Networks of Support and Influence in the Numeracy Development Projects: A Case Study of Two Schools

Joanna Higgins
Victoria University of Wellington
<joanna.higgins@vuw.ac.nz>

Linda Bonne
Victoria University of Wellington
<linda.bonne@vuw.ac.nz>

This paper reports on an exploratory case study of the networks that support and influence teachers' numeracy instruction. Forty-one teachers, numeracy lead teachers, and senior management in two schools that had recently undergone a renewed, two-year focus on the Numeracy Development Projects completed a survey that included creating a diagram of the network of people who support and influence their numeracy instruction. Fifteen staff then participated in an interview that included discussion of their network diagram. Characteristics of networks shown in participants' diagrams included strong within-school networks and elements of ongoing support from facilitators. A smaller role was played by networks that extended beyond the school site, such as lead teacher networks. The provision of release time was an organisational and resourcing consideration for schools that appeared to support teachers to engage with colleagues from their networks, with the shared purpose of improving their instruction.

Background

In New Zealand professional development projects, collaborative work focused on improving instructional practices in schools is often reported in studies of literacy (McNaughton & Lai, 2009; Timperley & Phillips, 2003) and, to a lesser degree, numeracy (Anthony & Walshaw, 2007). Numerous forms of school organisation (syndicate groupings, whole-school staff meetings, and senior management team meetings) provide opportunities for collaborative efforts in setting visions, planning, assessment practices, and professional learning. A variety of descriptors of this shared work in use in New Zealand primary and intermediate schools include communities of practice, communities of learning, and networks of practice. How teachers and school leaders see these various networks as supporting and influencing instruction in numeracy is the focus of the current study.

In their work on situating teachers' instructional practices in the institutional setting of the school and school district, Cobb and McClain (2006) used Wenger's (1998) three interrelated dimensions of a community of practice, "a joint enterprise, mutual relationships, and a well-honed repertoire of ways of reasoning with tools and artifacts" (p. 86), to analyse communities and networks of practice. A joint enterprise "entailed the teachers developing a relatively deep understanding of the mathematical intent of instructional activities so that they could achieve their instructional agendas by capitalizing on students' reasoning" (Cobb & McClain, 2006, p. 86). The dimensions of mutual relationships are the norms of participation, such as the sharing of instructional activities. Cobb and McClain suggest that through the three interrelated dimensions, "members of each community therefore afford and constrain the practices developed by members of other communities" (p. 81).

Coburn and Russell (2008), in reviewing definitions of professional community found in the literature, conclude that "they generally conceptualise it as including such dimensions as shared norms and values, a focus on student learning, social trust, deprivatisation of practice, collective responsibility, and collaboration" (p. 204). They caution that, while the field of study of professional community highlights the importance of teachers' social relations in improving instruction, there are several conceptual and methodological limitations to do with identifying which features of social relations assist teachers to improve their instructional practices. They suggest that at least four dimensions of teachers' social networks are important, including "structure of ties, trust, access to expertise, and

the content of interaction" (p. 204). These dimensions are similar to those that appear in Timperley, Wilson, Barrar, and Fung (2007). In summary, it is the depth and focus of the teacher interactions in a school that are important (Cobb & Smith, 2008).

This paper uses the term "networks of support and influence" because the notion of networks is relevant to up-scaling professional development (Cobb & McClain, 2006, p. 87) and sustaining new instructional practices within and across schools. The role of school-based networks of support and influence is critical to supporting ongoing learning and development in numeracy. Dimensions that may constrain and support the development and sustaining of networks include school size, school-based forms of reporting, school-based and project-based management structures (for example, senior management team, numeracy lead teacher), and the stage of implementation of the Numeracy Development Projects (NDP). Factors such as people's interpretation of roles, such as the role of the numeracy lead teacher, may also be important.

Methodology

This exploratory case study[1] aimed to define questions and hypotheses for a subsequent study. The focus on networks of support and influence was one component of a study[2] that also investigated instructional leadership, embedding the NDP, and the diagnostic interview as a smart tool. This paper examines the role of networks in supporting teachers' ongoing learning and development in numeracy and aims to answer the research question:

- What are the characteristics of structures of influence and support on which teachers draw for the ongoing development of their teaching practice, and how are they supported or constrained by the school organisation?

The study builds on the work of Coburn and Russell (2008) and Cobb and Smith (2008) to examine how school organisation "can support or constrain the development of productive social interaction between teachers that enables them to make positive instructional change" (Coburn & Russell, 2008, p. 48). Drawing on Cobb and Smith, 2008 (p. 14), the teacher and senior management team interviews incorporated questions to find out:

- who influences how teachers teach mathematics;
- each person's understanding of the school's policies for mathematics instruction (or their vision for instruction);
- the person's informal professional networks;
- official sources of assistance each person can draw on.

