Professional development for secondary school mathematics teachers: a peer mentoring model

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Professional development is important for all teachers, and in low socio-economic schools where the challenges of teaching are greater this need is crucial. A model involving a combination of one-on-one peer mentoring integrated with group peer mentoring was piloted with experienced mathematics teachers of senior students in low socio-economic schools. The results of the study highlight the benefits of this model and identify key factors necessary for successful implementation. In particular, these factors were selection of partners, time, trust, developing a clear structure around the goals, building a relationship, and meeting regularly as a collective group.

Keywords: Professional development; peer mentoring; mathematics teachers; secondary schools

1. Introduction

Student engagement and learning is an ongoing challenge for all teachers, but can be even more demanding for teachers who work in low socio-economic communities where many of the students enter secondary school academically unprepared for the requirements of the school curriculum. Furthermore, many students in these communities come from families where their income, housing and health care are at risk, having significant impact on their learning (Kitchen, 2003; Phillips, McNaughton, & MacDonald, 2001). For the teachers working in these schools, motivation and commitment to higher quality teaching with ongoing support are crucial (Desimone, Porter, Garet, Suk Yoon, & Birman, 2001).

The aim of this paper is to describe a model of peer mentoring, which was piloted with a group of senior mathematics teachers working in low socio-economic secondary schools, within a large city in New Zealand. These schools were part of a larger ongoing project which received substantial government funding to research aspects of mathematics development. In this paper the following question is explored: is peer mentoring a worthwhile

professional development strategy for mathematics teachers in low socio-economic secondary schools? A subsidiary question is: if worthwhile, what factors are important for setting it up? Issues particular to the academic abilities and welfare of students at schools in low socio-economic schools are not addressed, as this is beyond the scope of this article.

The article begins by describing the background of the mathematics teachers involved in the study to give the context. The literature follows, briefly reviewing the need for effective professional development and then more specifically peer mentoring and why this model was chosen. How the model was set up and the methodology used is outlined. The analysis and results are presented with a discussion of what was important for setting up peer mentoring and why it was worthwhile, highlighting the potential benefits and drawbacks.

2. Background context

Internationally, it seems that many schools in poor areas face difficulties. Kitchen (2003) describes schools in the U.S. that primarily serve high-poverty, diverse communities often consisting of dilapidated facilities, which are not conducive for teaching or learning. As well, he characterises these schools as having fewer resources which are also often outdated and that teachers repeatedly work with "children who face a myriad of difficult social circumstances" (p.18). The situation appears to be similar in New Zealand as the Education Review Office (Thrupp, 1998) reports that students from low socio-economic schools often face barriers to learning. These barriers also include the home environment in terms of parental stress, family instability and unemployment. One example reflecting this is the difficulty teachers' face having to work with students who may arrive at school hungry and distressed, or are the victims of parental neglect. In the homes, students may be expected to help with household duties and mind younger siblings, especially if both parents are working long hours to support the family, and for many, constraints such as these make it difficult to do homework or study for tests and exams (Kitchen, 2003; Phillips et al., 2001). As a result, many students in these areas are arriving unprepared for the demands of secondary school and consequently, student participation and achievement at school are of concern.

Kitchen (2003) argues that for students entering secondary schools in underprivileged areas there are gaps in the required knowledge they need and that this gap is growing. He claims that, as a result, expectations from teachers in the classroom are commonly lower, denying the students access to challenging coursework. Opportunities such as high-level

thinking and the development of critical thinking skills are regularly missing, and instead Kitchen insists, the focus, particularly in mathematics, is on rote instruction of low-level skills.

