Investigating the Learning of a Professional Development Team:
The Years 1-3 Mathematics Probes Project

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This study examines the learning of a diverse team of five professional developers as they led or supported a mathematics initiative. Although teachers are typically the focus of learning in professional development, we contend that the learning of professional developers is important and should not be overlooked. We examined our learning as a professional development team through first-person inquiry which drew on reflections, conversational accounts and other artefacts. These data sources were used to create a first-person narrative which was analysed for learning according to four domains of change in a model of teacher professional growth. Our findings revealed that this project was rich in opportunities for learning including: learning about mathematics pedagogy; learning about the potential for miscommunication of a message; learning about the challenges of teachers working across multiple agendas and systems trying to support these teachers; and learning about the advantages of team work. Many of these learnings were fortuitous rather than planned. Hence, we now appreciate the importance of being more conscious of the potential for learning in the conduct of professional development projects and to plan for this learning. The paper concludes with challenges for all who undertake or access professional development services in mathematics education.

Professional development is part of the fabric of mathematics teaching worldwide and involves a range of stakeholders including teachers, consultants, curriculum officers, school systems, critical friends and academics. Typically, professional development is designed to provide learning opportunities for teachers and much has been written about what teachers learn from these experiences and ways to support their learning (Aichele, 1994; Cheeseman & Clarke, 2005; Loucks-Horsley, Hewson, Love, & Stiles, 1998; Watson, Beswick, Caney, & Skalicky, 2005/2006). However, teachers' learning is only one of two facets of learning that can occur during professional development. Like the warp and weft of fabric, teachers' learning through professional development is interlaced with the potential learning of the professional developers. Understanding this learning is important because the effectiveness of professional developers impacts on teachers' learning about mathematics education just as teachers' effectiveness impacts on students' learning of mathematics. Thus, if professional developers are to provide rich learning

experiences for teachers, they need to engage in high quality professional practice.

The purpose of this paper is to investigate the learning of a team of professional developers engaged in a large scale mathematics education initiative. The following questions provide the focus for this investigation.

1. What learning did the professional development team experience?
2. What are the advantages and disadvantages of working as a professional development team?

The latter question has been included to establish the relationship between learning and membership of a team of professional developers.

We begin this investigation with an overview of professional learning and ways to analyse professional learning. This is followed by a description of the context for the study and an approach to investigating the research questions. We then present the chronology of the professional development project, and analyse the learning that occurred during the implementation of this project. We conclude with some questions to ponder.

Background

Professional Learning

According to Knight, Tait, and Yorke (2006), there are two dimensions to professional learning: the type of learning (formal or informal) and the intentionality (intentional or non-intentional). The first dimension, the type of learning, relates to the context; whether it be a structured professional development opportunity (formal) or social practice (informal).

> Professional learning is systemic, in that we see it as an interplay between individuals and their environments. This casts professional development as the development of capabilities that occurs as a consequence of situated social practices. There is still a place for event-based educational professional development, but it complements, rather than displaces, situated social learning. (Knight et al., 2006, p. 320)

The second dimension of learning, intentionality, depends on whether or not the individual learned what was anticipated (intentional) or learnt something novel (non-intentional). The types of learning and the intentionalities in learning are each complementary. Thus, there are four broad categories of learning: formal intentional learning (e.g., curriculum), formal non-intentional learning (e.g., hidden curriculum), informal intentional learning (e.g., workplace induction), and informal non-intentional learning (e.g., workplace norms). Teachers typically engage in a range of formal and informal learning. For example, formal-intentional learning occurs when teachers engage in a professional development event and achieve the outcomes that were anticipated. Informal-intentional learning occurs when teachers trial and reflect on new ideas in their classrooms and learn about these ideas through their practice.

Professional developers also have opportunities for formal and informal

learning that have intentional and non-intentional outcomes. For example, a formal intentional learning opportunity for professional developers would be when they participate in a training course designed to teach them how to disseminate an initiative to teachers (Cheeseman & Clarke, 2005). Unlike the specificity of the intentional outcomes of such a course, the non-intentional outcomes are diverse and unpredictable. For example, one participant might learn about a new colleague who lives in the same geographic location whilst another might learn about a new resource through an incidental conversation. Informal learning is more commonplace in professional development work than formal learning, yet there has been scant attention to the outcomes of the informal learning of professional developers.