Participants

The two Wellington-region schools participating in the study had originally completed numeracy professional development in the NDP's early years of implementation and, more recently, had undertaken a renewed focus on numeracy. The schools continued to call on outside facilitators to support the continued improvement of numeracy instruction. Both these urban full primary schools were selected because they reported recent improvements in their students' achievement; for example, data from school B showed that the achievement of a target year group had improved. Also, both schools were geographically convenient to the researchers.

School A was a medium-sized, high-decile, state primary school. The school had one numeracy lead teacher – a classroom teacher and syndicate leader – who had been in the lead teacher role for

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1 See Yin (2003) for a discussion of case-study methodology.

2 See other papers by Higgins and Bonne in this volume.

approximately eight years and who currently worked with two colleagues towards embedding the NDP in their school setting.

School B was a large, high-decile, state primary school. The lead teacher responsibilities at school B were shared by a classroom-based lead teacher (lead teacher 1) and a lead teacher who was a "walking" member of senior management (lead teacher 2). Lead teacher 1 had been a numeracy lead teacher at her previous school and had been in her current role at school B for three years. Lead teacher 2 had taken up the second lead teacher role when a colleague had left the school the year before and had also worked in the role several years previously.

The two schools can be thought of as being at different stages of implementation: school A was still undergoing the organisational redesign needed to support full implementation of the NDP; school B was embedding the structural changes they had already put in place.

Procedures

All teachers, numeracy lead teachers, and senior management (including principals) were invited to participate in the study. Initially, all teachers and senior management members were asked to complete a survey (see Appendix J, pp. 195–197) at each school's numeracy-focused staff meeting, at which the researchers made field notes. Several teachers at both schools took up the option of completing the survey after the meeting for later collection. Survey questions were generated using Cobb and Smith's (2008) frame of leadership priorities and were designed to elicit responses about leadership, networks of support and influence, formative assessment, and the roles these play in sustaining the NDP in their school[3]. At both schools, almost 90% of staff returned completed surveys.

As part of the survey, each staff member was asked to create a diagram of the network of people who support and influence their numeracy instruction. Of the total number of respondents, 11 from school A and 25 from school B created diagrams. The researchers were aware that respondents' interpretations of this task would vary and were testing its usefulness in preparation for future application on a wider scale.

Networks of support and influence was also a focus of one section of audio-taped interviews, which were subsequently carried out with lead teachers of numeracy, all members of senior management, and a representative sampling of teachers at both schools. At school A, there were six interviews, held with: the numeracy lead teacher (who also taught year 3–4 students), the principal, the deputy principal (who also taught new entrants), the assistant principal (who also taught year 5–6 students), and two other teachers who were part of the NDP team (one taught year 7–8 students; the other taught year 5–6 students).

At school B, there were nine interviews, held with: numeracy lead teacher 1 (who also taught new entrants), numeracy lead teacher 2 (who was also the deputy principal), the principal, the assistant principal, a teacher with special responsibility for curriculum, and one classroom teacher from each of the following year groups: years 3–4, years 5–6, years 7–8. An additional teacher of year 5–6 students, who had undergone NDP development elsewhere and was identified as having a particular strength in teaching numeracy, was interviewed at the principal's recommendation. All school and numeracy leaders were interviewed with the questions shown in Appendix J, which also includes teachers' interview questions. In the case of dual roles, leadership roles took precedence over teaching roles; for example, the numeracy lead teacher at school A, who also taught year 3–4 students, was interviewed using the questions for school leaders.

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[3] See other papers by Higgins and Bonne in this volume.

Lead teachers were also asked to provide copies of school documentation that supported the development of high-quality numeracy instruction and student achievement data for the current and previous year. In summary, the school's dataset comprised surveys, interview transcripts, school documentation, and student achievement data.

Analysis

A qualitative approach was taken to the diagram analysis, using three major patterns referred to as "spoke", "chain", and "net" structures by Kinchin, Hay, and Adams (2000, p. 43). These structures were used by Kinchin, Hay, and Adams in relation to students' depth of conceptual development. Adapted for the current study, the structures provided a helpful analytical lens through which to identify the complexity of networks with which teachers associated themselves. The three structures resemble the following patterns:

- Spoke structure: all members of the network are connected directly to the teacher but are not linked to one another;
- Chain structure: members of the network are linked in a linear order, perhaps implying hierarchy;
- Net structure: interconnections between various members of the network are indicated.

Characteristics of networks of support and influence were drawn from the diagrams, a sample of which is reproduced here. Data from interviews was used to identify how teachers' engagement with networks was supported or constrained by the school organisation.

Findings

Part 1: Characteristics of Networks of Practice

There were a number of challenges involved in analysing the diagrams: not all staff completed a diagram; some made what seem to be very cursory diagrams; the diagrams were collected across two sites; the diagrams capture one point in time in the professional development process; and because the diagrams were completed by individuals in the school, they do not necessarily reflect the stage of the embedding process at the school level. More research is needed to establish the depth and focus of the interactions between the people in the networks. In some cases, using the diagrams as a prompt in the interviews exposed the possibility of changes to the overall structure, so that, for instance, spoke structures might become net structures by the addition of interconnections.

