

Object-Motives of Mathematics Leaders' Professional Learning Leadership During Participation in a Mathematics Project

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Knowledge concerning the leadership work of primary mathematics leaders is rare. The object-motives of three mathematics leaders were explored using interviews and document retrieval as data sources. Using cultural-historical activity theory, five themes about the object-motives that the leaders pursued in their professional learning leadership activity during a mathematics project are provided. This suggests that their professional learning leadership activity was poly-motivated activity that included both leadership and managerial work aspects. This activity was largely mediated through the introduction of cultural tools by mathematics project team staff.

Over the years, Mathematics Education Research Group of Australasia (MERGA) researchers have reported important findings about the impact that participation in mathematics projects has had on teacher knowledge and practice. There is, however, limited literature concerning how mathematics projects influence the work of mathematics leaders (Sexton & Downton, 2014). This gap needs to be addressed considering that these leaders are viewed as important influencers of teacher professional learning in school-based professional development (Grootenboer, Edwards-Groves & Rönnerman, 2015).

This paper emerges from a doctoral study that concerns the motivations of mathematics leaders and their professional learning leadership after participation in a large-scale school mathematics improvement project (Clarke et al., 2013). With cultural-historical activity theory (CHAT) as the study's theoretical framework, the mathematics leaders' professional learning leadership work was positioned as an *activity system* (Engeström, 2015), with those leaders as the *subject* of that system. When using CHAT, the history of the activity system is investigated so that actions enacted within the system are better understood (Roth, 2012).

As a means of honouring the methodological implications of CHAT, findings about the object-motives (Leont'ev, 1978) that directed the professional learning leadership activity of mathematics leaders during their participation in the *Contemporary Teaching and Learning of Mathematics* (CTLM) project (Clarke et al., 2013) are presented and discussed.

Literature Background

School leadership is viewed as activity that is core business to the school, where that activity is enacted so that the knowledge, practices, and dispositions of its stakeholders (i.e., teachers, staff, families, & students) are influenced or perceived to have been influential by those school stakeholders (Spillane, 2005). Middle leadership, as a type of school leadership, is a relatively new area of research that is starting to gain attention (De Nobile, 2018). Middle leadership is viewed as a form of distributed leadership (Hammersley-Fletcher & Kirkham, 2007; Lárusdóttir & O'Connor, 2017). This view persists because the middle leader is most likely to be the person to whom the principal distributes leadership, where that staff member enacts responsibilities associated with the role (Lárusdóttir & O'Connor, 2017).

Middle leaders are regarded as working *between* the school upper leadership (principal & deputy principal) and the teachers and other staff within the school (De Nobile, 2018; Grootenboer et al., 2015). Due to this activity, that involves working with teachers in and about classrooms, middle leaders are deemed vital in the development of improved student learning outcomes (Grootenboer et al., 2015). As a result, middle leaders are viewed as being more connected to classroom practices than principals and other upper leaders within the school.

Middle leaders in schools tend to hold formal roles of responsibility (De Nobile, 2018; Lárusdóttir & O'Connor, 2017), although this is not always the case as teachers might enact middle leadership activity outside of formal roles (De Nobile, 2018). Grootenboer et al. (2015), however, defined the middle leader role, stating that along with a formal positional role, the middle leader would also undertake teaching responsibilities within the school. Middle leaders engage in activity that is “leadership work” and “managerial work” (De Nobile, 2018, p. 403). Leadership work is about influencing practice by motivating teachers to improve knowledge and practice, whilst managerial work concerns administrative and organisational matters.

In primary school settings, formal roles of middle leadership are often associated with specific curriculum areas (Hammersley-Fletcher & Kirkham, 2007). The mathematics leadership role in a primary school meets the characteristics of middle leadership (De Nobile, 2018; Grootenboer et al., 2015; Hammersley-Fletcher & Kirkham, 2007; Sexton & Downton, 2014). In Australasian primary schools, a middle leadership role for mathematics is common, especially when schools are engaged in mathematics projects.

The name attributed to this formal role of mathematics leader is varied with several titles reported in Australasian literature. Some titles for this middle leadership role used in mathematics projects have included: *numeracy coordinator* (Cheeseman & Clarke, 2005); *numeracy lead teacher* (Higgins & Bonne, 2011); and, *school mathematics leader* (Sexton & Downton, 2014). Even though the role titles differ, common beliefs about the function of the mathematics leader role enacted during mathematics projects is evident.