Analysing Learning through Professional Practice

Professional practice provides a fertile environment for learning because, as Clarke and Hollingsworth (2002) contend, "teachers 'change inevitably through professional activity'; teachers are themselves learners who work in a learning community" (p. 948). They argue this change environment consists of four interrelated domains. The teacher's professional world of practice is comprised of the domain of practice, the personal domain and the domain of consequence; the final domain is external to this professional world (see Figure 1). Clarke and Hollingsworth (2002) argue that change can occur in any of these domains of practice and that change in one domain can be translated into change in another domain through the processes of reflection and enaction.
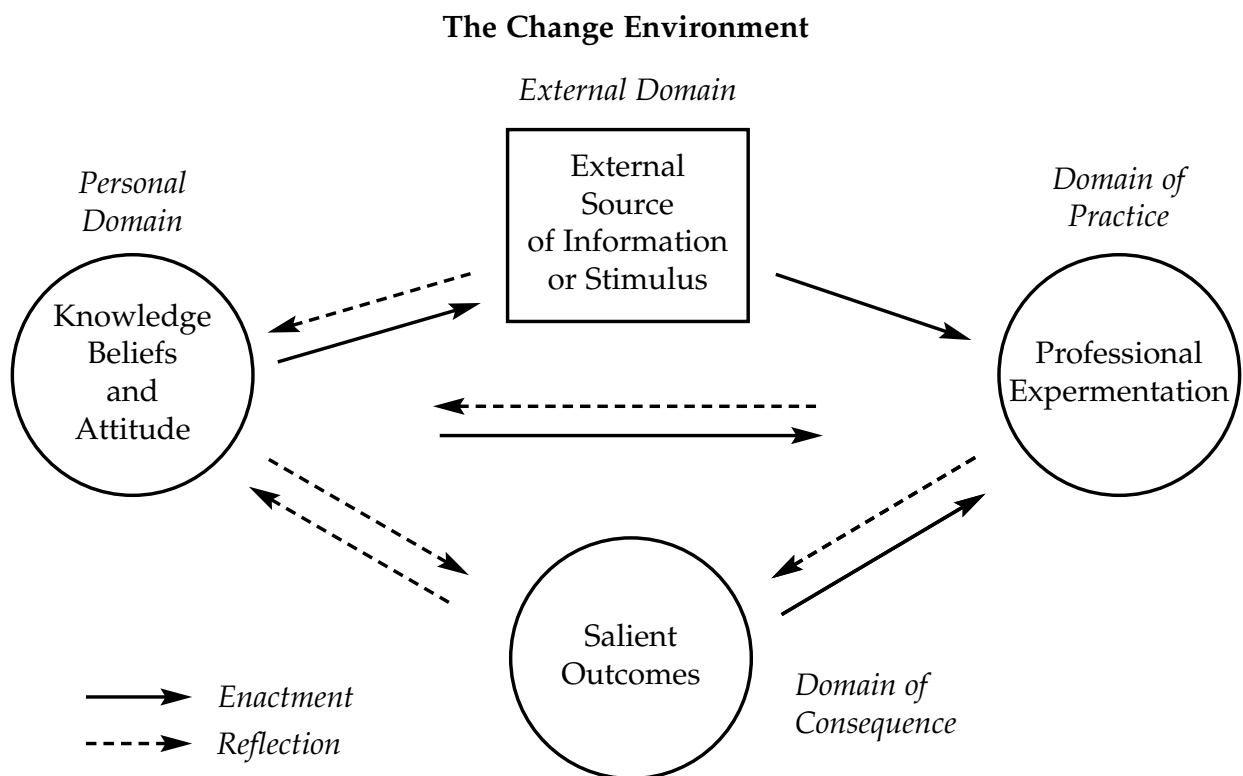
The Change Environment

Figure 1. The interconnected model of professional growth (Clarke & Hollingsworth, 2002, p. 951)

This model provides a useful guide for our investigation of the informal intentional learning of professional developers during their professional practice because it directs us to consider learning within and between each of the domains of professional practice and to focus explicitly on the processes of reflection and enaction in this investigation.

The Context of the Professional Development

During 2007, over 170 teachers in Catholic and Independent schools in the same district were participants in a mathematics project designed to improve the outcomes of Years 1 to 3 students through the use of Mathematics Probes. While the vast majority of participants were Years 1 to 3 classroom teachers, a few preparatory year teachers, learning support teachers, and principals also participated. In brief, the purpose of the project was to introduce the teachers to a series of Mathematics Probes that would identify students' knowledge of foundational mathematics concepts and to support teachers to use the information from this assessment to inform their instruction and selection of resources (Department of Education, Science and Training [DEST], 2005; Siemon, 2003).

The Probe Tasks are a series of short performance-based tasks that focus on key number ideas (e.g., subitisation, counting, addition) without which students' progress in school mathematics will be impaired. The tasks require low levels of literacy; can be administered individually; use cards and/or concrete materials; and generally require non-written student responses. For example, the Subitisation Probe require students to identify by sight (without counting) the number of dots on a series of cards, which become increasingly more complex. The Probe Tasks were initially developed for preservice teaching purposes at RMIT University (Siemon, 2003). However, they have also been used successfully in the *Supporting Indigenous Student Achievement in Numeracy Project* in the Northern Territory (DEST, 2005).

The Probes were used in the Northern Territory [NT] project (DEST, 2005) because they were:

- concerned with the development of key number ideas and strategies, the area identified by research school teachers on the basis of the results of the first round of testing as their focus for the action research phase of the project;
- supported by concrete materials and/or visual aids which significantly reduced the literacy demands involved in accessing and responding to the task;
- at a level more commensurate with where students 'were at' than was the case for some of the rich tasks used; and
- they were relatively easy to administer in first language in the context of the remote school.

Feedback on the use of the Probe Tasks in the NT project was very positive. Teachers, particularly Indigenous teachers and teacher assistants, reported that

the Probes gave a clear indication of what the students were able to do in mathematics as the literacy demands were much lower than either rich assessment tasks or conventional forms of assessment. They found the tasks easy to administer and were able to identify starting points for teaching from the students' responses. Many teachers adapted the ideas and models implicit in the tasks into their classrooms (e.g., the use of subitisation cards). In light of this experience, a Probe Task Manual was prepared to support teachers to interpret students' responses, identify learning needs, and choose appropriate tasks to address those needs. This guidance was prepared on the basis of the literature and student responses primarily derived from mainstream classrooms in Victoria and a small sample of Indigenous students from remote communities who were interviewed for this purpose. In the Probe manual, the advice for each Probe Task has been presented in a table that matches an observed response to a possible interpretation of that response and one or more suggested teaching responses. Teachers are advised to identify the observed response that best matches the student's response and to consider how they might implement the suggested teaching response. Due to the successful use of the Probe Tasks in the Northern Territory project, the Probes became the focus of a pilot project in 2006 designed to improve student outcomes in mathematics in a Queensland district, and this professional development project in the same district in 2007.