Network diagrams are used here to illustrate the study's findings. For each school, diagrams are presented here from the lead teacher/s, a classroom teacher, and a senior management member.

The first three diagrams (see figures 1–3) are from staff at school A, which is still implementing the organisational redesign needed to support further development of their numeracy instruction. The lead teacher at this school is also a classroom teacher, and the net structure she created (Figure 1) includes supports and influences from people who are outside the immediate school context: a family member, a friend, and mathematics advisors. Also noted in the diagram is the typical focus of the lead teacher's interactions with members of her network.

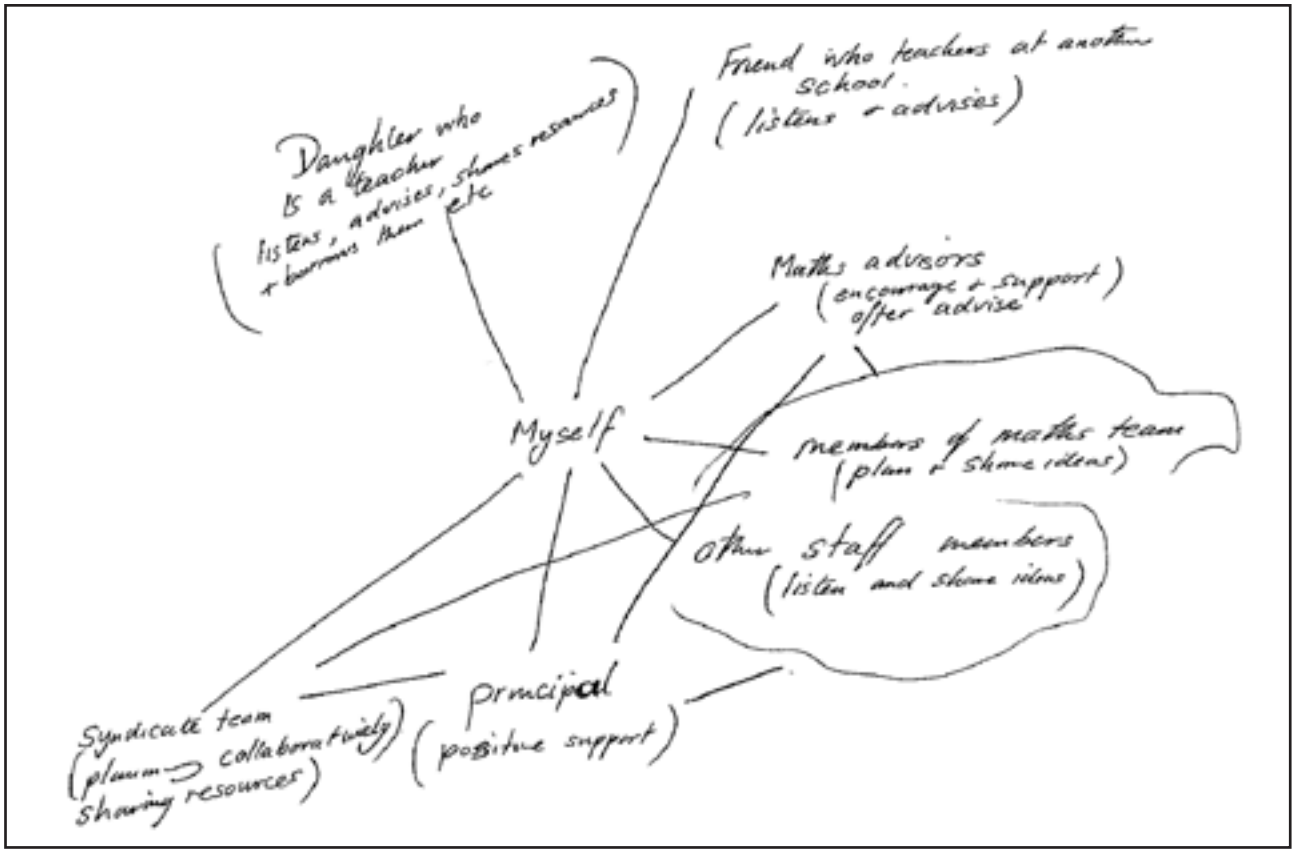

Figure 1. Classroom-based lead teacher's diagram of the network of people who support and influence their numeracy instruction (school A)

Figure 2, from another teacher, is a spoke structure that also includes as a support and influence a family member who is a teacher.