During projects, mathematics leaders have provided professional learning for classroom teachers through school-based opportunities, alongside what was offered by project team staff (Cheeseman & Clarke, 2005; Higgins & Bonne, 2011; Sexton & Downton, 2014). This happened through leadership work that focused on developing teacher planning practices (Cheeseman & Clarke, 2005; Sexton & Downton, 2014), and creating opportunities for teachers to engage in dialogue through staff meetings and other collaborative settings like informal conversations (Cheeseman & Clarke, 2005; Higgins & Bonne, 2011; Sexton & Downton, 2014). Developing a shared understanding for mathematics teaching with staff was also work enacted by mathematics leaders during projects (Higgins & Bonne, 2011; Sexton & Downton, 2014). Mathematics leaders achieved this understanding by providing in-classroom support for teachers through co-teaching experiences whilst building trusting relationships with staff teams (Cheeseman & Clarke, 2005; Higgins & Bonne, 2011).

Mathematics leaders have also engaged with management aspects of professional learning leadership. These aspects have included: preparing timetables (Higgins & Bonne, 2011), management of mathematics resources for teacher use, liaising with project team staff, and completing tasks for them (Cheeseman & Clarke, 2005). The mathematics leader has been an important feature of project design, and they play a role in supplementing the professional learning offered by mathematics project team staff (Sexton & Downton, 2014).

To contribute to literature about middle leadership and extend what is known about primary school mathematics leaders, the research question that is addressed in this paper is: *On what, did school mathematics leaders direct their professional learning leadership activity during participation in a school mathematics improvement project?*

Context: The CTLM project

The CTLM project was a large-scale school mathematics improvement project designed and facilitated by mathematics educators at Australian Catholic University (ACU). The project was supported by the work of School Advisors Mathematics (SAMs) at Catholic Education Melbourne (CEM), the organisation that funded the project. Seventy Catholic primary schools within the Melbourne Archdiocese participated in CTLM through four intakes from 2008 to 2012 inclusive, with each intake of schools participating for two years in the project.

Participation required all school staff (bar office administration staff) to attend off-site professional development (PD) sessions for two years (~5 per year), with ACU mathematics educators facilitating nearly all lecture and workshop sessions (occasionally SAMs would present). CTLM school staff were also required to engage in school-based professional learning opportunities provided by ACU staff members which were facilitated through demonstration lessons (Clarke et al., 2013). It was expected that classroom teachers would make efforts to implement the advocated knowledge and practices highlighted during the PD opportunities. Teachers were also expected to complete 'Between Session Activities' (BSAs) which usually consisted of classroom tasks and activities. SAMs would also visit CTLM schools (~2 per school term) to support mathematics leaders and teaching staff during the project.

Each school was required to appoint a staff member to undertake the mathematics leadership role. A title for this role was especially created for the CTLM project which became known as *School Mathematics Leader* (SML). Schools were required to provide appropriate time allocation for the SML to lead implementation of CTLM ideas and practices in the schools. An SML role description was created in 2011 by CEM staff in consultation with key ACU staff members. This document stated the expected actions for SMLs, categorised into three key component areas: *Leadership*; *Organisation and management*; and, *Consultation with others/liaison*. Descriptors about these areas were articulated in that document. The SAMs provided leadership advice to SMLs back in their schools on a regular basis during participation in CTLM. Occasional advice was offered to SMLs by ACU staff.

Methodology

With school leadership viewed as activity (Spillane, 2005), CHAT with its focus on ways of understanding activity, provided an appropriate framework to explore the research question.

Theoretical Perspective

As a theoretical framework, CHAT can support researchers interested in studying educational leadership activity, especially that which is enacted through distributed leadership (Hauge, Norenes, & Vedøy, 2012). CHAT, with its roots in Marxist thought, has evolved since the work of Vygotsky and his notion of the mediated act (Vygotsky, 1978). Later CHAT theorists moved Vygotsky's work on and provided researchers with important concepts and analytical tools (Engeström, 2015). Due to the constraints of this paper, the CHAT concepts of *labour*, *object-motive*, and *cultural tools* are focused on.