In New Zealand, resources in secondary schools located in low socio-economic communities are noticeably fewer, class sizes are larger, and for mathematics there is considerable variability in the level of skills the students have (Kensington-Miller, 2007). At senior levels in such disadvantaged schools, Kensington-Miller explains that there is commonly only one mathematics class - either calculus or statistics - whereas both are offered at schools in more affluent areas. In contrast, higher socio-economic schools have larger mathematics departments, with more teachers, and smaller class sizes. They are well resourced, and the students are at similar standards. There are usually at least three or four classes for each of calculus and statistics so teachers can work together and collaborate (Alton-Lee, 2003; TIMMS, 2003). It is understandable therefore that teachers in poorer schools may struggle to progress their students with the many formidable challenges they, and their students, face (Hynds & McDonald, 2009).

An earlier study by the author (Kensington-Miller, 2007), based on mathematics teachers in low socio-economic schools in New Zealand, discusses the isolation teachers in these schools regularly experience having only one senior class. The study highlights that as a result there a lack of available collaboration for sharing ideas and for monitoring the pace of delivery to students. For these teachers, professional development during school hours is often problematic, as finding good relief teachers who can also teach mathematics at senior levels is difficult . Furthermore, any funding for professional development is scarce as buying resources is often a priority. In addition, many feel that time away from their classes not only causes disruption but means further time spent catching up on work missed; time they do not have.

3. Professional Development

Willis (2002) recommends that professional development should be site-based, long-term, on-going, accessible, and inclusive, and therefore part of a teacher's everyday practice, rather than tacked on. In this way, more active learning opportunities can be offered to suit a teacher's individual needs and goals, and being long-term there is time for teachers to consider alternatives, while being encouraged and supported (Ball, 1996; Loucks-Horsley &

Matsumoto, 1999; Zaslavsky & Leikin, 1999). Another important factor is for teachers to have ownership of their development making participation voluntary and expectations explicit at the outset, so they know what they are 'buying' into (Kedzior & Fifield, 2004; Lee, 2001).

Traditional mentoring is one strategy that can incorporate many of the above recommendations. It classically describes a two-way relationship between a mentor, typically older and more experienced, who supports, guides and counsels a protégé, in an evolutionary process (Kram, 1988; Kram & Isabella, 1985). The articles on mentoring are prolific, promoting the merits of this strategy (Allen, Russell, & Maetzke, 1997; Chan, 2008; Ehrich, Tennent, & Hansford, 2004). In a meta-review by Ehrich *et al.*(2004) of over 300 research-based articles, the main benefits are listed as increased confidence, personal satisfaction and growth, encouragement, friendship, advice and feedback on performance, developing collegiality, networking, and reflection.

The difficulty of traditional mentoring however, is that it is not always easy to access (Darwin & Palmer, 2009) and finding enough good mentors who have time can be problematic (Ehrich et al., 2004). There are also concerns around the lack of time, poor planning, a lack of understanding of the mentoring process, unsuccessful matching of mentors and mentees, and lack of access to mentors from minority groups (Ewing et al., 2008). As well, traditional one-to-one mentoring can sometimes promote a hierarchical power relationship between the mentor and protégé reinforcing feelings of loneliness and professional self-doubt (Darwin, 2000; Driscoll, Parkes, Tilley-Lubbs, Brill, & Pitts Bannister, 2009). Furthermore, for schools in low socio-economic areas, the expense in terms of money and time to implement a formal mentoring programme can be prohibitive.

Peer mentoring is an adaptation of traditional mentoring, and can be set up between teachers who work together in the same domain to provide the help, advice and encouragement needed when trying to implement different ways of teaching (Darwin & Palmer, 2009). With effective peer mentoring, as the relationship grows and collegiality develops, trust will build, and current ideas and beliefs can be challenged or validated in a 'safe' environment (Robb, 2000). In this way, peer mentoring can provide a fresh 'set of eyes' in the classroom to help reflect on what is happening, to notice any difficulties that might arise, and to then help identify what the cause(s) might be (van der Berg, 2002; Zaslavsky & Leikin, 2004). An effective peer mentor is able to recognise and validate good practice (Kedzior & Fifield, 2004; Zachary, 2000) and can help their partner develop their

professional identity within their practice (Wenger, 1998). This in turn builds confidence (Graven, 2004).

