Symposium: From Tensions to Opportunities: Evidencing Mathematics Leadership

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This symposium offers insights into the leadership enacted by those who lead the mathematics education professional learning of in-service teachers in schools. We provide evidence of mathematics leadership practice as a way of contributing knowledge to this undertheorised area of mathematics education research. Three separate accounts of mathematics leadership are reported, with two focused on leading enacted in primary school settings, whilst the third paper highlights the support offered to rural and regional mathematics leaders through a sector-wide leadership network initiative.

Although separate accounts of leadership are presented, each paper is connected through the ways that tensions in practice provided opportunities for mathematics leaders to develop leading practices within the spaces in which their leadership was enacted. In this symposium, the relational dimension of mathematics leadership is highlighted, providing evidence of the critical role that relationships play in the ways that mathematics leadership responds to tensions as opportunities for practice development.

The format of the symposium is as follows:

Chairs: Matt Sexton and Ann Downton.

Paper 1: *Evidencing How Primary Mathematics Leaders Balance the Supports and Challenges of Their Role.*
Kate Copping & Natasha Ziebell.

Paper 2: *Evidencing Mathematics Leadership as Relational and Developmental Activity.*
Matt Sexton & Ann Downton.

Paper 3: *Evidencing Sector Leadership for Mathematics Leaders Working in Rural and Regional Schools.*
Bernadette Pearce, andrea O'Connor, & Lauren Gould.

Discussant: Peter Grootenboer.

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Evidencing Mathematics Leadership as Relational and Developmental Activity

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We report the leadership of mathematics leaders who participated in a leadership intervention. Participation in the intervention was provoked by a tension in teaching practice concerned with a lack of challenge in mathematics teaching in the leaders' schools. We evidence how the mathematics leaders sought to address the tension they faced through their relational and developmental leadership activity.

Using cultural-historical activity theory (CHAT), we report on the collective activity of eight primary school mathematics leaders who participated in a leadership intervention. The intervention focused on expanding mathematics leadership activity. The intention of activity expansion focused on ways that leaders influenced teachers' use of pedagogical approaches that facilitated greater challenge for student learning in mathematics lessons. We attend to the motive-objects and the mediational means that facilitated the leaders' activity with the purpose of responding to this research question: At what do mathematics leaders direct their activity and how is their leadership mediated?

Literature Background

Teaching practice that challenges learning can support students in becoming more autonomous learners as they rely less on teacher support and take greater ownership of their learning (Ingram et al., 2020). However, a tension that faces many teachers concerns the enactment of practices that incorporate appropriate challenge for all students in mathematics lessons (Russo & Hopkins, 2017; Sullivan, 2018). Sullivan (2018) stated reasons for this tension including teachers' beliefs about challenge in mathematics (Russo et al., 2020), and infrequent use of pedagogies that incorporate and maintain challenge. Another reason is teachers' limited mathematical content knowledge (MCK). The ways in which mathematics leadership responds to this tension in teaching for challenge remains undertheorised.

Mathematics leadership is understood as a form of middle leading, enacted by a staff member who leads mathematics education whilst undertaking teaching responsibilities (Sexton, 2019). Working in the space *between* executive leadership and classroom practice mathematics leaders enact leadership that develops dispositions, practices, and knowledge for mathematics education (Grootenboer, 2018). Sexton (2019) outlined how they lead that developmental work as a form of activity, through their leadership of school-based professional learning (PL). CHAT understands activity as *object-oriented* meaning that psychological and practical activity is concurrently advanced through attention to *motive-objects*, pursued in dynamic ways to achieve desired outcomes (Engeström, 2015). Motive-objects drive activity and are vital when interpreting the 'what' and 'why' of activity (Kaptelinin, 2005). Motive-objects are realised through a hierarchical organisation of activity, implying that individuals engage in action sequences to achieve the motive-objects they pursue (Leont'ev, 1978).

With *mediation* as core to CHAT (Miettinen, 2006), activity is facilitated through mediational means. Meditational means are understood as *cultural tools* (psychological tools like concepts and physical ones such as laptops), *rules* that explicitly and implicitly govern behaviours of those involved, and a *division of labour* that mediates the distribution and organisation of roles and responsibilities among those engaged in activity (Engeström, 2015). In CHAT, tensions are catalysts for change and the adoption of new mediational means can facilitate change in activity through the process of *remediation* (Miettinen, 2006).

Methodology

The context of the study was a mathematics leadership intervention, focused on leading the development of teaching practice that incorporated greater opportunities for challenge in mathematics lessons. The intervention was funded by a Catholic education system in the Sydney region during 2023. Eight mathematics leaders, working in five schools involved in the intervention, participated in our study. Three schools had two staff members undertaking the mathematics leadership role, whilst the other two schools nominated one leader. Each participant was required to enact mathematics leadership whilst undertaking teaching responsibilities, meaning they were middle leaders in their schools (Grootenboer, 2018).

In August 2023, data were generated using semi-structured interviews with each of the eight mathematics leaders who volunteered to take part in the study. Interview questions were informed by CHAT concepts, specifically motive-object, cultural tool, rules, and division of labour, to evidence the what, the how, and the why of the collective mathematics leadership activity enacted across the schools. Documents identified by the leaders, along with photographs of leadership activity were also collected. We used the aforementioned CHAT concepts when deductively analysing data, searching for evidence of them in the dataset. Inductive analysis involved asking these questions of the data: What are the mathematics leaders working on? How are they working on that? What is mediating their work?