During the 2007 professional development project, the teachers were provided with the Probes and associated resources, and a Probe Task Manual. For each Probe Task, the manual contained examples of student responses and interpretations of these responses, and suggested instructional responses. Teachers were advised to identify the observed response that best matches the student's response and to consider how they might implement the suggested instruction. In addition to the manual, teachers were also provided with a substantial compendium of teaching ideas and support materials as a resource for planning and implementing instruction.

This professional development project consisted of two days of professional development (January, April), follow-up professional support visits to schools after each professional development day, and the provision of a range of support materials described earlier. The professional development program was intentional in that it was designed to support teachers to implement the Probes and to use the results of the Probes to inform instruction and resource decisions. Opportunities for formal intentional learning were provided through the professional development days and opportunities for informal intentional learning were provided through the teachers' implementation of the Probes and the follow-up visits. At face value, the professional development program was sound in that it coupled structured learning experiences with situated social learning (Knight et al., 2006). Thus, it was reasonable to expect that the intentional outcomes would be achieved.

Design and Methods

Studying Professional Practice

This study of professional practice is a first-person inquiry (Ball, 2000) because we are interested in learning about our own practice as professional developers. Rather than being indulgent, self study provides a means to gain specific insights into professional practice where the practice and inquiry are closely related:

> What most clearly distinguishes first-person inquiry from other approaches to the study of teaching and learning is that it deliberately uses the position of the teacher to ground questions, structure analysis, and represent interpretation. In contrast, other research on teaching deliberately divides the work of practice from the undertaking of inquiry. (Ball, 2000, pp. 365-366)

In keeping with our purpose of investigating the learning of professional developers, we explore their informal learning in a particular professional development program, which is described further shortly. The focus of the learning is informal because it occurred during our professional practice rather than during a formal training program for us as professional developers.

The professional development team began as a group of four (a curriculum advisor [CA] (Eva), a curriculum officer [CO] (Geraldine), a mathematics consultant [MC] (Dianne), a critical friend [CF] (Carmel) but over time included a support person [SP] (Jillian). Henceforth, this group will simply be referred to as the 'the team'.

Tools for Studying Learning in Context

The tools for this inquiry were reflections, conversational accounts and artefacts. Reflections and conversational accounts were elicited from each member of the team following the completion of the professional development project using a template (Appendix 1). The reflections focused on the team members' roles and duties, their learning, and the advantages/disadvantages of working as a team. Through reflection, individuals should gain insight into their practice through a self critical process (Schön, 1983). Reflections are included in the text as transcript examples. The conversational accounts were recollections of three important conversations that members had during the initiative and how they impacted on the professional development project (Appendix 1). Eliciting accounts of these conversations is one way of identifying critical incidents, which provide exemplars of effective and ineffective behaviours in various educational contexts (Hunt, Tourish, & Hargie, 2000). Conversational accounts are also included in the text as transcript examples but they are identifiable by the addition of the terms "talking with" prior to the transcript text. Additionally, a range of artefacts were available for analysis. These artefacts were authentic work products prepared by various team members as they communicated about or conducted the professional development work. They included email excerpts, briefing sheets, field notes, and a report prepared for one of the schooling sectors. Here, artefacts

provide a complementary perspective to the reflections and conversational accounts because they were produced during the project rather than following it and were for professional rather than research purposes. These various types of data were first combined to present a collective first-person narrative account of the professional development project. Narratives provide opportunities for individuals to learn about themselves and others as they construct and reconstruct stories of their professional lives (Connelly & Clandinin, 1990). This narrative was then analysed for emergent themes of learning within and between domains of professional practice (Research Question 1). Finally, the data were examined for the advantages and disadvantages of working in a professional learning team (Research Question 2).

The Chronology of the Professional Development Project

1. Planning the Professional Development Project

There has been ongoing collaboration between the Catholic and Independent sectors over the past few years in the presentation of professional development in mathematics in Queensland. The curriculum staff from both sectors had planned and conducted professional development together and shared personnel and material resources. Both the curriculum advisor (CA) and the curriculum officer (CO) were employed by their sectors to provide curriculum support in mathematics. The CA specialised in mathematics in one sector whereas the CO was a general curriculum officer in the other sector. The mathematics consultant (MC) and the critical friend (CF) were academics who had previously worked with the CA and CO. The support person (SP) was a graduate student with early childhood mathematics experience but a newcomer to large scale professional development. Although members of the team had variously worked with each other, the full team had not previously worked together.

The professional development project originated with a presentation at a mathematics education conference in 2005 and the implementation of a pilot project in 2006 with Years 4-7 teachers. Feedback from the teachers in this pilot recommended that teachers of younger students would benefit from this professional development to enable strategic instruction and early intervention on the foundational ideas of Number using mathematical probes. Following the receipt of some funding for 2007, the focus of the professional development project shifted to Years 1-3 teachers and broadened to all teachers in Catholic and independent schools across a Queensland district. This initiative was part of ongoing and collaborative professional development in mathematics for these teachers.

> CO: This initiative was identified as the next stage in professional development, in an ongoing curriculum dialogue about Mathematics. This has been evolving as part of a collaborative relationship with the CA from Independent Schools Queensland (ISQ) for several years. It was a

> hands-on, supportive operational role that necessitated a keen interest in actively following the developments occurring at classroom level and liaising with presenters and critical friend at system level.