Teachers who meet together on a regular basis for group peer mentoring have the opportunity to share their experiences and support each other. From an extensive study of the literature by the Timperley, Wilson, Barrar, and Fung (2007), their recommendations support the participation of teachers in structured professional groups as interaction with colleagues create opportunities for new learning:

> All the core studies reported teacher participation in some form of structured professional group: this is one of the most consistent findings across the full range of studies. … The opportunity to process the meaning and implications of new learning with one's colleagues appears to be fundamental to the change process, where that change impacts positively on student outcomes (Timperley et al., 2007, p.201)

In a collaborative atmosphere, according to Darwin and Palmer (2009), members "discuss real issues relating to work, career and family with like-minded people .... the greatest benefits coming from interacting with others and sharing experiences" (p. 134). To begin with, physical, behavioural, cultural and professional differences can be strong, but with time, as collaboration and experiences are shared, a commonality of intellectual purpose, feeling, experience and resolve can take over (Driscoll et al., 2009). As a result, feelings of isolation and professional self-doubt commonly diminish, the participants will likely grow closer, and learning generally occurs (Kram, 2004). In the words of Wenger (1998) it is through participation "in the practices of social communities and constructing identities in relation to these communities" (p. 4) that learning takes place. In other words, by spending time together sharing information, pondering common issues and exploring ideas, Wenger argues that knowledge accumulates and needs are met. Jawitz (2007, 2009) and Nagy & Burch (2009) broaden this notion, claiming that groups can also exist in diverse contexts as groups "all share the underlying foundations of a defined domain, community and practice" (Nagy & Burch, 2009, p. 227).

Many incentives to join groups are linked to career advancement, accelerated productivity, personal satisfaction and growth (Darwin & Palmer, 2009; Ehrich et al., 2004).

Other groups focus on the support participants can receive through sharing knowledge and experiences, thereby diminishing feelings of isolation that may occur (Jawitz, 2009). In a review of group mentoring over the last 25 years, Huizing (2012) states that:

> If one of the goals of mentoring is to secure the wisdom and experience of others, it would seem that group mentoring – where the wisdom and experience of multiple people is available – would receive greater observation. (p. 27)

Thus, according to Huizing, collaboration provides the greatest benefit as it brings together the wisdom and experiences of different people. Further advantages of group mentoring, Huizing states, include flexibility, inclusiveness, shared knowledge, interdependence, broader vision, widened external networks, provision of a safe place, developed team spirit, personal growth and friendships.

4. Method

4.1   Participants and research site description

Eleven experienced mathematics teachers, from 10 low-socio economic schools, took up the opportunity to be involved in peer mentoring organised by the author and to attend group meetings for one school year. These meetings were part of a wider project on mathematics enhancement offered to all mathematics teachers . There was no external obligation or reward for taking part. The teachers varied in years of teaching experience with the least being 10 years. They also varied in the number of years living in New Zealand. Two were originally from New Zealand; the rest came from Samoa, Iraq, Wales, India, Zimbabwe and South Africa.

The teachers decided on their own pairs to have autonomy and ownership, choosing the same year level and subject area. In this way there was no inequality of status with contrived collegiality (Lawson, 1992), personality clashes (Murray, 1991), or opportunities for communication to be only one-way as can be the case sometimes with traditional mentoring where "the mentor directs and drives the communication down to the protege with little opportunity for the protege to have input or to respond" (Clarke, 2004, p.122). Some chose a colleague from their own mathematics department, others from another school in the project. No particular alternative was favoured, and some chose to have more than one peer

mentoring relationship at the same time, trying out the different options. Each pair established goals to focus on, such as developing mathematics resources for the classroom; trialing different delivery styles; teaching new mathematics content; and motivating students.

