School Mathematics Leaders' Perceptions of Successes and Challenges of their Leadership Role within a Mathematics Improvement Project

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The mathematics curriculum leader plays an important role in leading the mathematics curriculum in primary schools. They experience successes and face challenges associated with this leadership role. The perceptions that 25 mathematics leaders held about the successes and challenges they experienced whilst participating in a school mathematics project are reported. Main successes included improved mathematics planning practices using key ideas, transformed cultures concerning mathematics education, and greater use of quality tasks. The main challenge related to sustaining improvements and maintaining the profile of mathematics in school improvement agendas after involvement in the project.

It is common in many Australasian primary schools for a teacher to undertake a role that is related to the leadership of mathematics curriculum. This role could be deemed a *middle leadership* role within school leadership hierarchy because it requires subject leadership (Camburn, Rowan, & Taylor, 2003) that is enacted by a teacher who holds the responsibility for this aspect of the school's functioning (Hammersley-Fletcher & Kirkham, 2007). In recent years, a number of Catholic primary schools in Melbourne supported the institution of this middle leadership role as a result of participation in a school mathematics improvement project. This role was given the formal name of *School Mathematics Leader* (SML). Teachers who undertook this role played an important part in supporting the teachers who were encouraged to embed the mathematics teaching practices that were advocated during the project. Drawing on literature related to the successes and challenges experienced by mathematics curriculum leaders, it was decided that it would be important to inquire into those that were experienced by SMLs during the final year of participation in the *Contemporary Teaching and Learning of Mathematics* (CTLM) project (Clarke et al., 2013). The aim was to identify if the SMLs experienced successes and challenges like those identified in the literature and to disclose any new insights about the successes and challenges associated with the role when participating in a project like CTLM.

Literature Background

Research concerning middle leadership in primary schools has become evident in the literature in recent years. This is particularly the case in the mathematics research community in Australasia with a special issue of *Mathematics Teacher Education and Development* (MTED) that focused on educational leadership for reform in mathematics education (Lamb & Gaffney, 2010). Some articles within this issue considered matters such as the pressures associated with reforms in mathematics curriculum and the role of formal and informal leadership (Gaffney & Faragher, 2010; Lamb, 2010; Vale et al., 2010). Spillane (2005) describes leadership as the activities that are core business of an organisation, which are designed by organisational members. The intention of these activities is to influence other members' knowledge, practices, and dispositions within that organisation or to be understood by organisational members as impacting on their own knowledge, practices and dispositions. Gaffney and Faragher (2010) offer another

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definition set within the school context that sees leadership as "a process of facilitation to achieve whole-school success" (p. 73). These authors maintain that school leaders, in the context of mathematics reform, must have the "knowledge, skills and understandings to promote and support quality teaching, foster appropriate organisational arrangements and build effective community links and relationships" (p. 77).

A variety of names have been attributed to the middle leadership role associated with the mathematics curriculum. These include: *numeracy coordinator*, used in several projects in Australia and the United Kingdom (Bobis, 2006; Cheeseman & Clarke, 2005; Corbin, McNamara, & Williams, 2003; Millett & Johnson, 2004); *focus teacher*, used during a program in Victorian Catholic schools (Clarke, Stephens, Lewis, & Downton, 2005); and *lead teacher*, used in New Zealand (Higgins & Bonne, 2011; Thomas & Ward, 2006). Although the titles attributed to the role varied, the teacher(s) enacting the role played an important part in the reform agenda within the schools. School staff who undertook this role experienced some shared successes and confronted common challenges. The term *mathematics leader* is used in this paper as a way of capturing the different titles used in projects found in the literature.

Successes experienced by mathematics leaders within projects have been identified in the literature. An increased emphasis on mathematics planning practices was evident among teachers as a result of the leadership enacted by mathematics leaders in some projects (Cheeseman & Clarke, 2005; Clarke et al., 2005; Millett & Johnson, 2004). Linked to this success with planning, a greater use of student assessment data by teachers to inform planning decisions was an observable success reported in several studies (Cheeseman & Clarke, 2005; Clarke et al., 2005; Thomas & Ward, 2006; Vale et al., 2010).

Increased professional dialogue about student mathematics learning in informal and formal settings was another success identified by some researchers (Cheeseman & Clarke, 2005; Millett & Johnson, 2004; Vale et al., 2010). This professional dialogue concerned the use of shared language about student learning, planning and assessment in staff rooms, during staff meetings, and through informal conversations with mathematics leaders (Clarke et al., 2005; Millett & Johnson, 2004).

Having clarity of vision about priorities and the ways of managing teachers is a key aspect of mathematics leadership as perceived by some mathematics leaders in particular projects (Millett & Johnson, 2004; Vale et al., 2010). These leaders used their judgements to work individually or collectively with teachers, drawing on a variety of strategies to encourage dialogue about visions for shared understanding of mathematics teaching practices. Making informed decisions about the best way to deal with challenging situations was also a component of clarity of vision (Millett & Johnson, 2004).

