Policy Implementation: Integrating the Personal and the Social

Margaret Walshaw
Massey University

Glenda Anthony
Massey Universitys

Reforms in education have repeatedly been confronted with the challenge of policy implementation. Recent initiatives in mathematics are no exception. Pressing for fundamental and complex changes to pedagogy, the initiatives demand much from teachers. In this article, we propose a conceptual frame for understanding how teachers and schools work to transform instructional practice. In integrating two aspects usually considered independently in research, we explore the way in which teachers make sense of the reforms, and the means by which schools make implementation possible for teachers. Our investigation focuses on two teachers, and explores how both attempt to enact the spirit of a national numeracy project. The exploration provides important insights about patterns of change in pedagogy that follow on from large-scale reform.

Recent years have witnessed vigorous and sustained efforts from policy makers to reform the quality of classroom experience. The reform initiatives, targeting classroom experience across a range of subject areas, aim to engage all students with central ideas specific to the subject area. Mapping out far-reaching goals in relation to student outcomes, the reforms press for fundamental and complex changes to pedagogy and challenge deeply rooted beliefs about teaching, learning and content. Mathematics has featured prominently in these reform efforts (e.g., Australian Association of Mathematics Teachers (AAMT), 2002; Department for Education and Employment (DfEE), 1999; Ministry of Education, 2001; National Council of Teachers of Mathematics (NCTM), 2000), introducing initiatives that highlight the core dimensions of mathematics teaching.

The reforms represent an immense challenge to schools, in their task of supporting teacher development. They also demand a major shift in teachers' thinking about and operationalising practice that is consistent with the policy intent. Notwithstanding the challenges that the reforms signal, teachers and schools alike are mindful that the reforms aim to address major issues facing mathematics today. These objectives focus on the realisation that specific groups of students continually register low proficiency levels in mathematics, and on the recognition of the challenge of student diversity inherent in classrooms today.

Instructional practice pedagogy is a complex and multilayered process (Anthony & Walshaw, 2007) and is formidably difficult to change (Cobb, McClain, de Silva Lamberg, & Dean, 2003; Little, 2003; Spillane, 2000). Yet evaluation reports of specific projects (e.g., Higgins, Irwin, Thomas, Trinick, & Young-Loveridge, 2005; Young-Loveridge, 2006) tell us, on the basis of student data profiles associated with the New Zealand Numeracy Development Project (NDP), that change has occurred. If teachers have changed their pedagogical practice we would want to know how schools and teachers have managed the

change. Identifying school-wide patterns and individual profiles that contribute to sustained change in the wake of reform is important if we are to enhance our understanding of the relations between reform and teaching.

This paper has two main objectives. One is to briefly outline a novel theorisation of implementation of reform, in particular what Spillane (2000) terms "a perspective on implementation that supplements and complicates, rather than supplants, conventional accounts of the implementation process" (p. 169). We propose that this conceptual frame offers a way of examining how teachers and schools work to transform instructional practice. A second objective is to illustrate what these new understandings of the implementation process tell us about contemporary mathematics teaching practice enveloped by pedagogical reform. We examine the practice of two teachers in two different schools servicing different socioeconomic groups of students. Our focus is on teachers located within schools and on how teachers take up the Numeracy Development Project. The exploration will allow us to explore the multiple layers of reform enactment, and to provide insight about patterns of change in pedagogy that follow on from large-scale reform.

Conventional and New Analyses of Reform Implementation

Scholarship on education policy implementation has recently moved from an interest in rational choice theories to accounts that are premised on the complexity of individuals' sense making (O'Toole, 1986; Spillane, Reiser, & Reimer, 2002). In reworking their analyses, these scholars have been able to provide a more nuanced yet highly powerful understanding of how new policy is taken up by individuals and groups.

Rational choice explanations of implementation employed over the past 50 years have drawn upon three distinct lines of analysis. Most assume that implementers have a keen sense of the policy's intended messages. One kind of analysis is focused on policy design and the extent to which directives for the implementing agents and agencies are formulated clearly and consistently (e.g., Cuban, 1988). In these accounts implementation failure is seen as a result of policy weakness or ambiguity. On the other hand, clear implementation goals, a press for incremental changes, and the monitoring of agents' behaviours are all likely to lead to implementation success.

Another kind of analysis is focused on governing systems and the kinds of organisational arrangements in which the policy is constructed. Implementation failure in these accounts is considered to be the outcome of unclear demarcation lines of responsibility amongst the policymakers themselves (e.g., Porter, Floden, Freeman, Schmidt, & Schwille, 1988). Implementation fails when policy construction tasks are not well defined within the groups exercising policy jurisdiction. The power and authority of policy is seen as seriously compromised by a differentiated policy development because it sends unclear and sometimes conflicting messages and directives to implementation agents. In turn, the agents become uncertain about what, and to whom, they should attend and be accountable.

Yet another analytic approach explores the inclination and capacity of people charged with the responsibility for implementing policy. Policy implementation is analysed in relation to agents' willingness and capacity to take up and work in ways that are consistent with policies when those policies meet, or do not meet, their own agendas and interests (e.g., Fullan, 1991; McLaughlin, 1987). When policy does not meet agents' agendas, it is more likely to be selectively attended to, or modified. It might also be ignored or opposed. Insufficient or ineffective human and material resourcing may also result in a failure to meet the objectives of the policy.