Throughout the school year, the mathematics teachers from all the schools met together eight times for planned professional development meetings. During these meetings, time was set aside for the teachers involved in peer mentoring to meet together, and peer mentor each other as a group, to share their experiences and discuss any issues they might have collectively.

4.2   Data collection

Data was initially collected from a questionnaire given to all the participants in the wider project, in order to provide information about their attitudes and beliefs generally on professional development, peer mentoring, and teaching and learning mathematics. Thirty statements were given for the teachers to respond whether they agreed, disagreed or were undecided, with room for further comments. Thirty-eight mathematics teachers from the 10 schools completed these anonymously. Although this data was not intended for this study, I have incorporated some of the overall results as they provided interesting examples of the variability in how the teachers believed mathematics should be taught and learnt. Timperley et al. (2007) state that "it is possible for teachers to be given generous amounts of time to collaborate and talk together, only to have the status quo reinforced, with change messages misunderstood, misrepresented, or resisted" (p. 201). Knowing there were strong differences was significant as this meant that the teachers would most likely be challenged by what they would see, and have the opportunity to discuss this with their peer mentor (Franke, Carpenter, Fennema, Ansell, & Behrend, 1998; Fullan, 2002).

At the end of the study, in-depth interviews lasting approximately one hour were carried out by an independent researcher with all 11 teachers involved in peer mentoring. The interviews were in narrative style (Hollway & Jefferson, 2002) to elicit each story and to be able to probe more closely if needed. In this way, the stories can be anchored to events that have actually happened and represent choices made by the story teller, avoiding 'why' questions, without offering interpretations, judgments, or imposing the interviewer's own views. The interviews were recorded and transcribed. As part of the ethics application, the teachers had anonymity and were able to read their transcripts and make adjustments or

delete statements. They were also invited to read the final analysis and remove identifying statements they were unhappy with.

4.3 *Data analysis*

The questionnaire responses from the wider group were collated and summarised in order to gauge what the teachers felt about having professional development and their views about the teaching and learning of mathematics.

The interview transcripts were coded and analysed through an iterative process (Corbin & Strauss, 1990). Two researchers coded independently to identify recurrent themes that emerged from the data relevant to the research questions. These were then compared and revised until consensus was reached. Next, excerpts from the interviews that fell into these categories were gathered. Finally, using causal networks, the relationships between the codes were made with plausible interpretations of events (Miles & Huberman, 1994).

5. Results and analysis

5.1 *Initial reactions to professional development*

At the outset of the pilot study, the mathematics teachers were openly sceptical about receiving professional development and what it could offer them working in low socio-economic schools, as one teacher reflected:

> I was quite cynical because teachers at our schools get a 'bit of stick' that it's not real teaching and I thought maybe they're looking to see what a bad job we're doing and it's our fault the kids aren't succeeding. I think that's the general perception. I thought maybe they weren't looking for fault but that they were trying to fix us.

This attitude was typical of the teachers' negative reaction to past professional development and why they were cautious. They felt they were continually under the magnifying glass and having to justify their positions and explain that their schools lacked resources which they desperately needed. Although the teachers said they wanted new ideas they did not want to be challenged or pressured to change in the process. This was echoed in the initial questionnaire where 67% of the teachers revealed they had received professional development in mathematics they considered of little or no benefit.

Many of the teachers (77%) believed the purpose of professional development was to provide support, and approximately only a third (35%) considered professional development should challenge their teaching habits. Eighty per cent of the teachers assumed that peer mentoring might be a good strategy with the best option being pairs within their own school. Table 1 shows that the teachers noticeably varied in their beliefs and attitudes about how mathematics should be taught and learnt. Some examples of the variation are:

Statement of Belief	Disagree	Undecided	Agree
Students are rational decision makers capable of determining for themselves what is right and wrong	15	8	15
Being able to memorise facts is critical in mathematics learning	17	5	16
The role of the mathematics teacher is to transmit mathematical knowledge and to verify that learners have received this knowledge	18	4	16
If students are having difficulty, an effective approach is to give them more practice by themselves	18	5	15
Presenting problems that require a range of problem solving techniques is beneficial but not essential	14	6	18

Table 1: Examples of variability from the initial questionnaire, completed by 38 mathematics teachers

This variability in teachers' responses confirmed that the mathematics teachers involved in peer mentoring would most probably be observing differences in each other of how they believed students should learn and be taught mathematics. The value of this was to provide a purposeful way to prompt good debate with the peer mentoring and thereby constructive reflection of their practices.