Greater sense of collegiality and trust were evident in some projects by the way teachers were willing to share both successes and the failures with their colleagues and with the leaders themselves (Cheeseman & Clarke, 2005; Vale et al., 2010). Some mathematics leaders have reported successes in developing listening skills that supported the encouragement of collegiality between staff members (Cheeseman & Clarke, 2005).

Several challenges have been identified in studies relating to the mathematics leadership role. The most common challenge relates to lack of time allocated to the role which tends to be determined by the principal (Clarke et al., 2002; Cheeseman & Clarke, 2005; Thomas & Ward, 2006). Another aspect of time that causes concern relates to the proportion of time spent on organisation and resource management (Cheeseman & Clarke, 2005), which provides limited time to engage in the design and facilitation of professional

learning for teachers (Millett, Brown, & Askew, 2004). This can prevent opportunities for leaders to plan and teach with teachers, and train new staff members (Thomas & Ward, 2006).

Lack of support from the principal (Clarke et al., 2005) or inconsistent approaches to mathematics curriculum reform demonstrated by him/her (Lamb, 2010) are other challenges that face mathematics leaders. Spillane (2005) suggests that a primary school principal is more likely to engage in the leadership of literacy education rather than being involved in the mathematics routines at the school. This is of concern as principals have the responsibility of engaging with the design and implementation of mathematics professional learning that promotes quality mathematics practices in schools (Kendall-Jones, 2011). Clarke et al. (2005) and Corbin et al. (2003) report that some mathematics leaders faced challenges related to mathematics subject matter and its associated pedagogical knowledge. A lack of these knowledge types can impact on the quality of professional learning that is provided by these leaders, and can affect their own confidence in designing and facilitating such professional learning opportunities for teachers (Clarke et al., 2005). In other cases, lack of knowledge in these areas can inhibit the mathematics leaders' understanding of pedagogical ideas and advice provided by external experts (e.g., consultants) which is given to support the leaders in their role (Corbin et al., 2003). This is a tension considering that leaders are required to possess the appropriate knowledge and practices that promote quality teaching and learning in mathematics (Gaffney & Faragher, 2010).

Even though some studies highlight successes related to increased collegiality between staff, managing colleagues within the school setting is a challenge experienced by some mathematics leaders. Thomas and Ward (2006) report that teacher resistance to new ideas and their lack of motivation towards practices highlighted in professional learning settings caused tensions for some mathematics leaders. Corbin et al. (2003) found that some mathematics leaders experienced difficulties in sustaining teacher collegiality. Tensions existed due to supervisory practices associated with the role (e.g., monitoring teachers to see if practices are being embedded in classrooms) that the mathematics leaders were required to undertake. These practices reportedly affected relationships between the leaders and colleagues.

Method

The data reported here were collected during the final year of the CTLM project (Clarke et al., 2013). CTLM was a research and professional development project designed and facilitated by Australian Catholic University (ACU, Melbourne Campus) mathematics educators and funded by the Catholic Education Office Melbourne (CEOM). The project ran for five years (2008 to 2012 inclusive). During this time period, four intakes of schools engaged in CTLM with each intake participating in the project for a two-year period. One of the components of the project concerned gaining insights about the SML role. A requirement of participation in CTLM included the nomination of a teacher to undertake the SML role. This role was created specifically for the project and mandated by CEOM. Informed by previous studies (e.g., Cheeseman & Clarke, 2005), a role description was designed that focused on three components: *leadership*, *organisation and management*, and *consultation with others/liaison*. It was recommended that each school provide a minimum of six hours release time to allow the SML to fulfil leadership responsibilities.

In October 2012, 25 SMLs from 23 of the 24 Intake 4 schools completed a questionnaire that included opportunities for both closed and open-ended responses. Intake 4 was the final and largest cohort of schools that participated in the project. For this reason,

and due to writing constraints, data that relate to only this intake are reported in this paper. Only the responses to questions related to perceptions of successes and challenges that the SMLs attributed to their leadership role are reported. The responses were collated and then categorised according to themes that emerged from the data using codes (Miles & Huberman, 1994). In many cases, sub-themes emerged from the major themes which have been recorded in parentheses in the tables below.

Results and Discussion

All of the Intake 4 SMLs were able to identify at least one success related to their role, with many leaders articulating a number of successes. The themes and frequency of response are presented in Table 1.