All these explanations of implementation, based on rational choice theory, have come under attack for failing to take account of the complexity of human sense-making (O'Toole, 1986; Spillane, et al., 2002). Specifically, conventional accounts are underpinned by the following assumptions: that choice is the prerogative of an individual; that individuals' multiple choices are rational and unproblematic; and that personal interest lies at the core of all choices made. Spillane, et al., (2002) argue that implementation agents do not intentionally interpret policy, in the way intended by policy makers, to fit their own needs. In addition, they do not typically work to ignore, modify or undermine policy directives. Policy implementation, it seems, is not as simple as conventional explanations would want us to believe.

Analysts are now tending to think about implementation as nested within an evolving systems network. The systems network functions as an ecology in which the activities of the implementation agent — as well as those of others within the system — are mutually constituted through the course of interaction. To that end, analysts are developing conceptualisations that move beyond a fascination with policy design, governance, and the inclination and capacity of implementing agents, to an understanding of the ways in which agents understand the policy message and their self-in-community within that message, and how their understanding influences a change in their perception of their own practice. The new work begins with the idea that:

> Policy messages are not inert, static ideas that are transmitted unaltered into local actors' minds to be accepted, rejected, or modified to fit local needs and conditions. Rather the agents must first notice, then frame, interpret, and construct meaning for policy messages. (Spillane, et al., 2002, p. 392)

A number of analysts are engaged in uncovering and exposing the mechanisms of practice through which implementing agents come to an understanding of policy (Hill, 2001; Spillane & Jennings, 1997), and its corollary, the means by which they attempt to make links between their understanding and their practice (Coburn, 2001; Hill, 2001). In this they are heavily influenced by the work of theorists (e.g., O'Toole, 1986; Spillane, et al., 2002) who argue for an integrative framework that will allow the complexity of implementation to be analysed. In particular, three key interrelated elements that utilise ideas from three unique theoretical frameworks are analysed: the individual implementing agent, based on understandings from individual cognition; the context in which the agent

makes sense of the policy, building on situated cognition; and the policy signals that draw on the role of representations.

Spillane (2000), for example, one of the leading exponents of new implementation analyses, looked at how school districts in the United States respond to recent mathematics reforms. Highlighting how policy is deployed as a resource and as a form of property for new mathematics programs in a district, the research showed how district leaders tended to focus on surface ideas and enact piecemeal changes that often missed the crucial epistemological and pedagogical messages of the reforms. Within analyses like Spillane's, policy implementation is directly linked to the specific understandings that key implementing agents make of new policy. Such analyses advance our knowledge beyond the incapacities of key players to enact reforms. They also move us beyond accounts that reveal how reforms handed down from higher up the education policy landscape, are wilfully transformed or ignored. However, to date these new understandings of policy implementation have had little impact on mathematics educational policy and practice. While there is a growing recognition of the salience of integrated implementation processes within political science (Hill, 2001; Lin, 2000) and public policy (Weiss, 1989; Yanow, 1996), within mathematics education, however, policy implementation failure is frequently presented, if not as extreme as 'sabotage', then as 'misinterpretation' of implementing agents.

The Study

How exactly do teachers and schools work with the New Zealand Numeracy Development Project (NDP)? In attempting to address the question, we move away from the notion of the school and the teacher as the sustainer of the project to one in which they are interpreters and adaptors of new policy (Shulman & Shulman, 2004). In doing this our investigation explores the interplay of teachers' understandings and personal resources with the 'external' incentives made available by schools for teachers to engage with the NDP. Precisely because policy implementation takes place within nested systems of people and structures in schools, we have embedded institutional settings into the analysis of teachers' personal enactment of numeracy reforms. The theoretical underpinning for our approach can be found in the integrative model of policy implementation (e.g., O'Toole, 1986; Spillane, et al., 2002) that links the cognitive dimension of how people understand new policy with the neo-Vygotskian understanding (e.g., Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Resnick, 1991) of the social dimensions of learning and the way in which that learning might be mediated by tools. In terms of teachers' numeracy enactments in classrooms, those tools are taken as the support within the school community and the resourcing of the program.

If pedagogical practices for numeracy are enhanced by teachers' active engagement with processes, tools, and people, then we want to have a clear idea about how people and systems work to implement change. At the heart of our investigation was a desire to understand precisely what teachers do to actualise

the intent of the reforms. At a time when the policy machinery is focused on sustaining the NDP, we wanted to explore how school personnel interpret and adapt the numeracy development project's intents. We wanted to investigate those factors that relate to the professional learning community of teachers and to the sense that individual teachers make of the reforms, that contribute to the way individual teachers 'take up' and adapt their own classroom practices as a result of their participation in the NDP. We wanted to account for the visions, commitments, motivations and capacities that are both held by individuals and shared by the learning community.

We did have some promising guideposts. From a major study undertaken in the UK (Millett, Brown, & Askew, 2004) we knew that school-wide systemic change that aligns with the reform is an important factor in facilitating teachers' changed instructional practices. Principals in that investigation who were respectful of the professional expertise and change intentions of the school's mathematics teaching community made a difference, through both personal support and systemic school-wide change. Lead mathematics teachers, too, were key players in interpreting the project. They influenced 'how' and indeed 'if' the reform ideas were taken up by staff.