5.2   The benefits of peer mentoring

From the end of year interviews, the teachers were unanimous that peer mentoring was a worthwhile professional development strategy as they particularly valued the opportunity and support from talking to another colleague in their discipline about mathematics applications and the content itself, rather than just about general classroom management:

> Talking to another teacher was really good, seeing applications of mathematics and stuff. It sort of brings you out of just dealing with classroom management and kids not succeeding like they should. It draws you to that sort of higher maths level, but brings it back to doing maths.

Another benefit was being able to observe their peer mentor in action. One teacher described watching how to set up mathematical activities where the students had to talk to each other and be involved. This prompted her to try it with her class having picked up some helpful hints.

Not only was peer mentoring valuable for discussing applications, they all regarded the opportunity to "talk maths" and compare different methods of solving problems was beneficial. For example:

> I learnt some things that I don't even know about … different methods of working out problems. Like the other day X was talking about factorising and it was so easy … I tried it with my kids and now they find it so easy to factorise any problem.

> Some of the things we talked about in stats … I hadn't come across that type of thing … it was good to watch how he looked at the problem and then come from different ways at it … I learnt some new stuff to help me.

For the new immigrant teachers, peer mentoring provided an opening to compare how mathematics is taught in New Zealand with their countries and the support to adapt. One teacher who was very new to New Zealand reported that he had been struggling and that having a peer mentor had really helped him in his approach. Rather than give all the information to the students as he was used to in his country, he now works with the students to develop their knowledge:

> He told me this is the way you have to be in this school … I said gosh I am not used to this way of doing things. But working with another teacher it gives you a kind of comfort … you engage in a discussion which decreases the frustration as you get to find out what others do and what you can take to your school. And that's really rewarding … exchanging information … changing the way we do things. For instance, getting the students to find out 'x', I don't tell them anything now and I don't like giving a formula. I get them to write it down, figure out how it was established, be more creative, try not to use memory.

Another feature of peer mentoring that was well received was setting goals, even if they were different, and then working together to make sure they were attainable. Talking with their peer mentor provided on-going encouragement and accountability which they liked:

> Our goals were different but that was okay …. We talked about what we each wanted to achieve and we talked about them each time you know to make sure we're on track and what was happening.

5.3   *Establishing peer mentoring*

Five dominant themes emerged from the coding, related to the factors important for setting up peer mentoring. Each theme is described in turn and in no particular order.

5.3.1   *Selecting partners*

As the teachers talked about their experiences and what they considered an ideal peer mentoring partner, five predominant qualities stood out: someone who was able to build good relationships; was able to recognise and value good teaching; could communicate well; would be supportive; and would have strong mathematics. The teachers were less concerned about cultural differences, possibly because they were already used to working with diverse groups of students and colleagues in their schools. Preferably, the teachers also wanted someone to work with who appreciated and valued them for what they could offer in return in the relationship.

5.3.2   *Time to meet*

Clearly defining at the start how much time each participant could allow for being involved in one-on-one peer mentoring was crucial so that there were no hidden expectations. The teachers expressed the importance of scheduling meetings in advance to keep the momentum going, but being flexible if other events cropped up. It was common in these schools for the teachers to frequently lose their non-contact periods to supervision and other activities. Time was always critical and for many it was a constant struggle finding enough time to teach their subject in classes with wide ranges of ability, as well as helping individual students, coaching sports teams, leading cultural groups, and other aspects of school life with which they were involved. They compared themselves to teachers in high socio-economic schools, believing

the demands would not be as great as there was money available to employ specialists and professionals. Typical comments were:

> We found it really hard getting the time to go off, to go there while doing so much other stuff … time's a big factor.