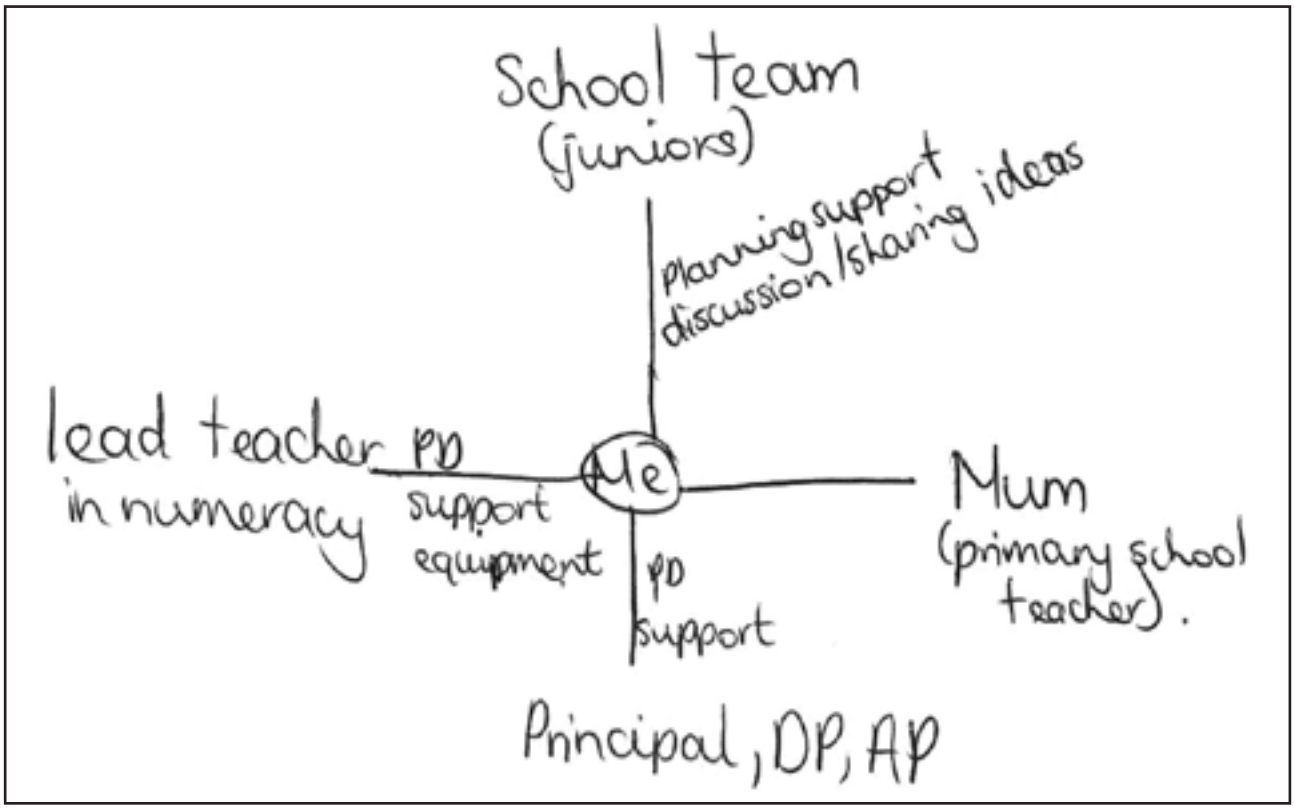

Figure 2. Teacher of year 1–2 students' diagram of the network of people who support and influence their numeracy instruction (school A)

Figure 3 from school A is from a member of the senior management team and reflects a strong emphasis on pedagogy and student learning. This is another example of a net structure, showing interconnections between network members.