Lead mathematics teachers also featured in a study undertaken by Ward, Thomas, and Tagg (2007). The views of lead mathematics teachers, and those of facilitators in schools involved in the NDP since its inception, were examined in order to tease out what makes a contribution to the sustainability of the NDP. Ward et al. (2007) found that school-wide factors such as quality resourcing and the provision of release time, as well as personal factors such as teachers' level of content knowledge, all contributed to the development and maintenance of the numeracy project. Higgins, Sherley, and Tait-McCutcheon (2007) emphasised teachers' knowledge as a key driver in the success of the NDP. Specifically, knowledge spanned four domains: content, students as learners, teachers as learners, and communities as learners. At the school-as-community level, Bobis (2004) found that support from within the institution and the broader school community was a critical feature in influencing teacher development and enhancing student learning. In her evaluation of the impact on teachers of the *Count Me In Too* numeracy program in Australia, Bobis reported that successful teachers were supported both practically and emotionally and worked within a professional context of shared knowledge and shared thinking about what counted as effective instruction.

In the larger study from which our current discussion is drawn, we explored policy implementation through a school case study approach. Given that a focus in the project was to identify those factors which appear to facilitate or inhibit the development of numeracy teaching practices, we studied 12 school cases, using purposive sampling in an effort to capture a wide socioeconomic mix. In 2003-2004 when the data were collected, all of the schools had completed the project at least two years previously. In each of the 12 schools our principal research method was interviewing. We interviewed a wide range of school personnel in each of the 12 schools, speaking individually with numeracy classroom teachers,

lead mathematics teachers, school principals, teachers who were new to the school and any other staff who specifically sought an interview. Each semi-structured interview lasted approximately 45 minutes and canvassed an extensive range of issues. We found that school personnel, when interviewed individually, were keen to respond to our questions, sometimes with unexpected revelations about the relation between people and systems.

We provide here an insight into the implementation approach taken by two teachers in two different schools, as they attempt to get 'on board' with numeracy reform ideas. We examine these two cases to highlight the interplay between external incentives with teachers' personal resources to enact the reforms. In our discussion we will first provide an overview of the NDP and its main intent. We will then situate the two case study teachers in their schools. Finally, their differential enactment will be explained and analysed. We have analysed the interactivity of external and personal resources, in the hope that some valuable conclusions about how reform efforts are interpreted and modified might be drawn. Understanding this interplay is vitally important during the current period of mathematics reform.

Enacting the Reforms

Coordinated at a national level, the aim of the NDP is to raise student achievement through raising teacher capability. Formalised as a professional development project for primary school teachers around the year 2000, its policy messages are spelt out in the Early Numeracy Project (ENP), aimed at the junior school, and the later introduced Advanced Numeracy Project (ANP), with its target group students aged 8-10 years. These two initiatives have more recently been complemented by the Secondary Numeracy Project (SNP), introduced into some secondary schools at the junior level. The key tools in the projects are a Number Framework and a Strategy Framework. These provide the backdrop for the solution of problems, for the stating of conjectures and for the defence of ideas that together are the hallmarks of the sophisticated mathematical experience outlined in the reform.

Numeracy facilitators work to improve content and pedagogical knowledge, explaining new ways of doing things, guiding planning and offering teaching episodes to capture the intent of the program. These are provided in a model that uses both on-site workshops and in-class teaching demonstrations to assist with planning and decision making concerning the selection of problems and activities for classroom work. The intention is that from the pedagogical approach advocated — one based on Skemp's (1986) theory of relational understanding, and its derivative practice of students' strategy sharing set within a formalised model of students' developmental stages of thinking — students will gradually develop the skills and dispositions towards mathematically accepted ways of thinking and reasoning.

Rowena's School

Rowena has been teaching for 27 years. "I wasn't confident in maths when I first started. I think I'm feeling pretty good about it now because I've been through it, you know, I've had the time to sort it out. I know the activities that work for me and how I want it to be done." To construct alternative practices, Rowena said: "I knew that there would have to be changes because there always is when new systems come in. You've got to make changes and you've got to rethink things that you are doing."

Like all schools in our larger study, Rowena's school took the intent of the project seriously and had made a significant commitment to it in terms of finance, time and resourcing. School-wide expectations and accountability measures at her decile[1] 3 school to some extent pressed her to attend carefully to the reform proposals. Her principal noted that "twice a year we collect information from school-wide assessments and from that we set out targets. At Year 8, I want them to be at a certain stage. I looked at our data and thought that's not good enough for them to be going off to high school."

Rowena believed that the project had made a positive impact in her classroom and was convinced that her enactment of the project was consistent with the reformers' intentions. Through her efforts to reform practice she had developed a new vocabulary in keeping with the language in the project. The vocabulary that organised her new teaching and learning experiences (e.g., 'strategies', 'tens frames', and 'the abacus') tended, however, to capture the 'tools' rather than the 'big ideas' of the reform rhetoric itself. She engaged not so much with the core ideas about practice in which the numeracy reform is grounded, as the activities that accompanied those ideas. Getting on board for her meant attendance at the professional development sessions and "accepting that I didn't have to see every group every day." Getting on board also meant adding new resources and activities into her teaching repertoire:

> I have the books — just open them up and then you've got addition and subtraction activities with your learning intentions. And your multiplication. So it's really easy. Because what I do is look at it and say right, this is for imaging — these are the things I need to cover. Like those are things I'll do for number knowledge, those are the things I can do for the addition for that particular learning intention. So it's basically all laid out for you. It's just making sure that you've got the equipment to use and the games to use.