Table 1
Perceived Greatest Leadership Successes Faced by School Mathematics Leaders in 2012

Categories of response	Frequency
Improved mathematics planning practices (use of consistent planning documents; focused planning of key ideas/understandings, teaching and assessment strategies)	14 (56%)
Transformed culture about mathematics education (improved teacher/student attitudes; greater profile of mathematics in school community)	12 (48%)
Increased professional dialogue about mathematics education (focused discussions in team meetings; greater use of specialised terms/vocabulary)	6 (24%)
Greater use of data for planning, teaching and assessing for mathematics learning	4 (16%)
Greater use of quality tasks in classrooms	4 (16%)
Consistent, 'whole-school approach' to mathematics teaching and learning	3 (12%)
Improvements in teachers' mathematical knowledge for teaching	2 (8%)
Greater use of feedback to improve teaching practices (increased opportunities for teachers to act as mentors/coaches with each other)	2 (8%)
Focused curriculum leadership with classroom teachers (gaining trust with teachers; identifying particular teacher needs)	2 (8%)

It can be seen that some of the perceptions of leadership success that the SMLs reported during the final year of the CTLM project align with those identified already in the literature. For example, improved planning practices (Cheeseman & Clarke, 2005; Clarke et al., 2005; Millett & Johnson, 2004), increased professional dialogue (Cheeseman & Clarke, 2005; Millett & Johnson, 2004; Vale et al., 2010), and greater use of data by teachers (Cheeseman & Clarke, 2005; Clarke et al., 2005; Thomas & Ward, 2006; Vale et al., 2010).

The theme of improved mathematics planning practices featured predominately with more than half of the responses (56%) classified within this theme. Some of the SMLs reported success with establishing the use of consistent planning documentation, and the development of teacher expertise in identifying and documenting key ideas and understandings found within the curriculum. The focus on using key ideas and understandings to support mathematics planning was specifically identified in a third of the responses grouped into this theme. Whilst improved planning practices is evident in previous studies about mathematics leaders, the success related to the identification and use

of key ideas and understandings during teacher planning sessions appears to be a finding unique to this study. This perceived success related to planning is important considering that teachers can experience difficulty with some aspects of mathematics planning, particularly when identifying the important ideas embedded in curriculum documentation (Sullivan, Clarke, Clarke, Farrell, & Gerrard, 2013).

A second finding not already identified in the literature reviewed for this study concerned transformations in culture about mathematics education in the CTLM Intake 4 school communities. Nearly half (48%) of the SMLs reported successes which were categorised within a theme about changes in the culture of mathematics teaching and learning. There was some focus on changes in the affective aspects of both teacher and student learning. Responses grouped within this theme included greater teacher confidence when teaching mathematics, students appearing to enjoy learning mathematics more, and raising the profile of mathematics within the school community.

Consistent with the literature, increased professional dialogue emerged as a success from approximately one-quarter of the responses. Some of the responses grouped into this theme described changes in the discussions that took place during staff meetings. One SML commented that she noted changes in the language being more specialised and shared by teachers within in her school. Another unique theme identified through this study relates to the perception that the SMLs held concerning the greater use of quality tasks. Four SMLs reported that due to their leadership, teachers used more purposeful tasks in their classrooms when teaching mathematics. Although the number of SMLs who reported this success is low, this success is worthy of consideration

The themes that emerged from the responses provided by the SMLs concerning the challenges that they faced in their leadership role are presented below in Table 2.

Similar to the successes, many of the SMLs reported more than one challenge that faced them in their leadership role. The table shows that the challenges that they faced were quite varied, as seen in the number of different themes that emerged from the data analysis. Again common to mathematics leaders in other projects, many of the perceived challenges of the SMLs are identified in research literature. These shared challenges include: lack of time to enact leadership responsibilities (Cheeseman & Clarke, 2005; Clarke et al., 2005); training new staff members (Thomas & Ward, 2006); sustaining teacher collegiality (Corbin et al., 2003; Millett & Johnson, 2004; Vale et al., 2010); and, managing resistant teacher behaviours (Thomas & Ward, 2006).

Unique to the SMLs in the CTLM project was a common challenge related to sustaining improvements and maintaining the profile of mathematics education once involvement in the project had ceased. This may have been prominent in the SMLs' responses due to the time of completing the questionnaire (the final professional learning day of the CTLM project in 2012). However, this concern would seem to be legitimate considering that external (e.g., access to mathematics educators) and internal supports (e.g., time release for planning sessions) made available to schools during projects tend to discontinue once project participation ceases (Heirdsfield, Lamb, & Spry, 2010). It is interesting to note that although nearly half of the SMLs (48%) stated that they had experienced success with changing the culture around mathematics, four leaders commented that they experienced difficulties with maintaining the profile of mathematics due to competing school improvement agendas.