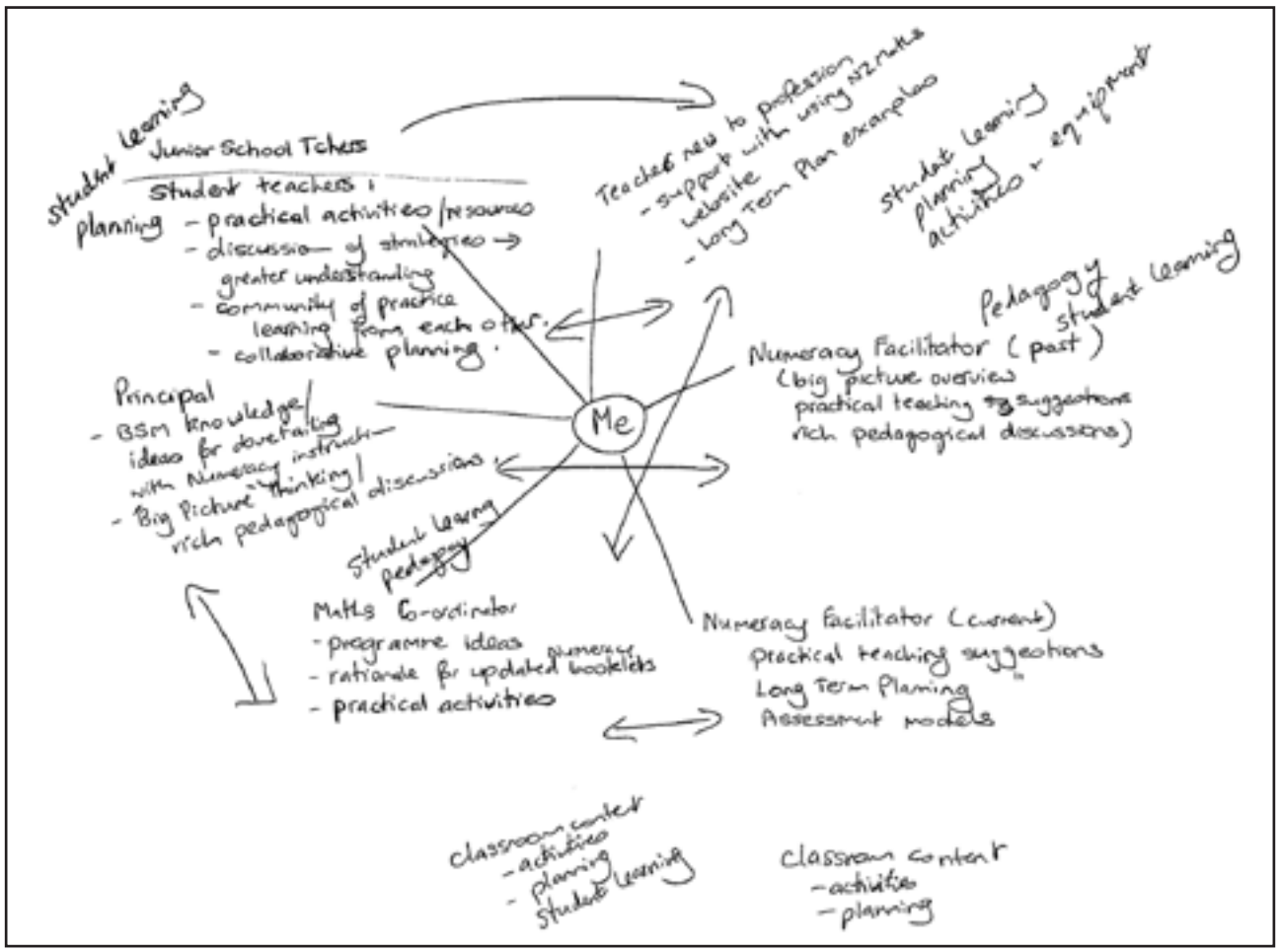

Figure 3. Senior management member's diagram of the network of people who support and influence their numeracy instruction (school A)

School B had two lead teachers of numeracy. Figure 4, a net structure, was drawn by a lead teacher who was also responsible for teaching a class.

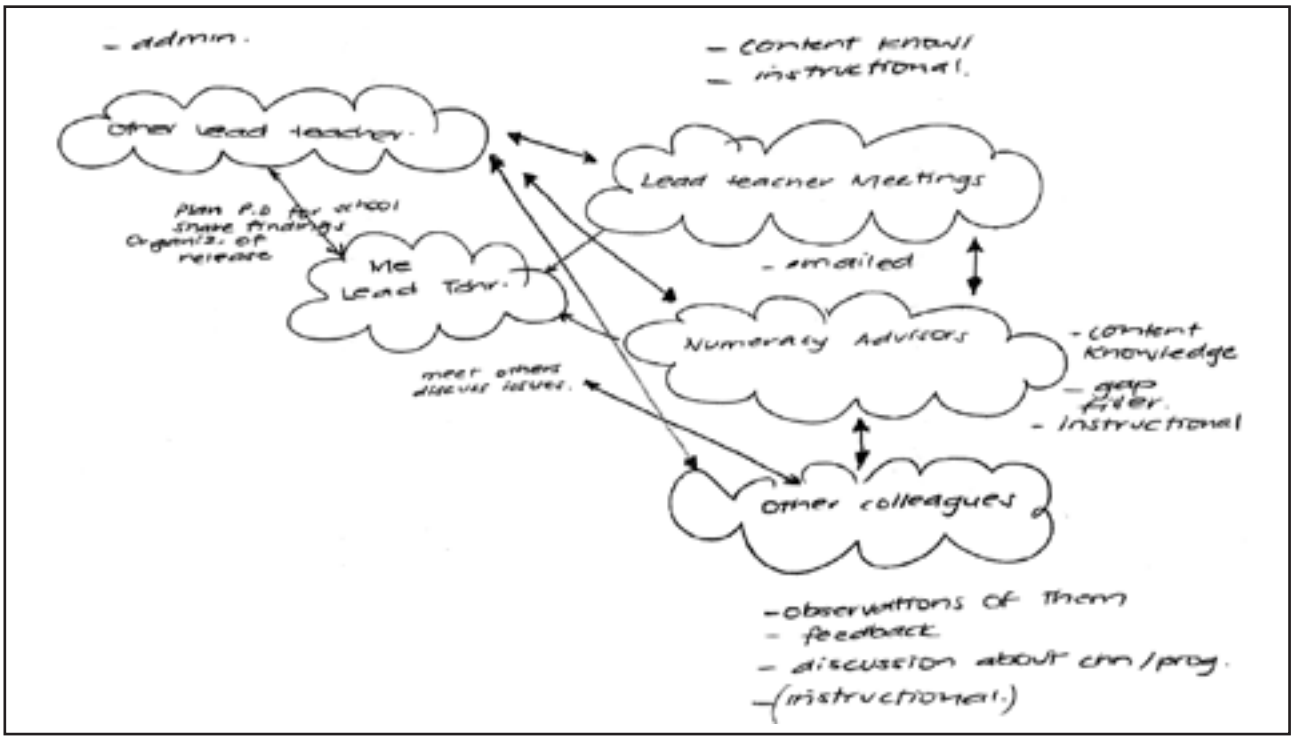

Figure 4. Lead teacher 1's diagram of the network of people who support and influence their numeracy instruction (school B)