Contextualising Rowena's classroom work, we report that the principal had organised extensive support for teachers. The lead mathematics teacher was instrumental to setting up professional support that was centred initially on an expert working in isolated classrooms and modelling lessons. Support didn't

---

1 Decile ranking (1-10) in New Zealand schools is assessed from Census data and from school ethnicity data. A low decile ranking is an indicator that the school community is formed from low socio-economic communities. High decile schools record the highest proportion of students from high socio-economic communities.

stop there: the expert "came back to check on teachers. We had a teacher who wasn't fulfilling the obligation and she came and worked alongside that teacher." It wasn't just "go off, have a day and then go back and do it," he explained. "There was that on-going thing." Colleagues as well as expert facilitators were central to the school's reform efforts. Still centred on the classroom, a school-wide system was developed whereby individual teachers chose one senior teacher in the school to "come in and observe a specific aspect of the mathematics program that the teachers decided on." Feedback was provided immediately afterwards. As the principal said, "that way we're actually continuing the professional development." Peer support and feedback not only allowed teachers to sort out pedagogical or content problems, it also provided teachers with the motivation to improve their practice.

Enactment of numeracy reforms at Rowena's school went beyond individual classrooms. As the school lead mathematics teacher explains, they took a whole school approach to professional development: "We share across the school the different things that we were doing. And so we did things like that to help our planning and to help our organisation." Collegial feedback on practice as well as sharing individual attempts to enact the proposals in their classrooms created incentives for teachers to revise their practice. They also created incentives to formalise their ideas about effective practice. From their team meeting deliberations, the teachers had produced a document that captured their collective ideas about effective numeracy classrooms. The schedule established for them the characteristics of effective teaching and the numeracy learner, as well as the features of the environment. This document resulted from ongoing personal deliberations that were grounded in understanding the reform ideas relevant to their particular students.

Cherie's School

Cherie had been teaching for "thirty plus years" and had "seen many changes in the maths program" over that period. Like Rowena, she tells us that she has a "very weak background in maths." It was not until she enrolled in curriculum studies in mathematics at Teachers College that she "began to understand the functions and the processes of maths much better." She pointed out that the school had to reorganise its school-wide program to accommodate the reform projects. As at Rowena's school, accountability measures drove practice. The principal of her decile 7 school noted that the school compared their numeracy data with the national figures. He noted too that "at the end of each year we have a record of where each child is at."

Although Cherie's own personal school experiences in mathematics were weak, the program "built on [her] own philosophy of how children learn." Cherie pointed out that her past teaching practice approximated the reforms. For her personally, the program required less unlearning of old practice and confirmed that what she "was doing was okay." For example, she said that the strategies for developing number sense were simply "what I do myself, so it was logical to be able to teach them to the children." She claimed that the project "was

just an extension of what I was doing; only more organised. It gave me lots more ideas and opportunities to use what I was already doing." In short, the program was not so much a fundamental shift in thinking on her part, but one that "provided new outlets for what she was already doing in the classroom." Cherie pointed out that, for some teachers, the Numeracy Project was a major shift in thinking and action, but for her, personally, the main difficulty lay in the organisational part such as sourcing activities and games for her numeracy class.

Cherie demonstrated her familiarity with the fundamental reform themes through a vocabulary that was consistent with the language in the project. The reform rhetoric became a key tool for organising new teaching and learning experiences and played an important role in constituting the realities of her classroom practice. During her interview she talked about 'early additive', 'advanced counters', 'diagnostic interview', 'flip numbers', 'the abacus', 'the slavonics', 'tidy numbers', 'number lines', 'doubles', 'tens frames', 'number fans', hundreds board', 'making up to tens', and 'strategies'. Cherie, more than Rowena, had assimilated the vocabulary into her own thinking and drew upon that language to represent her ideas about her practice.

In marked contrast to Rowena's experience, Cherie reported no sustained guidance for her classroom work. She noted that there were very few deliberations about practice and discussions about the ways in which the reform ideas might be enacted. Typically, the work that Cherie did in her classroom was not known about or discussed in the staffroom or at team meetings. In effect, teachers were practising in isolation in their classrooms. As she said: "I don't know about the others [teachers] ... I'm probably missing out heaps of stuff I should be doing, but hopefully I'm trying to cover what I can and do the best I can." Cherie tended to compensate for the lack of collegial support by making use of the NDP on-line "number site". For her the site is "really good. Really helpful for me because the lesson plans are all set out." What she would like are continuing discussions with colleagues and the opportunity to share ideas about and enactments of practice. These observations were echoed by a new teacher at the school who believed that "you've got to be talking with other people who are doing it."

Ultimately it is the principal who makes the decision about committing to the project. The principal at Cherie's school was prepared to commit "a lot of money" to the project provided it offered a "better school direction" than the topic approach to mathematics that was in place in the school at the time. He wanted it to meet the needs of the children. He attended the seminars held at the school to hear what the project offered for his particular school community. In his understanding, "the biggest change is the strategies." For him, the project allowed teachers to see "the children engaged in their learning. Doing the things that they need to know — the knowledge that they need but also the strategies that they need." He suggested that "there's more emphasis on the children or teachers knowing exactly where each child is working. And so the group dynamics, if you like, cater for those needs." Apart from meeting the needs of children, the project "was something new and we wanted to be part of it."