The professional development team was coordinated by a curriculum advisor (CA) who had multiple responsibilities.

> CA: I facilitated this initiative. I organised and convened the professional development team as well as the independent schools and Catholic schools within a particular district. My major role within the initiative was to coordinate the professional learning team as well as liaison with (the) CO and her office ... There was constant liaison with the Professional Development team in relation to their needs to ensure that the project was ready to proceed without any problems.

Following the initial planning between the curriculum advisor (CA), the curriculum officer (CO) and the mathematics consultant (MC), a critical friend (CF) was added to the team.

> MC: At this stage, it was also decided to employ a critical friend with expertise in early childhood education to follow up schools and work in classrooms.

> CF: I was invited by the CA and the CO to be part of the project to assist with school support to teachers as I was familiar with the school sector and district and I also have a background in early years mathematics.

2. The First Professional Development Day

The focus of the first professional development day was on introducing teachers to the Probes and the related support materials. The teachers were provided with a kit containing the Probes packaged by task with instructions and relevant resources, task advice from the Probe Task Manual, and a set of follow-up activities. The implementation of the Probe Tasks was modelled at the professional development day. However, conditions were not ideal due to the large numbers of teachers in attendance. The teachers were asked to undertake the Probes, when they returned to school, with a couple of students of interest, such as students who were experiencing difficulties in mathematics or making limited progress. Following this assessment in school, the teachers were to plan an intervention for these students that would typically be part of the class program. A range of teaching ideas and resources were supplied to support this intervention. The teachers were also advised that they should monitor the performance of these children over the next year and document the assessment performance and response to instruction for one of the students in a small case study.

Observations and feedback indicated that the majority of teachers were engaged and responded positively to the day. At this point, we were confident that the majority of teachers would implement the Probes in their classrooms. However, this was not evident during the first round of school visits.

3. The First Round of School Visits

A key purpose of the first round of school visits was to monitor teachers' implementation of the Probes and to support them with any difficulties they were experiencing. Initially, the CA, CO and CF were to conduct these school visits. However, after the first professional development day, the team decided to include a support person (SP) to assist with these visits.

> SP: My experience and research interests are in the field of early childhood mathematics ... My role was to engage with the teachers at the [2nd] professional development day and during school visits. My role was also to listen to the teachers and question them about the probes ... My role was to feed this information back to the team for discussion and to make [suggestions for] improvements ... [my role] evolved as the professional development program proceeded. I had to be conscious of staying within the bounds of the role so that my role and perspective did not get blurred with the other roles.

Following these initial visits, the CA, CO, CF and SP concurred that there was a misalignment between the professional development message and what occurred in schools. The message that was supposed to be received from the first professional development day was that teachers were expected to implement the Probes with a few students in their classrooms and report back on their findings at the subsequent professional day. However, only some teachers undertook this follow up task in their classrooms. Put simply, this misalignment between the message from the professional development day and the majority of teachers' actions is 'off track' behaviour. We regarded this lack of alignment as a serious threat to the success of the project because the achievement of learning outcomes is dependent on alignment between (teachers') knowledge, the (teaching) context, and the learning activities in which individuals engage (Biggs, 1999). It is reasonable to surmise that the longer behaviour is off track the more difficult it will be for an individual or school to get back on track due to the divergence of on track and off track pathways, and a lack of recall of the original message.

> CA: It became evident that no matter how many resources, modelling and directions that you give to teachers in some instances the message taken away from the initial professional development day was not the intent of the project. This became obvious after the initial visits.

> SP: The purpose of the visits we had just conducted was to see how teachers had begun to use the probes after their first inservice. The conversation centred around whether the teachers were 'on track'. It was clear that a number of teachers had misinterpreted the role of the probes. Discussion was about how to re-direct teachers at the next inservice.

Based on our collective field notes following visits to individual classes, we concluded that the majority of teachers were either yet to implement the Probes as diagnostic tools with their classes or were using the Probes for instruction rather than diagnosis.

CO: Probes were seen as a test [for the end of learning] rather than a diagnostic tool for [informing] learning.

Multiple reasons underpinned this misalignment between the professional development message and teachers' action as shown by feedback from teachers summarised from our field notes (Table 1). However, irrespective of these reasons there was a need to establish alignment quickly and a multi-faceted communication strategy was implemented targeting all stakeholders.

Table 1
Misalignment and the Reasons for Misalignment

Type of misalignment	Reasons given by teachers	Frequency
Yet to implement the Probes	Students are too young or not ready	S
	Not enough time	S
	Don't have access to the materials	R
	Didn't know I had to	R
Using the Probes for instruction rather than diagnosis	Teach students first and then assess them later	F
	Valuable for everyone to learn	S

Key: F-frequently reported, S-sometimes reported, R-rarely reported

Teachers' difficulties in viewing the Probes as a tool to inform learning was part of the broader issue of using assessment results to inform instruction.

CO: The nature of conversations around baseline data that this project has surfaced has been very beneficial. These by their nature have pointed to the need to keep developing the assessment for learning conversation with our teachers.

A further difficulty that emerged from these visits was teachers' confusion about how the Probes fitted into the 'big picture' of mathematics education initiatives.

CF (talking with CO and SP): Many teachers expressed confusion and a lack of clarity over the multiplicity of mathematics initiatives and how these initiatives fitted together to inform a cohesive mathematics program. The topics raised included the Probes, the continua, school-based plans, the syllabus, journeying [a form of streaming], textbooks, and assessment. The following teacher's comment echoed the concern of many teachers: 'nothing fits together'.