The diagram in Figure 5, by a member of senior management who was also the second lead teacher of numeracy at school B, is closer to what Kinchin et al. (2000) describe as a chain structure. This person's interpretation of the task may have been affected by the fact that they did only a small amount of numeracy teaching; the diagram tends to reflect the senior manager's/lead teacher's role in supporting and influencing others.

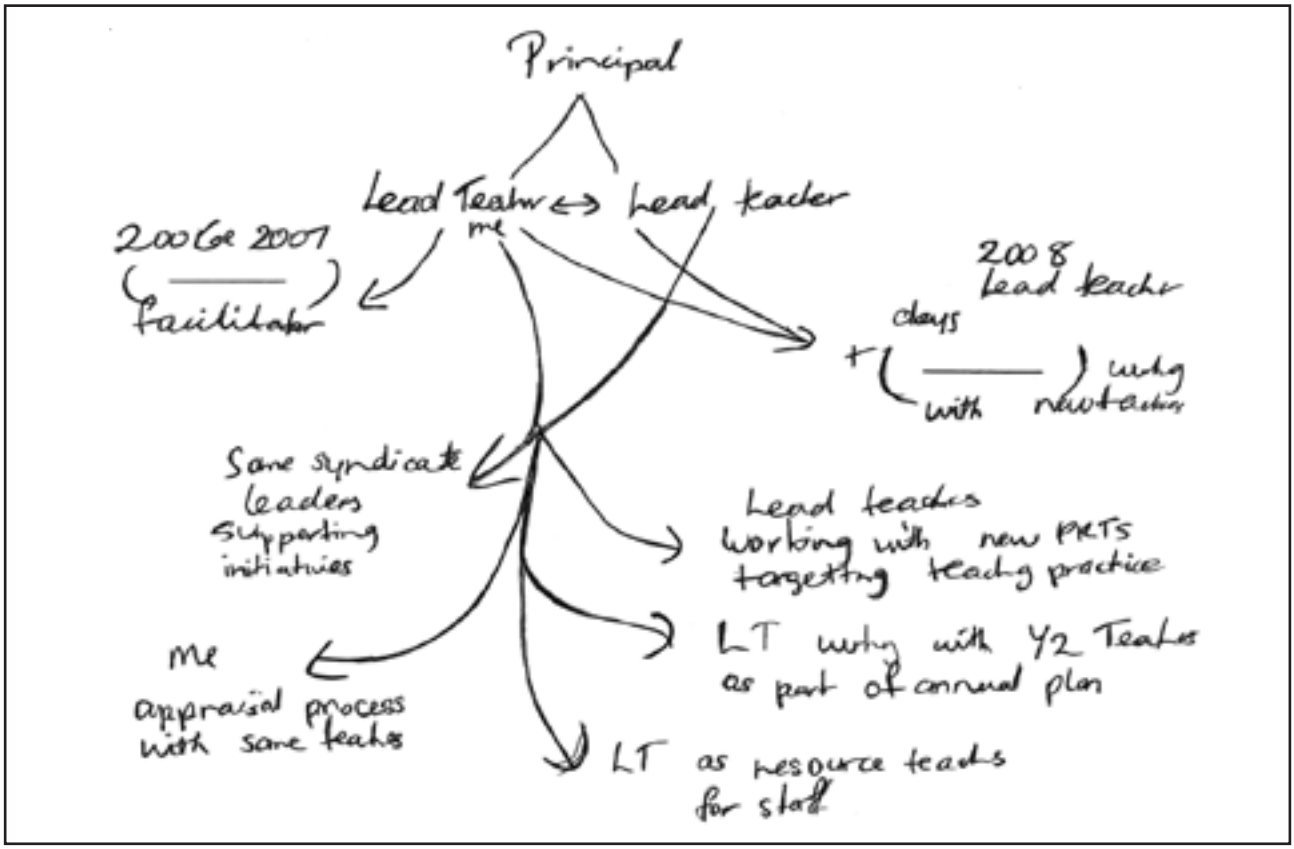

Figure 5. Lead teacher 2's diagram of the network of people who support and influence their numeracy instruction (school B)

The final diagram – another net structure – was created by a teacher of year 5–6 students.