Table 2
Perceived Greatest Leadership Challenges Faced by School Mathematics Leaders in 2012

Categories of response	Frequency
Sustaining improvements and maintaining the profile of mathematics education after participation in the CTLM project	11 (44%)
Fulfilling leadership responsibilities due to time constraints	6 (24%)
Limited budgets for resources	3 (12%)
Providing support to teachers new to CTLM school	3 (12%)
Managing behaviour from resistant teachers	3 (12%)
Supporting parents to understand contemporary approaches to mathematics teaching and learning	2 (8%)
Identifying and enacting specific leadership strategies to improve student outcomes	2 (8%)
Limited support from the principal	1 (4%)
Facilitating planning sessions with teachers	1 (4%)
Developing capacity for collaborative work between teachers	1 (4%)
Measuring impact of CTLM project on student outcomes	1 (4%)

As with other reports, time constraints confronted the SMLs during the CTLM project. A contributor to time constraints could be due to the multiplicity of roles that these SMLs were required to enact in their schools. All but one of the 25 SMLs were required to undertake at least one other role in their school setting with classroom teacher as the most frequently cited additional role. The multiplicity of roles appears to be a feature of the mathematics leadership role in primary schools (Higgins & Bonne, 2011). The SMLs identified some of the responsibilities that were restricted due to lack of time which included: planning leadership actions; facilitating mathematics planning sessions (Cheeseman & Clarke, 2005; Thomas & Ward, 2006); and, engaging in discussions with teachers (Cheeseman & Clarke, 2005; Vale et al., 2010). It is unfortunate that some SMLs reported that they had little to time to enact these leadership activities because they have the potential to impact on teachers' work. These activities are relevant to achieving whole-school success in mathematics (Gaffney & Faragher, 2010). Time to engage in discussions about mathematics teaching and learning and time to act upon outcomes of such discussions is important when sustaining professional development and changes in teaching practices (Millett et al., 2004). It appears that the minimum release time of six hours is insufficient for mathematics leaders to enact their leadership activities.

Three responses from the SMLs were grouped into a theme that related to limited budgets. These limited budgets had an impact on the provision for new teaching resources for use by teachers and students in the CTLM schools. Two SMLs were concerned that teachers in their schools did not use the tasks highlighted in the CTLM project because there were no funds to purchase resources used during the professional learning sessions facilitated by CTLM project team members.

Another challenge experienced by the SMLs related to supporting teachers new to the CTLM school. This challenge was faced by mathematics leaders undertaking a similar role in New Zealand primary schools (Thomas & Ward, 2006). Two SMLs reported that sharing information with newly appointed staff members was quite challenging because they

lacked the knowledge and practices associated with the effective mathematics teaching and learning that were explored during the first year of participation in the CTLM project.

Conclusion and Implications

Despite the limitations of gathering data through the use of a questionnaire, insights about the successes that were experienced and the challenges that confronted the SMLs during the CTLM project have become known. Although several successes and challenges are reflected in the literature, there are some new insights revealed by the SMLs who participated in the final year of the CTLM project. These new insights about the successes facilitated by the mathematics leader include: using key ideas and understandings in planning sessions; transforming school cultures associated with mathematics education; and, using a greater number of quality tasks in classrooms. The main new insight about the challenges that face mathematics leaders that has come to light is associated with concerns about sustaining improvement and maintaining the profile of mathematics education.

The successes reportedly experienced by SMLs in 2012 have a clear focus on what Spillane (2005) describes as leadership. This is the case particularly because those successful actions reportedly had effects on the knowledge, practices, and dispositions related to mathematics education in the CTLM school communities. The most frequent challenge reported by the SMLs could also be deemed as one associated with Spillane's notion of leadership because they were concerned with ways of sustaining improvements in mathematics teaching and learning. The challenge of maintaining the profile of mathematics also meets Gaffney and Faragher's (2010) ideas of leadership because the SMLs expressed a challenge in ensuring that the schools' organisational arrangements maintained a focus on mathematics education within their school communities after participation in the CTLM project.

Even though these SMLs are middle leaders, they require the assistance from principals to mitigate the challenges that they experience when leading mathematics reform. This is of particular interest considering that three of the most frequent responses regarding the SMLs' challenges appear to require support from principals. This could be a concern as school principals are more likely to be involved in the leadership of the literacy curriculum than the mathematics curriculum in primary school settings (Spillane, 2005). If principals play an important role in maintaining quality teaching and learning within the school setting (Kendall-Jones, 2011), then it is important that principals work closely with mathematics leaders to set up structures for opportunities to sustain reforms initiated during project participation and maintain the place of mathematics on school agendas (Higgins & Bonne, 2011).

An implication that arises for external experts (e.g., consultants, mathematics educators) who work with these leaders in projects relates to the planning of 'post-project directives' or action plans before participation in projects cease. Strategies for maintaining and adapting the processes and structures could form part of the professional learning for mathematics leaders and school leadership teams in the participating schools. This would be done with the intention of continuing improvements led by the mathematics leader, supporting the reforms advocated and highlighted through the improvement project and enacted by teachers in their classrooms.

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