The lack of cohesiveness between the Probes and other initiatives had been addressed but clearly needed further communication.

CO: The strategic alignment of current curriculum key messages with the diagnostic nature of the project was reported at regular intervals to Principals, as major stakeholders.

A key outcome of the discussion between team members about these initial visits was the development of an action plan to improve the alignment between the intent of the professional development and its implementation and to clarify the role of the Probes in strategic directions in mathematics education.

> CA: It was necessary to have conversations with the team and discuss a plan of action. We need to articulate it very carefully, document what the expectations are from teachers and how the case study [of a child] needed to be conducted and written up.

The action plan focussed on delivering a consistent message to teachers from all members of the team that they were to implement the Probe Tasks with their students and plan instruction in response to the students' performance. This occurred orally through forums in which team members communicated with teachers or school administrators, in a follow-up briefing sheet to school administrators (Appendix 2), and in a careful restating of the message at the second professional development day within the context of strategic directions in mathematics.

> SP: The CF and I had a conversation with CO about guiding the teachers. The conversation centred on the teachers' concerns and fears about using the probes. These fears included their knowledge of how the probes fitted in with their school programs, 'journeying' [a form of streaming] and what to do with the information. The conversation brainstormed ways to guide the teachers and reassure them about the probes. One suggestion was to get the principals more involved and the CO discussed putting the probes on an agenda at an upcoming principals meeting or having a meeting with each principal to see if he/she was aware of the importance of the probes.

> MC (talking with CA): One important variation from past years was the production of the 'yellow sheet' which clarified the specific expectations of teachers in the PD (Appendix 2). This was done after CF's feedback.

> CO (talking with teachers): I felt that the one page realignment of key messages that they were given to take away [from the 2nd PD day] was valuable for its clarity (Appendix 2).

A second outcome following the initial visits was some change to roles of team members, especially that of the critical friend. The role of the critical friend broadened from focusing on the applied knowledge of individual teachers to building the intellectual capacity of schooling sectors as a learning organisation (see Armistead, 1999 for a discussion of the individual and organisational outputs from knowledge transformation activities).

> CA: The role of organisational duties remained the same throughout the project. However, as the project began to develop there was a need to support schools and teachers more intensively. Teachers needed and wanted constant reassurance that they were on the right track as well as in some instances needed to be put on the right track.

CO: Visits were based on the idea of supporting teachers' classroom practices. This changed early in the project in response to the interplay of two elements. Firstly, discussions around the role of critical friend and the lens she would be working through, and secondly, the experiences of the initial round of visits which indicated that there was a gap in the understanding of the key messages necessary for effecting implementation. It was apparent that a realignment of messages at the dual levels of teacher professional development and school curriculum leaders needed to be made. Liaising with the critical friend allowed for an immediate opportunity to turn a perceived liability in teachers' perception of the diagnostic nature of the probes, into an asset. This was achieved through support of where teachers were at in terms of their practical understandings. Mistakes in understanding were accepted as opportunities to ask for opinions and suggestions ... The critical friend model reinforced a positive demonstration of interest in teachers as learners through face-to-face encouragement.

CF: Initially, my role was to provide on site support as a critical friend to teachers. This included encouraging and assisting teachers to implement the Probes and to select appropriate support strategies to build students foundational mathematics knowledge informed by the outcomes of the Probes. Following a discussion with the CO about the progress of teachers following the first set of school visits, I was also invited to act as critical friend to the system and to provide feedback on the effectiveness of this professional development initiative within the broader context of mathematics education.

4. The Second Professional Development Day

The second professional development day was initially designed to introduce the teachers to further Probes and to have them report back on their implementation of the initial Probe activities from the first professional development day. However the brief of this day expanded to clarifying the role of the Probes and highlighting what teachers were expected to do in their schools subsequent to this second professional development day.

SP (talking with CA, CO, and MC): As a result of the previous conversation [about misalignment], decisions were made about how to more efficiently get the message across at the next professional development presentation. It was decided that the MC would do a general overview at the beginning of the inservice day and recap the aim and purposes of the probes.

This day provided opportunities for teachers to share their experiences and engage in active learning (Figure 2). A few teachers presented detailed documentation and photographs of their implementation of the Probes.

2 pictures to come

Figure 2. Teachers' participation in the second professional development day.

The role of the SP also included providing assistance to groups of teachers on the professional development day.

> CA   (talking with CO and SP): After the initial follow-up visit and subsequent visits it was necessary to have the SP come on board in a different role to reassure the teachers that when they gave their presentations on the 2nd day they would feel comfortable with this process ... The SP worked along side the teachers and supported them as they did their presentations and encouraged other teachers to share what they have brought along. A job well done and there was a sense of self worth and great presentations.

Despite the focus on realignment between the intent of the professional development and what teachers were expected to do in their classes, teachers responded favourably to the SP and other team members. For example, the teachers engaged in lengthy conversations, showed examples of students' work and resources, and asked questions about the Probes and broader mathematics education issues.

5. The Second Round of School Visits

Following the second professional development day, the school visits were very heartening. Generally, teachers had implemented the Probes and were keen to discuss their findings. Although some staff had used the results of the probes to inform their planning, others needed guidance as to how to use the results from the Probes. The advice to teachers included: to use the findings to emphasise and de-emphasise aspects of their mathematics program; to incorporate selected activities from the support materials into their mathematics program; to retest students with the Probes in a few months to establish the effectiveness of the

current program; and to provide a differentiated mathematics program for students whose capabilities were identified as substantially above or below the majority of their classmates. Overall, these visits were received very positively although some staff were struggling with how to use the findings of the Probes within a textbook-focussed program. This issue is broader than the Probes and relates to how effectively a textbook can address the aims of the syllabus.