Within a CHAT perspective, labour is seen as a collective, social process enacted through joint activity. Through this joint activity, the collective subject (group of people focused on shared outcomes) engages in communication with others through their participation in that labour process (Engeström, 2015; Leont'ev, 2005). Any labour process has two functions: to act on the object-motive of the activity, and to influence other people (Leont'ev, 2005).

All labour, and its associated activity, is directed at object-motives (Leont'ev, 1978). Object-motives bring force and drive to the labour activity enacted by the subject in the activity system (Kaptelinin, 2005). Object-motives might take the form of specific tasks or actions that are performed by the subject. The object-motive of the activity system acts as an analytical tool for not only knowing what the subject does, but it also helps understand why that activity is being enacted (Kaptelinin, 2005). Labour activity which is directed at object-motives leads to desired outcomes which act as further driving forces for the activity (Engeström, 2015; Leont'ev, 1978; Roth, 2012). These outcomes are realised once the objective-motives have been achieved (Roth, 2012).

A core tenet of CHAT is that mediating artefacts are used by the subject to mediate the object-motives on which activity is directed (Vygotsky, 1978). These artefacts may take the form of cultural tools or signs. There is a distinction between a cultural tool and a sign due to the way that they orient activity. Cultural tools are externally oriented and practical in nature,

whilst signs are psychological in nature (e.g., concepts). Cultural tools and signs, which carry culturally determined meaning, mediate the relationship between the subject and the object-motive (Engeström, 2015; Vygotsky, 1978). These cultural meanings are expressed most often through language (Vygotsky, 1978). The subject may use both types of mediators to achieve object-motives (Engeström, 2015; Vygotsky, 1978). Cultural tools, used by the subject from one activity system, may also enter the system of another, where they interact and remediate the activity of the subjects in the systems (Engeström, 2015).

Participants and Data Generation

A criterion sampling strategy (Creswell, 2007) was employed to support the selection of participants. The criteria for the participants were that they: participated in the CTLM project (in Intake 4 during 2011 and 2012); enacted the SML role during and after participation in the CTLM project; and, held responsibility for the leadership of mathematics professional learning for classroom teachers during and after the project. Three participants (all female) fulfilled the selection criteria and agreed to participate, with each working in three different school sites.

The three SMLs were interviewed individually in the later months of 2014, at the schools in which they worked. The focus of those interviews (each ~90 minutes) concerned their professional learning leadership labour during participation in the CTLM project in 2011 and 2012. Each SML was asked to bring documents and/or resources that they used and perceived as important in supporting their professional learning leadership during CTLM.

Data Analysis

The CHAT concept of *object-motive* was used as a sensitising concept that acted as an important analysis tool (Kaptelinin, 2005). Using that concept deductively in parallel with an inductive approach, interview transcripts were analysed. Whilst working within the parameters of the broader doctoral research question, the following analysis questions were asked of the data: *What do the school mathematics leaders talk about when discussing the focus of their professional learning leadership during the CTLM project? What do they talk about that is unexpected? What are they not talking about?*

Evidence of object-motives within data sources were sought through a process of reading and coding. Data were coded deductively using the tag *O* (for object-motive), followed by inductive coding using a short phrase that captured examples of the object-motive. The same process was used for coding the data about evidence of cultural tool use (with the tag *T* used). To strengthen validity, a colleague independently coded data excerpts. Both sets of coding were compared looking for consistency. The coded data were then grouped into categories, which were then used to create main themes about the SMLs' object-motives. These themes were then tabulated and matched to data about the cultural tools that SMLs reported that they used.

Findings and Discussion

The analyses of data are presented in Table 1. This presentation shows the themes assigned to the object-motives pursued by the three SMLs in their professional learning leadership activity during CTLM. These themes are not presented in any hierarchical manner. Examples of specific tasks and/or actions, coded during analyses of data, are used to exemplify each object-motive theme. The use of cultural tools is also reported. The provider of a specific tool is shown within parentheses, using the acronym 'ACU' for Australian Catholic University mathematics educators and 'SAM' for the School Advisors Mathematics. If there is no reference to ACU or SAM, then this means that the SML created or sourced the tool themselves.