Based on the principal's understandings of the project, classroom release for the lead teacher was subsequently arranged and it was the lead teacher who coordinated the program and worked with "parents in group situations making equipment." The lead teacher noted "we had support meetings and talked a little bit." She hoped that the project "was going to change a few things and give the children some new strategies and ways of dealing with things." In the lead teacher's estimation, the teachers "probably have had to change, because they've had to use new equipment and do things in a different way." In terms of on-going support after completion of the project in the school, the principal pointed out that the teachers "were getting courses." He noted that "some of them are going to more than one course, depending on where they're at." The opportunity for teachers to attend further courses is a commitment taken at the expense of other curricular areas because, in the principal's words, "teachers' professional development in mathematics ... is a target area for our school development." However, enactment of the reform ideas required more than course attendance. As Cherie says, "What I'd really like to do is see what other teachers do in their classrooms and how they organise things and plan things. I mean even though we do go to one or two courses afterwards, it's still not enough."

Differential Enactment

Both Cherie and Rowena claimed to be familiar with key reform themes and believed that their own skills and knowledge base had been enhanced. Both teachers expressed their support of those reform ideas and both claimed to be teaching mathematics in ways that approximated key aspects of the NDP's recommendations. Precisely because the way they implement the reform ideas takes place within nested systems of people and structures and develops "in situations where the available information is often partial or incomplete and where the consequences of actions are not always immediate" (Doerr & Lesh, 2002, p. 132), their institutional settings are fundamental to the way they enact the intent of the reform in their classrooms. How might we account for the fact that Cherie undertook more extensive changes than Rowena in the core dimensions of practice?

Personal Arena of Enactment

A number of researchers (e.g., Cohen & Ball, 2001; Little, 2003) have argued that teachers' prior practice, dispositions and beliefs all influence their ability to practise in ways recommended by reformers. To meet the reformers' intentions, first and foremost our two case study teachers had to question how their current deep-rooted content and pedagogical knowledge measured up with the change proposals. Both claimed an understanding of the key concepts and both assessed those ideas against previous practice. Rowena talked in ways that resonated to a lesser degree than Cherie with the rhetoric of the key aspects of the numeracy reforms. We would suggest that Rowena's understanding was located at the surface level and thus did not prompt her to make significant changes to her

practice. Cherie, on the other hand, had a more substantive grasp of the key ideas and those ideas meshed to a certain extent with her own. For her, the policy was crafted and represented in ways that allowed her to grasp the significance of the ideas for her own practice. She was able to signal how those concepts might be incorporated into the core dimensions of her practice.

Principal's Support

It is in the personal arena of enactment where the teachers made mostly private sense of, and put into practice, their individualised ideas of the reform. But a teacher's effort to enact reforms is a distributed activity and has an important social dimension (McClain & Cobb, 2004). A very plausible explanation for the differential levels of engagement lies in the support that they received at their respective schools. Principals who are respectful of the professional expertise and change intentions of the school's mathematics teaching community significantly influence how reform efforts are implemented (Millett & Johnson, 2004). Coburn (2005) has found that principals, through their greater access to policy messages, directly influence teachers' practice. Principals "receive directives and participate in networking events associated with reform efforts, learning about new materials, approaches, and ideas associated with changing policy" (Coburn, 2005, pp. 499-500). The central ideas are represented to them and, as a consequence, in their discussions with teachers and in the provisions they make for learning, principals emphasise certain aspects of curriculum while downplaying others, based on their own understandings.

Evidence from the interview data reveals that Cherie's principal had engaged with the new practices and understood them as signalling a change in the existing mathematics program at the school. However, like the district leaders in Spillane's (2000) study, his interpretation "tended to miss the full import of the reforms" (p. 141). Unlike many of the primary school principals involved in a study by Wood (2003), Cherie's principal did not report any tensions when trying to balance his individual teachers' needs for personal growth with his whole-school improvement priorities. His interest was focused on getting into something new and wanting to be a part of it, and, as a result, he implemented only piecemeal changes such as enabling the teachers to get to courses and failed to orchestrate the systems support that teachers at the school required.

Rowena's principal, on the other hand, had constructed an understanding of the reforms that "resonated with the 'spirit' of the mathematics reforms" (Spillane, 2000, p. 169) and had succeeded in putting in place support systems to help teachers to work in ways consistent with the intent of the NDP. The principal not only attended professional development and progress meetings with the numeracy facilitators and worked alongside teachers. He also kept fidelity to the policy makers' intent by representing their ideas accurately, by modelling dispositions, language and actions characteristic of the reform. Through this he was able to generate enthusiasm and enhance teachers' beliefs in their own capabilities.

School Support

Typically, school leaders are reluctant to involve themselves in mathematics reforms and tend to devolve their responsibility to lead mathematics teachers (Spillane, 2005). Pedagogical change at Rowena's school, however, became a collaborative problem-solving activity for the principal, classroom teachers, and lead teachers. In this process, the school leadership team functioned as a central engine of school development. The principal, working from a sound understanding of the policy intent, took an active role to ensure that the messages and technologies of the reform were taken up in collegial deliberations within the school.

Complementing the leadership taken by the principal, the lead mathematics teacher at Rowena's school, like the middle grade teacher in a study undertaken by McClain and Cobb (2004), was instrumental in conveying the policy intent to classroom teachers. In their "pivotal role as brokers between their own and the other communities, the [lead teachers] had at least partial access to the practices of both the professional teaching and the school leadership community" (McClain & Cobb, 2004, p. 285).