> CA (talking with CO and CF): As part of the follow-up visits, teachers were reassured they were doing a great job. For many teachers just the fact that they have developed some self assurance and self esteem in teaching some aspects of mathematics was very rewarding.

6. Sustaining the Professional Development Program

The sustainability of the professional development program in this district was paramount because, due to its location, there are a high proportion of relatively inexperienced teachers and a high turnover of teachers. With these issues in mind and to reinforce the message from this project, a booklet of example cases of the implementation of the Probes is being prepared for access across the sectors. Throughout the project, teachers were particularly interested in how other teachers were implementing the Probes and the instructional and resource decisions they made. Teachers and administrators had also requested a DVD showing the implementation of the Probes and ideas for instruction. This request has been budgeted for in 2008 because multimedia provides a powerful agent for teachers' learning through vicarious experiences (Watters & Diezmann, 2007).

> CO (talking with a principals' group): [They] Identified Probes as a valuable tool and wanted video created of best practice.

Through school visits we identified exemplary teachers for the DVD.

> CA (talking with CO and CF): This process also allowed us to target teachers that could be part of the project's DVD in 2008.

Teacher's engagement with the booklet and DVD are likely to impact on the sustainability of this professional development initiative because they highlight content knowledge in the learning and teaching of number concepts, provide a stimulus for the collective participation of teachers in the same school, and extend the duration of the professional development activity. Content knowledge, collective participation and duration of a professional development activity are all characteristics of effective professional programs (Garet, Porter, Desimone, Birman, & Yoon, 2001).

Results and Discussion

The two research questions are addressed in turn, followed by a discussion of the relationship between the findings from these questions.

What Learning Did the Professional Development Team Experience?

According to Clarke and Hollingsworth (2002), the potential for learning resides within each of four change domains and through the enaction and reflection between pairs of domains (See Figure 1). Analysis of the project data revealed exemplars of this learning in two domains and between five pairs of domains.

1. The Personal Domain

There were five changes in the knowledge, beliefs or attitudes of the team. First, there was an increased understanding of the complexity of a successful professional development project. In particular, we identified a range of reasons why some teachers did not implement the initiative (Table 1). Second, we learnt about the unique roles in a professional development team and how they serve complementary purposes; about the value of particular team members assuming responsibility for particular types of tasks (e.g., presentation, resourcing, supporting teachers) rather than multi-tasking; and about the difficulty of assuming unfamiliar roles. Third, we recognised that it was useful to have a critical friend who was committed to the project and could draw on other experiences to contribute ways to think about particular issues or events and act as a sounding board for ideas. Fourth, we were reminded that teachers responded in different ways to the same professional development experiences with some adopting initiatives quickly, others needing support and a few remaining resistant. Finally, we recognised that despite our team roles and background, we can still learn about the teaching of mathematics.

2. The Domain of Practice

There was evidence of two changes in practice across the team. First, the non-sector support team (CF, SP) assumed a higher profile in working with teachers in some schools than their systemic team members. This occurred because teachers did not perceive these team members as part of the system and seemed more relaxed about sharing issues of concern and seeking assistance. Additionally, because systemic staff oversee broader curriculum matters than this project, conversations sometimes strayed from the Probes. Second, the team became very proactive in working with teachers during the second professional development day and in the follow up visits to encourage teachers to implement the initiative.

3. The Personal Domain to the Domain of Practice

There were four changes in the team's enactment of knowledge, beliefs or attitudes within the domain of practice. First, there was a need to make a substantial and urgent response to the misalignment between the intent of the first professional development day and what teachers had done in schools by the first round of visits for the success of the project. One of the ways this change was implemented was through the production of a Briefing Sheet which was distributed widely to teachers and school administrators (Appendix 2). Second, the team purposefully responded to teachers' lack of understanding of the project or lack of implementation of the Probes as a catalyst for conversation. As

a consequence, many teachers engaged in rich professional dialogue about assessment and instruction. Third, the team recognised the need to make explicit links between this project and teachers' current practices. Subsequently, making connections was a key focus of the second professional development day. Fourth, following a reflection on teachers' and administrators' requests, planning was commenced for the production of a DVD resource to provide models for the implementation of the Probes and associated instructional ideas.

4. The Domain of Practice to the Personal Domain

One change was evident in the team's reflection on their practice in ways that influenced knowledge, beliefs or attitudes. This was a realisation that the task of implementing the Probes and using the Probes to inform instruction was complex for some teachers and needed to be broken into an assessment component and an instructional component.

5. The Domain of Consequence to the Personal Domain

Five changes occurred as a result of the team reviewing the outcomes of the project which influenced their knowledge, beliefs or attitudes. First, we realised that effective professional development involved more than the presentation and modelling of new ideas and the provision of resources. The intent of the professional development needed to be understood by the teachers and they needed to implement the ideas presented in their classrooms Second, we recognised the disjuncture between teachers' feedback on the professional development day and what was occurring in practice. Although there was widespread satisfaction with the professional development days, this was not a reliable indicator of the likelihood that all teachers would implement the Probes in their classrooms. Third, as a result of seeing teachers' struggling with the implementation of the Probes for philosophical reasons (i.e., the role of assessment in learning, testing in the early childhood years), we modified our expectations of what some teachers could achieve in the short term. Fourth, there were recurrent indicators that most teachers' views of assessment were restricted to testing after instruction. This realisation led us to consider the importance of broadening teachers' thinking about the relationship between assessment and learning. Finally, we realised that the exemplary teachers were identified by their characteristics rather than by their number of years of teaching or their roles within a school. These characteristics were: trialling the Probe Tasks and documenting the outcomes, using the advice from the Probe Task manual to interpret students' performance on these tasks, and judiciously selecting activities from the resource materials to support students' learning based on their performance on the Probe Tasks. Typically, the most innovative and creative teachers were relatively inexperienced and unnoticed in their schools. We plan to make a conscious effort to foster such teachers' leadership capacity in future professional development projects.