Table 1
Object-Motives Pursued by School Mathematics Leaders During CTLM

Object-motive	Example of task/action	Cultural tool
Developing consistent, shared understanding of mathematics planning and teaching practices	Facilitating mathematics planning meetings and mathematics staff meetings with teachers (with support from SAMs when at the school) Discussing insights from demonstration lessons and Between Session Activities with staff Co-teaching mathematics lessons with teachers Setting teaching goals with staff	Mathematics planning document (ACU) Demonstration lesson observation template (ACU) Professional reading (ACU) Between Session Activities (ACU)
Influencing teacher affect about mathematics teaching	Developing staff confidence Building trusting relationships with staff Mediating staff relationships with ACU and SAM staff Providing 'warm' feedback to teachers	Feedback protocol (SAM)
Establishing mathematics professional learning behaviours	Building collegiality and responsibility for professional learning Expecting staff to contribute to meetings Requiring staff to complete professional readings Managing staff behaviour at PD sessions	Team agreement (SAM)
Complying with ACU and SAM staff requests and expectations	Completing follow-up tasks set by ACU and SAM staff Ensuring staff complete Between Session Activities Purchasing advocated texts and other resources Responding to email and phone communication	Between Session Activities (ACU) 'Suggested mathematics resources' document (ACU)
Managing human and physical resources	Creating timetables for school visits Seeking permission from staff to host demonstration lessons Booking rooms for school visits Managing mathematics budget Auditing and making available maths resources for staff use	School visit timetable 'Suggested mathematics resources' document (ACU)

By using the CHAT concept of object-motive as an analytical tool (Kaptelinin, 2005), insights about the SMLs' professional learning leadership labour during CTLM became known. The five themes capturing the SMLs' object-motives are: *developing consistent, shared*

understanding of mathematics planning and teaching practices; influencing teacher affect about mathematics teaching; establishing mathematics professional learning behaviours; complying with ACU and SAM staff requests and expectations; and, managing human and physical resources. These object-motives were commonly pursued by each SML, even though they enacted their role in different CTLM schools.

When discussing, on what they directed their professional learning leadership labour, the SMLs articulated several similar tasks and actions found already in literature about leaders' work in mathematics projects. Commonalities between the work of other mathematics leaders and the SMLs are: facilitating mathematics planning meetings and mathematics staff meetings (Sexton & Downton, 2014); co-teaching mathematics lessons with teachers; building trusting relationships with staff (Cheeseman & Clarke, 2005; Higgins & Bonne, 2011); purchasing advocated texts and other resources; responding to email and phone communication; managing mathematics budget (Cheeseman & Clarke, 2005); and, auditing and making available maths resources for staff use (Cheeseman & Clarke, 2005).

Object-Motives as Leadership and Managerial Work

Interestingly, the way that De Nobile (2018) classed middle leadership activity into the roles of “leadership work” and “managerial work” proved a helpful way of making sense of the SMLs' object-motives pursued during CTLM. The object-motives of *developing consistent, shared understanding of mathematics planning and teaching practices, influencing teacher affect about mathematics teaching, and, establishing mathematics professional learning behaviours* are aspects of their labour that could be classed as “leadership work” (De Nobile, 2018). The reason for this is that these object-motives have a clear focus on influencing the knowledge, practices, and dispositions (Spillane, 2005) of the teachers with whom the SMLs worked during CTLM.

The object-motives of *complying with ACU and SAM staff requests and expectations and managing human and physical resources* are aspects of the SML activity that could be deemed “managerial work” (De Nobile, 2018). This is because these object-motives were concerned with administration and organisation. Although not directly related to leadership as influencing knowledge, practices, or dispositions, these object-motives were important in enabling the SML professional learning leadership labour to happen in the CTLM schools. Therefore, these findings suggest that when it came to professional learning leadership labour during the CTLM project, the SMLs directed their activity at both leadership and managerial object-motives. Attention to both leadership and management is required when mathematics leaders enact professional learning leadership activity during mathematics projects.

Poly-Motivated Activity and Tensions Between Object-Motives

The notion that one activity can have several object-motives that directs that activity was first articulated by Leont'ev (1978). This phenomenon is named *poly-mediated activity* (Kaptelinin, 2005). It is evident that the professional learning leadership labour of the SMLs during the CTLM project was indeed this poly-mediated activity. This highlights how complex this middle leadership role can be (Cheeseman & Clarke, 2005).