Yet despite the extensive support systems put in place in this low decile school, Rowena failed to adapt her classroom practices in a way that was consistent with the reformers' intent. In her interview she made frequent reference to 'following' the NDP. We would like to suggest that other factors may have come into play to prevent her from full engagement. One of those factors may have revolved around her level of content knowledge. The Numeracy Development Project Evaluation reports (e.g., Ward & Thomas, 2007) have noted that insufficient content knowledge prevents teachers from fully engaging with the reform. Another explanation for Rowena's changed practices may have been her lack of confidence with mathematics teaching, and her uncertainty about how the mathematics she was teaching, served as a baseline for more advanced classes. Yet another reason may have been associated with teaching mainly socially disadvantaged students, and working in an environment characterised by frequent turnover of students and sometimes low staff morale (see Gutierrez, 2004). Whilst Rowena's school principal was enthusiastic about the project, Rowena's long-term work of generating energy to sustain a practice with disenfranchised students, with whom she lacked shared life experiences, may well have contributed to her less-than-wholehearted inclination to implement the policy changes.

Personal and External Interactivity

Deliberations at Rowena's school were grounded in everyday efforts to help teachers improve practice in specific ways. Little (2003), Darling-Hammond and Bransford (2005), as well as Steinberg, Empson, and Carpenter (2004) have all provided convincing evidence that the presence of a 'knowledgeable' mathematics resource person in the classroom, charged with the task of observing, describing, and unpacking critical moments that the classroom

teacher overlooks, gives the teacher confidence to try out new ideas and new pedagogical approaches. Yet the extensive support provided by a more senior teacher, and ongoing deliberations with colleagues in Rowena's school, failed to move her beyond a superficial level of practice. In contrast to the teacher in the study by McClain and Cobb (2004), she did not draw on her colleagues for support as classroom resources. Conversations with peers that exemplified *a norm of collaboration and deliberation* (Spillane, 1999) did not enable her to grasp what the reforms meant for the core dimensions of her teaching. In marked contrast, the *norm of privacy* (Spillane, 1999) dominating classrooms at Cherie's school guaranteed that her enactment was highly individualistic. Her active agency, as well as her conceptual fit with the reform intentions, played a major part in her reform enactment. Accompanying that enactment, however, was a concern that the important ideas embodied within the project were not being fully harnessed.

While the analysis is striking, it is not so much about the diversity of interpretations of new policy by change agents such as principals and lead mathematics teachers, nor their differentiated approaches to systems level support for that policy. Rather, what stands out are two key concerns: one is the way provision made available by 'knowledgeable others' in the school — set in place to enable teachers to enact the intent of the reform — was differentially taken up by the two teachers; the other is the importance of the individual teacher's sensemaking of new policy within the context of others. While Rowena and Cherie were offered similar initial professional development, the two teachers constructed distinctly different notions about practice from their engagement in the program developed at the schools.

More conventional explanations of policy implementation might focus on either a systems approach to learning, as embodied in models of situated cognition, or they might direct their focus to the individual implementing agent, using ideas from theories of cognition. On the basis of our small investigation we would like to suggest that neither focus, by itself, may be able to grasp the full measure of policy implementation. Analyses that put cognitive structures (knowledge, beliefs, values, emotions, and attitudes) at the forefront, bring an oversimplified model of human cognition to the task of understanding policy implementation. Similarly, analyses that emphasise the social context of policy implementation tend to overlook the important part that an individual teacher's cognition plays in the policy sensemaking process.

Our account underscores the complexity experienced by two teachers in implementing new policy. Arguably, both the external and personal sectors of their zones of enactment are important in helping us understand their learning about practice but, by themselves, neither is able to account for why these two individual teachers did or did not revise core practice to meet the intent of policy makers.

Conclusion

It has long been recognised that school reform is not always implemented in ways that approximate reformers' intent. Numeracy reforms that seek to shift teachers' core practice demand from teachers a change in behaviour — a change to habitual ways of doing things. But they also demand a change in teachers' thinking and it is this personal cognitive aspect that we propose weighs heavily on how, and indeed, if, policy will be implemented. Taking account of teachers' sensemaking of new ideas, and their actions based on the ideas they construct, together with the human and material resources provided by the school, provides a different perspective to understanding policy implementation. Our approach provided a point of departure from the body of literature that focuses solely on the role of professional development in supporting teachers' reorganisation of their instructional practices and their views of themselves as learners. The approach stands in contrast, too, to that body of literature that is concerned in the main with the structural or organisational systems within schools. Our perspective contributes to an understanding of policy implementation by attending to the interplay of personal and external enactments of policy. For us, it is the co-dependence of these two lines of inquiry that is more usefully able to account for the enactments of teachers' reform practice.

Our integrated approach to teachers' response to reform looked at how personal resources and inclinations link with school-wide processes. The two teachers expressed a willingness to reform their instruction in ways that they understood to be consistent with the numeracy project. Whilst our data sources are limited to what teachers told us about their practice, there was no evidence to suggest that either of these teachers was resisting the reforms. We can glean from their self-reporting that both teachers undertook changes to practices but in making sense of the reforms, they demonstrated differential effects at meeting the reformers' intent. In unpacking their unique approaches to policy implementation we could not argue that either the personal or the external influences was more critical to reforming practice. On the basis of the data available to us, and our interpretation of that data, we suggest that neither influence is sufficient on its own to enable teachers to effect generative change.