6. The Domain of Consequence to the Domain of Practice

The team made three changes to practice after reviewing the outcomes at various points in the project. First, the school visits revealed commonly occurring difficulties with the implementation of the Probes. This finding led to a focused

search for conditions that facilitated and inhibited the implementation of the Probes during school visits. Second, the extent of teachers' implementation of the Probes was less than anticipated and so a variety of actions were directed towards bolstering implementation, such as networking teachers with others in their school who had successfully implemented the Probes. Finally, the widespread lack of implementation of the Probes indicated a sector wide issue. Thus, an additional focus of the CF's practice became working at a system level, seeking the reasons for a lack of implementation and providing recommendations to assist in the uptake of the initiative (Diezmann, 2007).

7. The Personal Domain to the External Domain

Two changes resulted from knowledge that staff in leadership roles can influence the success of an initiative. First, we sought the assistance of more senior staff in the system to raise expectations in the district about the implementation of the Probes and to disseminate these expectations in a variety of forums. Second, we forewarned senior staff that the success of the project would also be impacted by some school practices because although the project was consistent with the constructivist-based philosophy, it was inconsistent with the use of textbooks as a proxy curriculum.

A summary of the topics of learning within and between pairs of domains of change is shown on Table 2. These categories provide some indications of the types of outcomes that could be anticipated if another professional development team engaged in a similar project.

What Are the Advantages and Disadvantages of Working as a Professional Development Team?

We identified five advantages and two disadvantages in working as a team. The advantages related to expertise and responsibilities, professional dialogue, the value of a critical friend, working towards common goals and the quality of the professional development (Table 3). The disadvantages related to distance and time as four of the five team members lived at a distance to the district and all of us had multiple responsibilities apart from this project (Table 4).

Table 2

The Topics of Learning within and between Domains

Domain/s	Topic of Learning
The Personal Domain	• understanding the complexity of a successful professional development project • understanding the uniqueness of roles in a professional development team • appreciating the value of a critical friend on a project • understanding that teachers can respond differently to the same professional development experience • recognising that the team are still learners about the teaching of mathematics
The Domain of Practice	• elevating the profile of the non-sector team in working with teachers to allay sector-based concerns and focus the dialogue on the initiative rather than broader issues • assuming a very proactive role to working with teachers to implement the initiative
The Personal Domain to the Domain of Practice	• making a substantial and urgent response to the misalignment between the initiative and teachers' implementation of it • responding to teachers' lack of implementation of the initiative as a catalyst for dialogue • making explicit links between this initiative and teachers' current practices • planning for the production of a multimedia resource to support the implementation of the initiative
The Domain of Practice to the Personal Domain	• appreciating that an initiative can be too complex for some teachers and may need to be broken down
The Domain of Consequence to the Personal Domain	• understanding that the implementation of an initiative is influenced by the clarity of the message and teachers' responses • appreciating that teacher satisfaction of a professional development day is not a reliable indicator of whether teachers will implement the initiative • recognising some teachers' reluctance to implement an initiative is philosophical • recognising that many teachers' views of assessment are restricted to testing after instruction • identifying exemplary teachers by their characteristics rather than by their seniority or their roles within a school
The Domain of Consequence to the Domain of Practice	• seeking conditions that facilitated and inhibited the implementation of the initiative • being proactive in orienting teachers towards the implementation of the initiative • enlarging the scope of the CF to include responding at a system level as well to individuals
The Personal Domain to the External Domain	• knowing that staff in leadership roles can influence the success of an initiative and making an effort to mobilise their support and influence

Table 3
The Advantages of Working in a Team

Advantages	Example Responses
Capitalising on the Expertise of Team Members	CA: "Having a professional learning team that was able to take on a range of different responsibilities was critical to the success of the project. Each team member had a pivotal role regardless of their experience and expertise and combining all of these people, roles and relationships made a professional learning team that catered for all schools and their given contexts ... The professional learning team needed to work as a close knit unit and be able to rise to the occasion when necessary. With the range of people in this professional learning team we are able to share ideas, skills and talents in relation to this initiative."
Opportunities for Professional Dialogue	CO: "Working with a team facilitates a critical element of review and reflection in real time. This is not always possible to achieve while working independently. This project's collaborative nature enabled a focus on the process of PD as an agent of change not just on the products. It enabled conversations around the how and with whom do we go forward as [a] sustainability issue to be scaffolded into future professional development."
The Value of a Critical friend	MC: "A particular advantage this year, was the role played by the critical friend [e.g., this uncovered some difficulties with the initial presentation where we worked with a very large number of teachers which could be addressed in the follow-up school visits]. This added strength to the team and improved the overall quality of the PD."
Working towards a Common Goal	SP: "This was the first time I had worked within a [professional development] team and I saw the advantages as huge. To have the expertise of academics, researchers, curriculum advisors and teachers working together to achieve a common goal produced a very thorough approach."
Quality of the Professional Development	SP: "The personnel involved in the team brought knowledge of curriculum, mathematics, assessment, teaching, learning and development. I observed how the triangulation of all of these knowledges and skills benefited all involved. Most specifically the involvement of the team in the planning, presentation and review of the professional development created a comprehensive, accurate, evidence-based, and research-proven program of inservice."