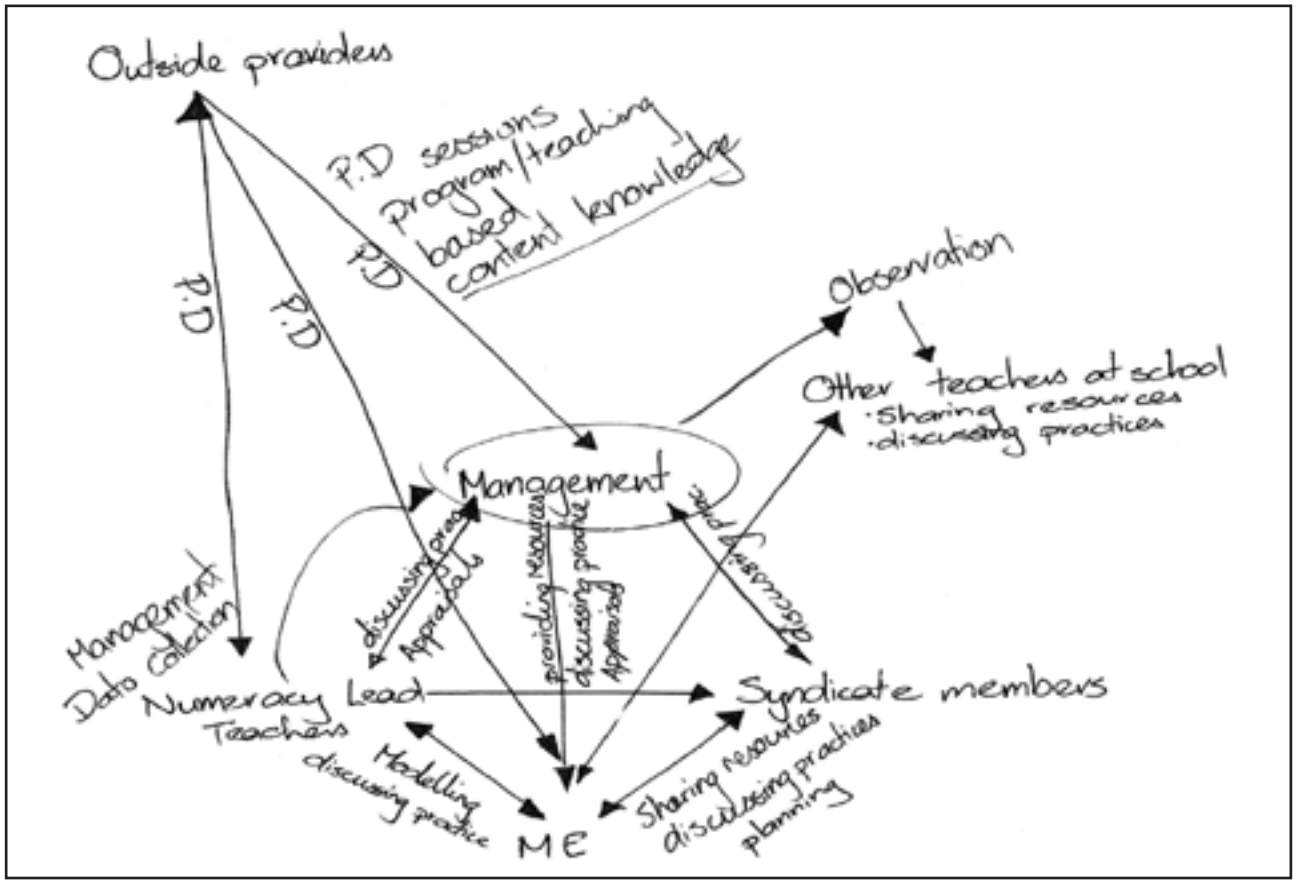

Figure 6. Teacher of year 5–6 students' diagram of the network of people who support and influence their numeracy instruction (school B)

From the three diagrams from school B reproduced here, as well as from those drawn by others at the same school, it seems that the teachers at school B tend to draw support from within their own school rather than seeking it beyond their immediate context. It was interesting to note that there was little evidence of professional, collegial relationships with teachers at other local schools. One likely reason for this is that this data was collected in a large school, in which there were many opportunities for observing colleagues who teach a similar year level. Structures and practices that support the continued improvement of numeracy instruction, such as the lead teacher being released to model for colleagues and then observe them and give critical feedback, were by now embedded in the fabric of the school. The apparent self-sufficiency of the staff might also be influenced by the whole-school professional development model; the more typical model of delivery begins by drawing together teachers of year 1–3 students from a cluster of neighbouring schools, before working with teachers from years 4–6, and then years 7–8. It may be that this more common model provides opportunities for teachers to build networks with colleagues at other schools.

Looking across the diagrams completed by staff from the two schools, the structures most often used are spokes (19 diagrams), with net structures the second most common (10), and chains the least common (7).

Part 2: Supports and Constraints of School Organisation

A variety of structures were in place at school B to provide teachers with opportunities to develop their numeracy instruction by drawing support from, and being influenced by, colleagues within

their own school. These structures included: a buddy-teacher system (teachers were paired with a colleague who taught a different year level and who often had a different degree of expertise); syndicate groupings; neighbouring teachers (typically teaching the same year group); lead teachers being released to model and then to observe colleagues and give feedback; and numeracy goals being part of every teacher's appraisal.