Whilst in no way downplaying the importance of the professional school community in enhancing efforts at implementation, we would like to suggest that the school community cannot fully determine how individual teachers will construct ideas about practice. Teachers make sense of new policy in unique ways and it may well be the case that teachers in the same school, with the same support structures, demonstrate markedly different approaches to enacting new policy. Robust professional communities, embracing the directives and developing incentives and initiatives that help divert teachers' attention away from the force of tradition towards innovative practice, will not always be able to provide conclusive evidence about how the reform will enter into the minds of teachers. Instituting collaborative work amongst teachers will not necessarily guarantee that teachers will work in ways fully consistent with reformers' intents.

All mathematics reforms require a shift in thinking about practice. Historically New Zealand teachers have, in the main, shifted their thinking as they worked at implementing pedagogical reforms. However, reforms directives have usually signalled minor changes — those in relation to which content will be taught at which level. For example, in recent years statistical ideas have moved from the preserve of the secondary school to their introduction within primary school classes. The Numeracy Development Project, however, represents a much more wholesale change to teachers' practice and requires a major cognitive shift in thinking about mathematics teaching and learning. Our integrated approach is particularly useful in exploring implementation of such reforms. It allows us to investigate the interplay between teachers' personal response to the lure or threat of innovation and the press of the professional community on teachers to take up new ideas.

The potential value of our integrated analytic model is two-fold. First, the model can support teacher development by providing the means to enhance the school's efforts at sustaining professional development amongst individual teachers. By including the personal cognitive perspective the model draws attention to sensemaking of teachers that is or is not conducive to the transformation of teaching. Individual teacher's sensemaking of reform that does not sit comfortably with reformers' intent can easily be disguised within collaborative professional groups, even within those groups that show a commitment to improving practice. Change agents at the higher level in schools need to monitor teachers' understandings and classroom practice on an ongoing basis. Transformative educational change is an iterative process that is enhanced by the nurturing and support of the community of mathematics teachers. By focusing on people, tools and processes, we can begin to understand why some teachers, more than others, engage productively with reforms.

Second, the model provides policymakers and analysts with an additional tool to investigate the implementation process. It is designed to strengthen as well as complicate the large body of research that explains how policy is taken up in schools and classrooms. The approach unsettles claims about the important contribution that professional school communities make to individual teachers' instructional change and it does this by showing that whilst strong professional communities open up opportunities for teacher learning about reformed practice, the effectiveness of the opportunities on offer is profoundly influenced by the sense that individual teachers make of the reform. The impulse to heed the spirit of the reform is in no small measure an issue about resolving conflicts between the press to take up the new practice and the force of tradition in everyday workplace practice. If we are to understand more fully the way in which policy is implemented then we need to understand how reforms are understood by individuals working within professional communities.

References

Anthony, G., & Walshaw, M. (2007). *Effective pedagogy in mathematics/p_ngarau: Best evidence synthesis iteration* [BES]. Wellington: Learning Media.

Australian Association of Mathematics Teachers (AAMT). (2002). *Standards for excellence in teaching mathematics in Australian schools*. Adelaide: AAMT.

Bobis, J. (2004). Time, resources, information overload and classroom management: Issues surrounding professional development. In I. Putt, R. Faragher & M. McLean (Eds.), *Mathematics education for the third millennium: Towards 2010* (Proceedings of the 27th annual conference of the Mathematics Education Research Group of Australasia, Vol. 1, pp. 103-110). Sydney: MERGA.

Brown, J., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Cobb, P., McClain, K., de Silva Lamberg, T., & Dean, C. (2003). Situating teachers' instructional practices in the institutional setting of the school and district. *Educational Researcher, 32*(6), 13-24.

Coburn, C. (2001). Collective sensemaking about reading: How teachers mediate reading policy in their professional communities. *Educational Evaluation and Policy Analysis, 23*(2), 145-170.

Coburn, C. (2005). Shaping teacher sensemaking: School leaders and enactment of reading policy. *Educational Policy, 19*(2), 476-509.

Cohen, D. K., & Ball, D. L. (1990). Relations between policy and practice: A commentary. *Educational Evaluation and Policy Analysis, 12*(3), 249-256.

Cuban, L. (1988). *The managerial imperative and the practice of leadership in schools*. Albany: State University of New York Press.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world*. San Francisco, CA: Jossey-Bass.

Department for Education and Employment (DfEE). (1999). *The National Numeracy Strategy: Framework for teaching mathematics from reception to Year 6.* London: Department for Education and Employment.

Doerr, H., & Lesh, R. (2002). A modelling perspective on teacher development. In R. Lesh & H. Doerr (Eds.), *Beyond constructivism: A model and modelling perspective in mathematics teaching, learning and problem solving* (pp. 125-139). Mahwah, NJ: Lawrence Erlbaum Associates.

Fullan, M. (1991). *The new meaning of educational change*. New York: Teachers College Press.

Gutierrez, R. (2004). The complex nature of practice for urban (mathematics) teachers. Paper presented at the Rockefeller Foundation Conference, *Investigating the practice of school improvement: Theory, methodology, and relevance*, Bellagio, Italy.

Higgins, J., Irwin, K., Thomas, G., Trinick, T., & Young-Loveridge, J. (2005). *Findings from the New Zealand Numeracy Development Project 2004*. Wellington: Ministry of Education.