Table 4
The Disadvantages of Working in a Team

Disadvantages	Example Responses
Distance `	CA: "The only disadvantage from working with this professional learning team was that fact that we were all so far apart in distance. Even though we consistently communicated via email and phone there is nothing more powerful than face to face discussion."
Time together as a Team	CF: "We had limited time together as a full team and had to rely on conversations on the hop due to our busy schedules, the home base of team members and most of the team working away from home."

The Relationship between Learning and Working in a Team

The evidence of learning by the professional development team is indisputable. Equally clear is the value that the team saw in working together. However, the ability to work effectively as a team and learn through this process should not be assumed. We contend that our ability to collaborate and work effectively was due to some existing relationships within the team, to frank and constructive communication, to respect for each other's professional knowledge and each of our roles in the project, and importantly, to trust. Hargreaves (1994) argues that trust in people and processes are essential to productive working relationships.

Conclusion

Teacher quality and upskilling the workforce are key issues in government agendas. Hence, in education there is a booming industry in professional development. As professional developers, our focus is typically on how to support the learning of teachers. However, we need to be mindful that teachers' learning is at least to some extent dependent on our own learning. Thus, we need to seek ways to monitor and improve our professional practice. In this study, we sought to examine our learning as professional developers, and the advantages and disadvantages of working as a professional development team. The perspectives of Knight et al. (2006) on professional learning and Clarke and Hollingsworth's (2002) model of teacher professional growth proved useful tools for investigating our learning.

Our team reported intentional and non-intentional learning outcomes consistent with Knight et al.'s (2006) view of the intentionality of learning. The non-intentional learning outcomes from undertaking a professional development project are idiosyncratic. However, intentional learning outcomes can be planned for, which raises the question of: *What (self) learning is anticipated by the professional developers as an outcome of conducting a particular professional development project*? Prospectively, we expected some outcomes such as learning from each other, learning about the Probes, and the newcomer to our team

learning how to engage in professional development. However, we gave scant attention to facilitating our own learning, relying largely on serendipity. Retrospectively, we think differently. Professional development provides a fertile ground for the learning of professional developers. Hence, we need to plan for and capitalise on the opportunity that each project provides. As the proverb reminds us, "In teaching others we teach ourselves". But what are we teaching ourselves? Anticipating that a project has the potential for professional developers' learning as well as for teachers' learning raises questions of: *What (self) learning would be desirable from a project? How will this (self) learning be fostered?* and *Is it worth conducting a project that has no learning value for professional developers?* The answers to these questions will vary according to respondents' perspectives — professional responsibility, academic interest, economic necessity or triple bottom line thinking (i.e., financial, environment and social performance).

In contrast to the study of learning and quality in teaching, the study of learning and quality in professional development is in its infancy. In teaching, there are models of professional growth, vocational training, accreditation and standards of practice — in professional development there lack similar models and quality mechanisms. Thus, a serious professional, theoretical and empirical question for all stakeholders in professional development is: *What sets an effective professional developer apart from an ineffective professional developer?*

Acknowledgement

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Appendix 1: Professional Development Team Feedback Form

1. Reflection

Questions	Response
Roles and Duties	
1. How did you become involved in this initiative?	
2. What was your specific role in this initiative and your key duties?	
3. Did this role change over time, if so how?	
Project +ve & -ve	
4. What PL outcomes were achieved through this initiative?	
5. What obstacles related to PL (professional learning) did you encounter in this initiative?	
Team +ve & -ve	
6. What were the advantages of working as a PL team?	
7. What were the disadvantages of working as a PL team?	
Other	
8. Any other comments	

2. Professional Dialogue

Describe 3 important conversations that you had during this initiative with other team members and how they impacted on the professional development.		
Topic of the conversation	**Conversation with**	**Description of the conversation**
1		
2		
3		

Appendix 2: Years 1-3 Project 2007 Overview

Expectations:
- Teachers should select 2 or 3 students to undertake the Probe Tasks with.
- Teachers should use some of the Probe Tasks to identify difficulties students have in Mathematics. These tasks should only take a few minutes with each student. Teachers may seek the support of learning support teachers, teacher aides, teacher assistants etc to help them with the undertaking of the Probe Tasks.
- Teachers need to record the results of the probes used for each student and identify their starting points for intervention.
- Teachers should use the additional support materials to help with the intervention planning.
- Teachers need to track these students over the next 10 months to monitor their development.

Case Study
- Teachers are asked to write one case study (one student, 2 A4 pages).
- Teachers are asked to keep any work samples, assessment etc that can be added to their case study.
- Teachers are asked to write in their case study the strength and weaknesses of the probes, additional support materials and how they have been used to monitor this students.
- Teachers are ask to provide pre and post probe results as part of their case study.
- If teachers have used some of the probes or extra support materials with the whole class please make some note of this in the case study report and the progress that students have made.

Other facts to consider:
- If in year 3 were these students identified as below benchmark?
- If in year 2 were these students identified in the Year 2 Diagnostic Net?

Follow-up visits:
- During Term 2 and 3 schools should be prepared for follow-up visits in relation to the project. This could be a number of different people.
- During Term 4 Eva and Geraldine will come and visit all schools to collect the case studies. This will occur during the 2nd and 3rd weeks in November.
- Schools will be notified by phone call or email as a reminder that we are coming.

Thank you so much for you dedication and hard work in relation to this project.

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