

Editorial

International Multi-perspective Analyses of Classroom Activity

Gaye Williams, Leicha A. Bragg, Colleen Vale

Deakin University

MTED Volume 15, Issue One includes papers from authors within and external to Australasia that are focused on classroom activity. Towers and Proulx contribute a new perspective on analysis of classroom activity, Lai explores the use of mathematical registers and familiar language in classroom activity, Quebec Fuentes reports the action research of a teacher which significantly progresses their understandings of classroom activity, and the other three papers examine preservice teacher education through a) a 'classroom activity focused' pre-service teacher program (Meagher, Edwards, & Ozgun-Koca); b) interactions between pre-service teachers and their school mentors (supervisors) (Rhoads, Samkoff, & Weber) associated with classroom activity; and c) how limited mathematical content knowledge can affect pre-service teacher ability to interpret the mathematical activity of students (Maher & Muir). Between them, the papers highlight what a teacher can achieve through autonomous exploration, whether or not there are opportunities for pre-service teachers to engage in autonomous pedagogical exploration, whether pre-service teachers are 'ready' to engage in such activity, and ways in which analyses of this could be undertaken. This suite of papers highlights complexities associated with developing pedagogical capabilities for teaching mathematics. They will hopefully stimulate reflections that lead to further exploration of these issues.

The first paper in this volume (Towers and Proulx), offers a new perspective on the way we conceptualise actions in mathematics classrooms and thus broadens our understanding of the landscape of teaching through the lens of Enactivist Theory. The authors reject the polarisation that often occurs in trajectory models of teaching that have shaped the general thinking in recent decades. These trajectory models seek to position and shift teacher actions from the "bad" teacher-directed practices to the "good" teacher as facilitator models. Towers and Proulx propose that teacher actions are non-linear and recursive, and that teacher actions are legitimatised through the structural coupling of teacher, learner, and the environment. Through an examination of teachers' practice, three categories were clustered; Informing, Orienting, and Shepherding actions. This framework offers reasons why teachers dip in and out of different actions and it assists in explaining the complexity of teaching. It shifts the focus from one that can be judgemental in nature to one that aims to account for what occurs.

Lai draws attention to language and discourse in mathematics learning and

the critical role of metaphors and models in mathematics teaching and teachers' pedagogical content knowledge. The study provides salient examples regarding concepts in junior secondary mathematics and teachers' knowledge of mathematical content and their students' knowledge of such. It draws attention to the role of students' everyday language and images and objects that are familiar to them that may be useful for crafting analogies and metaphors in the classroom. In this study Lai analyses the way in which a Year 7 teacher uses familiar objects and images to promote and support students' understanding of the much more specific and rigorous meaning of 'similar' and 'circumference'. This paper should be considered in conjunction with the final paper in this volume (Maher and Muir) in considering whether the types of teacher actions described in Lai's paper are possible when mathematical content knowledge is limited (as found in Maher and Muir's paper).

Quebec Fuentes' action research in mathematics lessons identifies issues that negatively impacted on promoting discourse in small group situations and suggests effective interventions. In this study, ten issues were presented and for each issue an intervention was developed and refined that promoted and improved student-to-student communication. The interventions include how to encourage non-communicating groups to commence engaging in discourse and how to maintaining the flow of discussion once communication has been established. Advice for interventions for peer tutoring was also offered. The author's interventions shift the classroom culture from one that unquestioningly accepts authoritative figures' suggestions to one that values and is sensitive to the input of all. In doing so, it provides useful information on ways to increase discourse during classroom activity. This paper demonstrates understandings that can be developed through a teacher's exploration and reflection, and it points to the usefulness of enabling pre-service teacher autonomy for the purpose of promoting such activity. The teacher education program described by Meagher, Edwards, and Ozgun-Koca provides opportunity for exploration and reflection.