> The potential was there … if only we had a bit more time.

> I have to say that the times I went to peer mentor were always a bit pushed for time.

> You need more non-contact time so you can do more peer mentoring.

The teachers talked about their efforts to organise peer mentoring in their non-contact periods and were keen to work between schools so they could get fresh ideas. However, this was difficult with distance:

> It was a bit inconvenient as we weren't very close to each other … maybe if the school was nearby it might have been better.

> Within the same school it's fantastic … you can spend five minutes talking … but visiting and leaving [the school] it's hard … not impossible but hard.

They explained that often the number of periods and timing of breaks differed between schools and sometimes their own timetables would change. As a result, there would be a mismatch with the classes they wanted to observe their peer mentor teaching and would thus require supervision for their own class, which was difficult to arrange. Tied in with this was frustration with senior management in their schools who seemed to be unsupportive of them working with another teacher if it interfered with the timetable. All the teachers commented on having to defend their time to senior management and assumed this lack of support signified they were not valued.

5.3.3   *Goals*

Having a clearly defined structure and specific goals when the teachers were peer mentoring one-on-one was paramount for success and for developing a productive relationship of value to each partner:

> We sat down beforehand and discussed where we might focus … so that was kind of clear and we both knew that.

> It felt to me that a lot of the time we didn't have a focus.

> I could have had a better rapport … by actually setting some clearer goals in relation to peer mentoring … and working on that.

The teachers felt the structure of the peer mentoring should be prescriptive but also flexible, explaining that it was better to begin with something even if this changed. Those that set goals and were clear about their role described their peer mentoring as productive. One pair failed to have a clear structure and in their interviews talked about the frustrations and assumptions they had, each attributing the other for their disappointment.

Their diversity of backgrounds caused some misunderstandings about ways of doing things. One pair, comprised of teachers both new to New Zealand, had extremely different cultural backgrounds but had wanted to work together as they had similar year levels they were teaching. Although they organised meetings, they didn't take the time to structure them and their relationship did not grow. The expectations of one partner were not met and as a result he grew disillusioned. This teacher commented that he did not know how to 'handle' his disappointments and felt the easy option was to pull out.

5.3.4   Building a relationship

The teachers believed that building a relationship depended on getting to know each other and developing friendships but also being committed:

> We had to work together and start to get to know each other.

> There developed a relationship which you build through working together and just building up some friendship.

> We got to know each other and now the relationship is strong.

It was necessary the teachers felt to take time to establish the relationship by having set tasks to do. In this way, they found that if they each established a focus of what they were going to work on, with a set agenda when they met, and pre-arranged times and venues, the relationship developed faster and trust was cultivated. Without this, some of the pairs did not become properly established, as they spent the time chatting about students and unrelated events, and eventually found excuses not to meet. Although this 'downtime' was important, a time frame restricted this from taking over and facilitated the focus on development.

Some of the teachers arranged to meet socially outside of school hours and found that this developed more respect for their partner, especially if they had different cultural backgrounds. Meeting socially, they said, broke down any 'barriers' faster and they learnt more about the best way to work together. As the relationships strengthened, the anxieties of working with another teacher and what they might 'see' disappeared.

5.3.5   *Creating a community*

All the teachers considered the larger peer mentoring group, which met for professional development meetings off-site, worthwhile as it gave them further opportunities to share with other mathematics teachers, make new friends and hear new ideas. Typical comments were:

> The meetings got people together and got people talking, people bouncing ideas off each other … they've been fantastic.

> The meetings were good, they were quite open with no hassles … we just talked in the group and I liked to work with them. Some of the teachers were really nice … all of them actually.