Results and Discussion

We found that the mathematics leaders worked on two main motive-objects of activity: the development of relational trust and the development of mathematics planning practices.

Development of Relational Trust

The development of relational trust through collaborative approaches to PL surfaced as a motive-object of mathematics leadership activity. Table 1 provides examples of evidence.

Table 1

Evidence Examples of the Development of Relational Trust Motive-Object of Activity

Motive-object	Key leadership actions	Adoption of mediational means
Development of relational trust	Making the developmental work focus explicit and shared amongst staff	**Cultural tool** Mathematics Leadership Activity Plan (MLAP) **Rule** Everyone knows what we are working on and why
	Creating dialogical spaces for pedagogical discussions about teaching practice development	We are all in this together, so everyone has to trial ideas in classrooms **Division of labour** Leaders share their own PL with staff along with their own experiences of teaching for challenge Leaders and teachers engage in pedagogical discussions to create shared commitment to new practices

The mathematics leaders pursued relational trust development when they nurtured shared understandings about the purpose and content of the leadership intervention through the deliberate opening of spaces for pedagogical dialogue (Grootenboer, 2018). Developing relational trust through a commitment to collaboration supported the adoption of new rules (Miettinen, 2006). Those new rules concerned shared understanding of reasons for teaching practice development and the expectation that teachers will trial new pedagogical practices.

One critical mediator that supported the pursuit of the relational motive-object was the *Mathematics Leadership Activity Plan* (MLAP), a leadership planning resource introduced

within the intervention. The MLAP, which documented their work plans for influencing teachers' PL, was adopted as a cultural tool by the leaders (Miettinen, 2006). They used the MLAP to develop *interactional trust* by creating communicative spaces about reasons for teaching practice development, as well as *pragmatic trust* by highlighting how that development was linked to teachers' work in reasonable and practical ways (Grootenboer, 2018). This was highlighted by Cathy's (a pseudonym) statement about the use of the MLAP:

> Because we had to make the plan on the MLAP. So, then we shared with the staff what we were doing and why we were doing it. And that seemed to be a big shift with how teachers were participating in the planning (meetings), but also what we were doing in the classroom.

Development of Mathematics Planning Practices

The mathematics leaders engaged in developmental activity by working on improvement of mathematics planning practices in their schools. Table 2 presents examples of evidence.

Table 2

Evidence Examples of the Development of Planning Practices Motive-Object of Activity

Motive-object	Key leadership actions	Adoption of mediational means
Development of mathematics planning practices	Using challenging tasks with teachers in planning meetings to develop teachers' MCK Influencing teachers' use of anticipation, questioning, and extending prompts during planning meetings	**Cultural tools** Mathematics Leadership Activity Plan (MLAP) Planning documentation includes sections about anticipation, questioning, and extending prompts for tasks Mathematical task analysis document with pedagogical discussion prompts Challenge task sequences **Rule** Planning meetings are teacher PL opportunities. Teachers do the maths tasks in planning meetings and specifically plan for the use of extending prompts **Division of labour** Mathematics leaders facilitate planning meetings Teacher share responsibility for the design of planning documentation

The leaders decided that to address tensions about the lack of challenge in mathematics, they needed to create opportunities that influenced how teachers were prepared to teach for challenge. This saw the surfacing of the developmental motive-object, realised through a repositioning of planning meetings. This developmental motive-objects was mediated by the leaders' own PL within the leadership intervention within which examples of challenging task sequences, advice concerning the use of anticipation and extending prompts (Sullivan, 2018), and a mathematical task analysis tool were provided. The leaders claimed they used those as planning resources, evidencing an example of cultural tool adoption intended to remediate teaching practice (Miettinen, 2006).

Remediation of planning practice was further evidenced through the adoption of new rules (Miettinen, 2006). This was realised through the leaders' co-option of teachers' planning meetings, using them as opportunities for PL to improve teachers' MCK (Sullivan, 2018) and to develop beliefs about challenge (Russo et al., 2020). MCK development was worked on when leaders used challenging tasks along with the mathematics task analysis document in planning meetings. They also encouraged teachers to adapt planning tool to include sections for anticipation, questioning, and extending prompts as ways of preparing teachers to teach for challenge. Claire (a pseudonym) evidenced this when she shared:

> It is about them (teachers) actually taking the time to do the tasks themselves, to work it out, because then that's going to lead them to being more confident in presenting it and working with their students. But it's also giving them ideas, and think, 'oh, what kind of questions might the kids ask in response to this?'

It is important to acknowledge the crucial support of principals. The mathematics leaders reported how principals created conditions for their leadership. An example of this support was how principals advocated for the introduction of facilitated planning meetings and arranged the spatial and temporal resources for those meetings to take place. This highlights again the role of principal leadership in mediating mathematics leadership activity (Sexton, 2019).

Concluding Remarks

We do not know yet the influence on teachers' practice, but we highlight that the mathematics leaders responded to the practice tension by directing their activity at relational and developmental motive-objects. We evidenced the adoption of cultural tools, rules, and divisions of labour by the leaders and how they acted as mediational means that mediated the motive-objects of their leadership activity with the intention of remediating teaching practice. Although presented separately, the mathematics leaders pursued their motive-objects in simultaneous and dynamic ways (Engeström, 2015). For example, as they engaged teachers in challenging tasks during planning meetings to develop MCK (Sullivan, 2018), they also worked on relational trust development by opening dialogical spaces for teachers to engage in pedagogical discussions (Grootenboer, 2018). This highlights the dynamism of mathematics leadership as a relational and developmental activity.

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