Higgins, J., Sherley, B., & Tait-McCutcheon, S. (2007). Leading a curriculum reform from inside a school. In F. Ell, N. Hawera, J. Higgins, K. Irwin, A. Tagg, G. Thomas, T. Trinick, J. Ward, & J. Young-Loveridge (Eds.), *Findings from the New Zealand Numeracy Development Projects 2006* (pp. 99-108). Wellington: Learning Media.

Hill, H. C. (2001). Policy is not enough: Language and the interpretation of state standards. *American Educational Research Journal, 38*(2), 289-318.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Lin, A. (2000). *Reform in the making: The implementation of social policy in prison*. Princeton, NJ: Princeton University Press.

Little, J. (2003). Inside teacher community: Representations of classroom practice. *Teachers College Record, 105*(6), 913-945.

McClain, K., & Cobb, P. (2004). The critical role of institutional context in teacher development. In M. Hoines & A. Fuglestad (Eds.), *Proceedings of the 28th conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 281-288). Bergen: PME.

McLaughlin, M. W. (1987). Learning from experience: Lessons from policy implementation. *Educational Evaluation and Policy Analysis, 9*, 171-178.

Millett, A., Brown, M., & Askew, M. (Eds.). (2004). *Primary mathematics and the developing professional*. Dordrecht: Kluwer.

Millett, A., & Johnson, D. (2004). The role of the mathematics co-ordinator. In A. Millett, M. Brown, & M. Askew (Eds.), *Primary mathematics and the developing professional* (pp. 19-54). Dordrecht: Kluwer.

Ministry of Education. (2001). *Curriculum update: The numeracy story No. 45*. Wellington: Learning Media.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

O'Toole, L. J. (1986). Policy recommendations for multi-actor implementation: An assessment of the field. *Journal of Public Policy, 6*, 181-210.

Porter, A., Floden, R., Freeman, D., Schmidt, W., & Schwille, J. (1988). Content determinants in elementary school mathematics teaching. In D. A. Grouws, T. J. Cooney, & D. Jones (Eds.), *Effective mathematics teaching* (pp. 96-113). Reston, VA: NCTM.

Resnick, L. (1991). Shared cognition: Thinking as social practice. In L. Resnick, J. Levine, & S. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 1-20). Washington, DC: American Psychological Association.

Shulman, L., & Shulman, J. (2004). How and what teachers learn: A shifting perspective. *Journal of Curriculum Studies, 36*(2), 257-271.

Skemp, R. (1986). *The psychology of learning mathematics* (2nd ed.). London: Penguin Books.

Spillane, J. P. (1999). External reform initiatives and teachers' efforts to reconstruct their practice: The mediating role of teachers' zones of enactment. *Journal of Curriculum Studies, 31*(2), 143-175.

Spillane, J. P. (2000). Cognition and policy implementation: District policymakers and the reform of mathematics education. *Cognition and Instruction, 18*(2), 141-179.

Spillane, J. P. (2005). Primary school leadership practice: How the subject matters. *School Leadership and Management, 25*(4), 383-397.

Spillane, J. P., & Jennings, N. E. (1997). Aligned instructional policy and ambitious pedagogy: Exploring instructional reform from the classroom perspective. *Teachers College Record, 98*(3), 449-481.

Spillane, J. P., Reiser, B. J., & Reimer, T. (2002). Policy implementation and cognition: Reframing and refocusing implementation research. *Review of Educational Research, 72*(3), 387-431.

Steinberg, R. M., Empson, S. B., & Carpenter, T. P. (2004). Inquiry into children's mathematical thinking as a means to teacher change. *Journal of Mathematics Teacher Education, 7*, 237-267.

Ward, J., & Thomas, G. (2007). What do teachers know about fractions? In F. Ell, N. Hawera, J. Higgins, K. Irwin, A. Tagg, G. Thomas, T. Trinick, J. Ward, & J. Young-Loveridge (Eds.), *Findings from the New Zealand Numeracy Development Projects* 2006 (pp.128-138). Wellington: Learning Media.

Ward, J., Thomas, G., & Tagg, A. (2007). Numeracy sustainability: Current initiatives and future professional development needs. In F. Ell, N. Hawera, J. Higgins, K. Irwin, A. Tagg, G. Thomas, T. Trinick, J. Ward, & J. Young-Loveridge (Eds.), *Findings from the New Zealand Numeracy Development Projects 2006* (pp. 87-98). Wellington: Learning Media.

Weiss, J. A. (1989). The powers of problem definition: The case of government paperwork. P*olicy Sciences, 22*, 97-121.

Wood, J. (2003). *Professional development in mathematics for primary teachers*. Unpublished master's thesis, Massey University.

Yanow, D. (1996). *How does a policy mean? Interpreting policy and organisational actions*. Washington, DC: Georgetown University Press.

Young-Loveridge, J. (2006). Patterns of performance and progress on the Numeracy Development Project: Looking back from 2005. In F. Ell, J. Higgins, K. Irwin, G. Thomas, T. Trinick, & J. Young-Loveridge (Eds.), *Findings from the New Zealand Numeracy Development Projects 2005* (pp. 6-21). Wellington: Learning Media.

Corresponding Author

Margaret Walshaw, School of Curriculum and Pedagogy, Massey University, Palmerston North, New Zealand. Email: <M.A.Walshaw@massey.ac.nz>