> Since I joined … I have managed to open up. It has built up my confidence to interact with other people with the same profession.

> There was an advantage of being able to interact with other teachers and talk about teaching at the meetings … what works … and what's not working.

> With the other teachers at the meetings you now sit down and have a chat … and that friendship clicks.

The teachers recounted that meeting together provided more ideas to work on in their teaching and they loved comparing stories. They talked about the support working together and the overwhelming feeling of community as everyone shared the same difficulties and challenges from teaching in low socio-economic schools but also the joys and successes, no matter how small the achievements. The teachers described the meetings as a place of common ground to get to know each other, and the intensity of the camaraderie that developed surprised them. They also enjoyed the meetings as it was a time to take a step back and "see the bigger picture as we never get time to do that" and:

> We talk about the things we do, you find out there are other people in those types of schools and you sit down and have a chat … you talk about what you are doing … that is valuable, very, very valuable.

6 Discussion

The data revealed a number of important issues around the value of peer mentoring as a professional development model for mathematics teachers, and in particular for those working in low socio-economic schools which lacked finances for other forms of professional development. All the teachers involved in the pilot unanimously reported that peer mentoring was an effective strategy and that they wanted to continue with it. What then, made it particularly worthwhile for them? One explanation is that peer mentoring allows for sharing of resources and new ideas more easily, which teachers usually all want and need. Although this is a seemingly simple explanation, our first experiences with the teachers indicated they were very protective about what mathematics resources they had, they were sceptical about sharing these, and wanted to know what they would gain in return if they were to share them. Consequently as trust developed sharing occurred.

Another explanation relates to the sense of abandonment the teachers felt from senior management through the lack of professional development provided for them. Although this was a reflection of the financial difficulties low socio-economic schools are under, impacting on the amount and quality of resources available, it limited opportunities for the teachers to

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have professional development, as any available money is absorbed into buying necessary and much needed equipment. Consequently, the teachers relished the opening for some professional development and benefited from the discussions and inspiration that resulted through peer mentoring. Some of the immigrant teachers described the teaching style in their countries as traditionally 'stand at the board and deliver'. The teacher would work procedurally through examples step-by-step which the students copied down and repeated by doing exercises. As trust developed between the pairs in the course of one-on-one peer mentoring, the teachers began to make small changes in the way they taught mathematics, developing and sharing some of their ideas. They found that having another mathematics teacher who was also experienced, to work closely with and provide constructive feedback, was encouraging. At the group peer mentoring sessions these same teachers became quite animated sharing their experiences on what they had tried. Over time attendance became notably more punctual as they looked forward to sharing together.

Another benefit was the immediate access to support through peer mentoring making the teachers feel less isolated. This perspective is consistent with Timperley et al. (2007) who state that:

> Teaching usually requires information, expertise and support far beyond the resources available to the individual teacher working alone in an isolated classroom. Teachers who collaborate with their colleagues are more likely to be effective with students, because they will benefit from expanded resources. (p. 202)

They regularly talked about the lack of support from senior management and even some of the teachers within their departments. Those new to New Zealand did not have established contacts and did not know the system, making it harder to get started. It was assumed that they would just assimilate into the schools easily as they were experienced mathematics teachers. A few, however, described struggling with the mathematics at senior levels and needing help. Thus, the offer to be involved in peer mentoring signalled opportunity and permission for them to work with other teachers and have support that would be on-going.

As the model involved two different types of peer mentoring – one-on-one and group – working concurrently, the role of the growing group dynamic which emerged provided new friends as well as mathematics colleagues. Although sceptical at first of what was being offered, once the teachers realised they weren't being judged, they valued the time spent with other teachers from similar schools, peer mentoring as a group. The isolation many felt being

the sole mathematics teacher at senior levels gradually lessened. They began to feel special that these meetings had been organised just for them, and as time went on they became a strong collegial group, proud of whom they were and keen to express achievements. The symbiosis between the group and one-on-one peer mentoring was an important component and the strength of the model. The camaraderie and the opportunity to share stories at the group peer mentoring meetings developed strong relationships; the one-on-one peer mentoring provided continuity and support on a more personal level.

