning trajectories of the three PSTs, Kazemi and Waege offer some timely observations about the on-going challenges for practice-based pedagogies and course design. The range of possible instructional design considerations for others who are currently working with practice-based pedagogies relate to issues of equitable opportunities for learning (for example, access to opportunities to engage in rehearsals in weekly sessions), managing interactions with students, using representations, the role of IAs, and identities and knowledge for teaching.

Again concerned with PSTs' learning transferring to the classroom practice, the paper, *Designing approximations of practice and conceptualising responsive and practice-focused secondary mathematics teacher education*, by Campbell and Elliot raises the issue of whether practice-based approaches face the risk of not preparing beginning teachers to continue ambitious and equitable practices within the socially and culturally-defined work of the classroom. Using activity theory as a theoretical lens they look closely at the relationship between professional education and the school setting. In addressing the need to work towards a more responsive and bidirectional relationship, they argue that any reforms for ITE designs must be responsive to the settings in which teachers teach, if indeed the pedagogical innovations promoted within ITE are to be seen as useful by teachers. Drawing on a larger design study, Campbell and Elliot



provide an explanation of how they iteratively developed a series of IAs for use in their secondary teacher education programme. In considering the relationship between the teacher education and school setting, two main design considerations emerged around the way in which approximations of practice – represented within the IAs – align to the content and goals of school classrooms and how they specify and explicate the structure and complexity of teaching practice. In the first consideration, it was noted that collaboration between the MTE, PST, and classroom teacher around the content and goals of IAs needed to consider the mathematical ‘history’ of the classroom. The second design consideration concerned the complexity of the pedagogical moves associated with launching an activity, monitoring student thinking, eliciting solutions and ideas, and constructing explanations with the whole class. Like Kazemi and Waage, it was noted that sometimes the PSTs utilised instructional moves in ways that did not realise the full potential. Campbell and Elliot suggest that discussions around the decomposition of practice, that makes explicit the nested episodes, practices, and moves within the IAs, is a necessary component of pedagogies that utilise approximations of practice. Overall, the paper provides an important addition to the literature on IAs, with the focus on the secondary school setting and critical application of both a mathematical and pedagogical content lens.

Billings and Kasmer’s paper, *Micro-cycle teaching experiments as a vehicle for professional development*, examining how teachers develop mathematical knowledge and pedagogical methodologies within micro-teaching experiments adds another dimension to the papers in this collection. Billings and Kasmer explore to what extent teachers can engage in design experiments (more specifically micro-teaching experiments) as an intentional method for improving their teaching. In this paper the use of two routines to elicit student reasoning – prediction and a workshop model – are described. The researchers note that all the teachers made change but these were incremental and varied. The use of a routine exemplified in the writing of a prediction sentence supported two of the three teachers to become better able to listen and respond to student reasoning. The cyclical routine of setting an intentional mathematical learning goal and planning of how to connect the goal with a summary part of the lesson was found to directly contribute to the teachers’ growth in noticing and building upon students’ thinking. However the use of the prediction question lent itself to this purpose also, but *only* if the teachers used it to promote consolidation and reflection and tie it back to student thinking.

Elements of classroom management along with accessing and building upon the mathematical reasoning of students in a secondary school setting are discussed in the paper by Biza, Nardi, and Joel, *Balancing classroom management with mathematical learning: Using practice based task design in mathematics teacher education*. Jaworski’s (2004) teaching triad including three vertices: mathematical challenge, management of learning, sensitivity to students was used as the basis to develop practice-based tasks. These tasks represented realistic classroom scenarios and included three parts: a brief description of the classroom context (including year and attainment level of students) and the mathematical problem; a dialogue that occurred in a fictional classroom; and, a series of questions in which participants were invited to reflect upon and respond to as the teacher of this class. The results showed that the PSTs were able to identify and discuss the social and socio-mathematical norms that they aspired to develop in their classrooms. However, in responding to the classroom scenarios, the PSTs prioritised classroom management issues over those related to mathematical learning. A key finding was that using practice-based tasks requiring written responses such as in this study led to the PSTs outlining their overall aspirations in broad terms but not giving detailed information about how this would be achieved. The authors of this paper highlight the need to use additional tools



such as group discussions when using practice-based tasks involving classroom scenarios rather than just relying on written responses.

A common thread within this Special Issues is the impact of the community of learners and group involvement within discursive discussions. In the paper “*Doing what comes naturally*” in mathematics education? *The role of social class in pre-service teachers’ responses to innovative mathematics pedagogies*, the authors Jackson and Povey advocate for mathematics educators to consider carefully the dissonance caused by the diverse backgrounds of different participants as they engage in mathematical tasks. Using a Bourdieu lens in a preservice setting, Jackson and Povey draw on the narrative accounts of four diverse PSTs as they worked within a community of learners. Their reflective accounts of their learning through engaging with, and doing mathematical problems and tasks in discursive ways, as part of the larger group provided rich evidence of who was able to access the learning more readily than others. Jackson and Povey argue the need for not only teachers but also MTEs to consider carefully how all learners can be supported to equitable access mathematical learning.

The articles collected in this special issue make an important contribution in the field of practice-based teacher education, with a focus on ways that we can support teachers to engage in equitable and culturally responsive pedagogies. Collectively, these papers highlight what works in practice-based teacher education associated with learning to teach mathematics, but also highlight the need for close critique of emergent instructional practices and suggest areas that need more development. As Kazemi and Waege note, as tempting as it is to attribute shortcomings in the prospective teachers’ learning to them individually, this position misses the importance of understanding how course design and pedagogical practices influence prospective teachers’ opportunity to learn. In an era that focuses on regulation of teacher education (Lerman, 2014) it is all the more important that we continue to interrogate and develop teacher educator practice.

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