The provision of release time for lead teachers allowed them to attend lead teacher professional development meetings at the local university. Both lead teachers at school B referred to lead teacher days or lead teacher meetings in their diagrams (see figures 4 and 5), although both commented during their interviews that they had not attended these consistently and were unconvinced of the usefulness of attending these sessions, which sometimes required employing a relief teacher. One of the lead teachers did, however, remark on the potential helpfulness of such a network:

> It would be nice to be in contact with other lead teachers in other schools, particularly those who you might get along with in some way and you felt you could ring that person and ask "Hey, what are you doing about this or what are you doing about that?" Cos sometimes, you know, I do feel like sometimes we're in an island in a very big sea. (Lead teacher 1, school B, interview)

Where release time was not made available, teachers attended after-school courses. An advantage of attending courses outside school hours was that a whole syndicate was able to attend: "and that is so much better than one person, that's so good to actually ... really be involved" (senior management member, school B, interview).

Release time was a necessary component of the lead teachers' classroom modelling, observation, and feedback process and was highly valued by teachers as a means of collaborating with members of their networks of support and influence to develop their numeracy instruction. At school B, this practice was reported by 22 of 28 staff as being one of the three most important factors that had contributed to sustaining the development of numeracy instruction in their school, with comments such as:

> Modelling and feedback – teaching practice can change through teacher modelling and feedback, rather than dialogue alone. (Year 0–1 teacher, school B, survey)

Release time was also needed for liaison visits to early childhood centres. These visits occasionally included a focus on numeracy.

Email was used to maintain communication between various members of networks of practice, as needed:

> I've just emailed [the facilitator] with a couple of questions, and she said "I'll just [call in] and answer one of those" ... (Lead teacher 1, school B, interview)
>
> [the facilitator] and I still email over various things over mathematics. (Senior management member, school A, interview)
>
> I provide the feedback form and I email that through to [the teacher] plus our AP ... whoever's in charge of that area, and if it was a provisionally-registered teacher, a copy also goes to their tutor teacher. (Lead teacher 1, school B, interview)

During the interviews conducted as part of this study, lead teachers and those in management roles were described as lynchpins and hubs, signalling their pivotal role in connecting people in networks in order to develop numeracy instruction:

> So even if it's not a professional development focus, [the lead teacher] is really our lynchpin in that she goes to the workshops and she brings back into the school the new thinking. (Senior management member, school A, interview)
>
> And within school management, well yeah, because I'm part of middle management, so I guess you've got, we're bridging that gap between our scale A teachers and our senior management and sharing what's going on between the two ... (Year 7–8 teacher, school B, interview)

> And it's having that relationship with teachers that they come and say "Oh I just can't get so and so", and then we're able to think on the spot and say "Oh right, okay, I'd bet ... [the lead teacher] would know", or "[another teacher with expertise in mathematics teaching] has been using ..." So if you know what everyone's doing ... you're a hub to sort of say, "Oh okay, go and talk to this person" or "Let's have a look at the data, what does your number test say?" or "What does your GloSS [Global Strategy Stage] say?" (Senior management member, school A, interview)

One lead teacher described networks of practice as supporting teachers to become confident numeracy teachers:

> I think that everybody is confident, or if they're not confident, [they] know where they can find the help they need, that they've got the guidelines and the processes [so] that they can become confident teachers. So they've got the support networks in place for them. (Lead teacher, school A, interview)

Discussion and Conclusions

Characteristics of the networks of support and influence at these two schools are particular to their contexts, so the findings from this initial study cannot reasonably be generalised to other settings. The study showed that, in the two participating schools, a greater number of functional, within-school networks supported and influenced teachers' numeracy instruction than networks that reach beyond the school. While the main involvement of the facilitators was two years prior to the diagrams being completed, many participants included the facilitator in their network diagram. What is not known is the extent to which the scope of the networks was shaped by the stage of embedding the professional development or by the fact that the teachers had undertaken their most recent numeracy professional development as a whole school led by an external facilitator. The provision of release time enabled numeracy lead teachers, senior management members, and teachers to interact with others in their networks in order to collaborate with the goal of improving instruction. Both schools indicated their intention to visit other schools in the coming year to observe numeracy instruction. What remains to be seen is whether doing this will impact on the teachers' networks in terms of the depth and focus of the interaction, how this might in turn influence their numeracy instruction, and, ultimately, how this might be linked to students' achievement in numeracy.

For Further Research

- "There is abundant evidence that the mere presence of collegial support is not by itself sufficient: both the focus and the depth of teachers' interactions matter" (Cobb & Smith, 2008, p. 5). Further research is needed to examine these aspects of teachers' interactions within their networks of support and influence.
- What are the effects of teachers having no networks that extend beyond their own school? How is a teacher being part of a wider network associated with the achievement of their students?
- In what ways are networks of support and influence of more experienced teachers different from those of less experienced teachers?

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