The subsidiary question in this study was what factors are important for setting up peer mentoring? All the schools experienced systemic difficulties regarding time, distance, rigidity of timetables, extra-curricular demands, and a perceived lack of support from management. The teachers found it difficult to convince management that expensive one-off workshops were not as beneficial as on-going professional development on-site and therefore to release them for frequent short intervals of one-on-one peer mentoring. The time issue was overriding and realistically one-on-one peer mentoring was easier to set up within the same school as this meant more opportunities for contact, easier arranging visits and the teachers were able to work within their non-contact periods. However, working between schools provided access to sharing resources and collaboration.

The importance of building a relationship was crucial and depended on having a fairly rigid structure during the one-on-one meetings so that these times were practical and constructive. Each teacher needed a focus and a clear goal of what they wanted to work on, which needed to be prescriptive and structured so that the teachers had clear expectations of what they were going to do each time they met. In reality, those teachers that arranged times to meet regularly with clear tasks for peer mentoring were more productive. In contrast, those that did not, found it difficult to work openly with each other and say the things they wanted to say.

Meeting as a larger peer mentoring group on a frequent basis was more important for the model than expected and it may be that this link is significant for those working in low socio-economic schools. As collegiality developed and the teachers began to network and make connections the 'barriers', of scepticism and mistrust, came down. Professional friendships built, and with them trust, commitment and communication developed and natural pairings for peer mentoring emerged. The peer mentoring group provided strength, security, and nourishment, from which new ideas were generated. The teachers who had been involved in successful peer mentoring came to the meetings enthused and keen to share with the larger

group what they had been doing. There was an atmosphere of pride about what they were accomplishing together and the sharing renewed their energy. This was contagious, and the teachers would leave each meeting keen to try some new things with their classes that they had heard about.

The role of the coordinator in organising the peer mentoring needs further exploring as it was surprisingly critical. This role was difficult to perform from afar, at the university, and someone on-site or local being at 'the helm' would be the recommendation. This role included administration, helping the teachers organise peer mentoring meetings, and supporting them as they tried to convince their senior management to release them. It also included pastoral care, following up on each pair by visiting at their schools. Access to computers was limited and emails were very slow or missed completely, and telephone calls were unsuccessful as messages were often not received and the timing of calls was hard to organise. Pastoral care also meant the coordinator being alert to difficulties that arose and working through these, which was not always straightforward. The job required a significant time commitment and warrants further research around the role it plays.

7 Conclusion

Other studies have shown the value of teachers working together in the same domain in order to facilitate their own learning and make changes which can transform their teaching practice. The purpose of this study was to provide an alternative professional development model, of teacher learning and development, for the mathematics teachers working in low socio-economic schools. The model was content-focused, school-based, incorporated into day-to-day work, collaborative, and teacher-driven. The purpose was not to discredit or compete with other professional development initiatives but to provide a model which was financially inexpensive, easy to set up, could provide relatively immediate access and on-going support, and could accommodate the different needs of all the mathematics teachers.

This model of peer mentoring, which included two aspects – one-on-one peer mentoring combined with group peer mentoring – was piloted with the mathematics teachers of the senior classes from 10 low socio-economic schools. The study highlighted the benefits and feasibility of using the model for professional development as well as factors that were key for successful implementation. These included organising and planning one-on-one peer mentoring times to meet, building a strong relationship by developing a clear structure to suit

individual goals, and meeting regularly together for group peer mentoring. The significant effect of this last feature, meeting together as a group, assisting the one-on-one peer mentoring, was unanticipated.

Future recommendations would be to explore the feasibility of developing peer mentoring groups between schools on a regular basis, and allowing the pairings that naturally form through this to progress to one-on-one peer mentoring.

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