The complexity of the role occurs when tensions between object-motives arise, creating what is known as a *need state* (Leont'ev, 1978). To resolve this created state, the subject develops a hierarchy of motives (Leont'ev, 1978; Kaptelinin, 2005). This is where object-motives are prioritised over others. This phenomenon was experienced by the SMLs during the CTLM project.

One example is from Rachel. She became concerned that some teachers were not participating in discussions that she used to develop shared understanding of mathematics planning practices. Rachel recounted that she discussed this tension with the SAMs who worked in her school. The SAMs introduced to her a ‘team agreement’ document (a set of

norms of teacher behaviour), they discussed the purpose of the document, and then suggested that she use that tool with her staff. Rachel shared:

And, so that was a really good spring-boarding to "Well, do you (teachers) think that perhaps it would be a really good idea as a staff if we did this? And, so the staff actually said, "Yep. We think we need to do this". So, then we broke it down, and had a big day on discussing all these parts of it (team agreement). So, that was good!

Here Rachel resolves the tension between two object-motives: developing shared understanding of planning practices and establishing professional learning behaviours. This need state (Leont'ev, 1978) was resolved when a team agreement (cultural tool) was introduced to her by the SAMs. Rachel then used that cultural tool to remediate the object-motives that she pursued in her own professional learning leadership activity system (Engeström, 2015). It is also important to note that Rachel did not simply take the team agreement and use it. She appropriated that cultural tool that was introduced via another activity system (i.e., the SAMs), and transformed its use ("we broke it down") to meet her object-motives. Through this process, as Rachel worked on her object-motives, she also developed as a middle leader of teachers in her school. This is an example of the dynamic, dialectical relationship that exists between the subject and the object-motive in activity (Leont'ev, 2005; Vygotsky, 1978).

Introduction of Cultural Tools by Project Team Staff

The previous example (Rachel) shows how during the CTLM project cultural tools offered by the SAMs and ACU entered, were taken up, and remediated the object-motives within the SML activity system. In the case of Rachel, a cultural tool that the SAMs used to influence teachers' behaviour in their own work was offered to Rachel. Rachel, in turn, took up use of that cultural tool and appropriated it for use within her own activity system.

As seen in Table 1, the SMLs used cultural tools that were introduced by project team staff, both the SAMs and ACU staff members. These cultural tools were critical for the SMLs in achievement of their object-motives. This also reflects the importance of those responsible for in-school professional learning to gain access to and use tools as a means of development for themselves as middle leaders, as they pursue object-motives of their labour.

This does not mean, however, that all cultural tools introduced to activity systems are taken up, appropriated, and used to mediate object-motives. One unexpected insight from the data sources was that despite being provided with a role description during CTLM, not one of the SMLs brought this document to the interview, nor was it discussed by the SMLs. This insight suggests that the SMLs did not use this cultural tool to mediate their professional learning leadership labour during CTLM or it was not consistent with their labour processes. An implication here for teams working in future mathematics projects exists. With some cultural tools, specifically role descriptions, it might be better to co-construct these tools with mathematics leaders, if project teams wish for them to be used to mediate their own project team object-motives and those pursued by the mathematics leaders.

Conclusion

The findings shared in this paper show that the SML professional learning leadership activity during CTLM was a special form of labour. This labour was poly-motivated activity, where the SMLs enacted some tasks and actions that were previously undertaken by other mathematics leaders in projects before CTLM, with others that were unique to SMLs and their labour during that project. During the CTLM project, SMLs directed their professional learning leadership labour at object-motives that could be classed as both leadership and managerial work. The introduction of cultural tools from other activity systems proved important in mediating and re-mediating those object-motives pursued by the SMLs.

An important focus, and impetus for the mentioned doctoral study, is future research on how the SMLs continued the use of the cultural tools introduced to them during CTLM, and

how they adapted them for use in their post-project leadership. It is also important to study which cultural tools are no longer used by the SMLs and how their object-motives have changed since participation in CTLM. This offers insights into the SMLs' mastery of tools and how they adapt them to their context when they no longer are part of a project with no direct influence of the ACU and SAM activity systems.

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