Meagher, Edwards, and Ozgun-Koca discuss a secondary mathematics teacher education protocol designed to shift secondary pre-service teachers' perceptions from 'learner of mathematics' to 'doer of mathematics'. The activity pre-service teachers undertake involves doing a rich task themselves, analysing authentic student work on the task that illustrates the diverse strategies and methods that students used to solve the problem, then designing an assessment key and modifying the task to scaffold students' learning. This article illustrates the power of the protocol in shifting pre-service teachers' thinking to consider learners' thinking and strategy as opposed to their own thinking and strategies. It raises the following questions: a) How do elements of this protocol fit with Jackson and colleague's (2012) findings that pre-service teacher modifications to rich tasks can lead to proceduralising the learning by removing challenges and thus limiting the potential for school students to develop understanding and mathematical literacy; b) How does the protocol fit or not fit with Sullivan and colleagues' (2006) findings that anticipating student responses is critical to the

practice of developing appropriate 'enabling' and 'challenging' prompts to scaffold student learning. Could this inclusion of student responses within the protocol described by Meagher, Edwards, and Ozgun-Koca support such scaffolding activity? And c) Does this paper have a focus on trajectories that contrasts with the position taken by Towers and Proulx?

The paper by Rhoads, Samkoff and Weber stimulates reflection on other aspects of the preparation of pre-service teachers. The focus is on expectations of pre-service teachers in school and teaching experiences and in-service teacher professional learning during school and teaching experience. It raises issues about the knowledge of mentors (or supervising teachers) and their preparation for this role. The authors identify seven causes of tension between a secondary pre-service teacher and one of their mentors: including the freedom and flexibility provided pre-service teachers to try out teaching approaches during their practicum. Developing reflective and generative practices is strongly endorsed in the literature of pre-service teacher education. Given the learning progress of the teacher in Quebec Fuentes paper (who had freedom to explore), this is an issue. Although not discussed explicitly by the authors in the Rhoads, Samkoff and Weber paper, the nature of effective teaching approaches and opportunities for pre-service teachers to observe and practice these approaches is raised which suggests that the pre-service teacher and mentor teacher had alternate views on the nature of quality of mathematics teaching that was hidden within differences in their perceptions about the nature of preparing and enacting a lesson plan in class. This pre-service teacher experienced no such clash with the second mathematics mentor teacher at the school, suggesting that there is no shared vision or common approach to teaching mathematics at this secondary school or at least that the expectations of pre-service teacher preparation differed for the two mentor teachers involved. This points to a usefulness in schools and pre-service teacher education programs working together to develop a shared understanding of what pre-service teacher preparation in schools should include. Reflection on the importance of enabling pre-service teacher autonomy is stimulated through these papers. The final paper in this volume (Maher and Muir) though does provide a cautionary note about whether or not all pre-service teachers are ready for such autonomy, and if not, what additional preparation is required.

Maher and Muir's paper sheds new light on the teaching decisions pre-service teachers make based on their understanding of mathematical content when required to respond to hypothetical students' work samples on a multi-digit multiplication task. The pre-service teachers were asked to analyse errors in the students' work and identify possible teaching strategies to assist these children. The findings revealed that the pre-service teachers who possessed only instrumental understanding of the mathematical processes were limited in the number of appropriate approaches or teaching strategies they could offer for developing conceptual understanding in students. Limited pre-service teachers mathematical content knowledge has serious implications for the effectiveness of their proficiency in responding appropriately to their future students. How do

we build this knowledge during teacher education though? Can it happen within programs like that discussed by Meagher, Edwards, and Ozgun-Koca or does it have to be built before pre-service teachers can participate meaningfully in such activity? Can pre-service teachers have opportunity for autonomy in their learning preparation and delivery (identified as necessary by Rhoads, Samkoff and Weber), or do some need more mathematics knowledge before they can participate in such activity? Skemp (1976) found relational understandings were not developed by teaching approaches that focus on the 'transmission' of rules and procedures. This finding should be considered when developing relational understandings for pre-service teachers as well. Do the papers in this volume assist us in considering how this could be achieved?

This suite of papers provides opportunities for reflection about ways to analyse classroom activity, progress that can be made through action research approaches, what pre-service teachers need to know before they can benefit from exploratory activity (whether this be mathematical or pedagogical problem solving activity), and how we can add to the quality of pre-service teacher experience. We hope you enjoy and benefit from the reflections the volume stimulates for you.

References

- Jackson, K., Shahan, E., Gibbons, L., & Cobb, P. (2012). Launching complex tasks. *Mathematics Teaching in the Middle School*, 18(1), 24–29.
- Skemp, R. (1976). Relational understanding and instrumental understanding. *Mathematics Teaching*, 77, 20–26.
- Sullivan, P., Mousley, J., & Zevenbergen, R. (2006). Teacher actions to maximize mathematics learning opportunities in heterogeneous classrooms, *International Journal of Science and Mathematics Education*, 4(1), 117–143.