The Numeracy Development Projects:  
a Successful Policy–Research–Practice Collaboration

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This paper reveals a policy–research–practice collaboration operating in the Numeracy Development Projects (NDP) that shows promise of making an important contribution to New Zealand’s schooling improvement work programme. A framework for analysing collaborations within schooling improvement initiatives is used to describe and explain the sorts of learning connections that are occurring between several groups involved in the NDP. Two tiers of collaboration are apparent: strategic collaboration among policy developers, researchers, developers, publishers, and school leaders to design and evaluate the NDP; and operational collaboration among facilitators and practitioners to implement the NDP in classrooms. An important outcome of the two-tiered collaboration is practitioners buying into the use of a set of inquiry practices that check what students know and think at the beginning and end of teaching cycles. Advantages of the approach as a lever for schooling improvement centre on role clarity and what is known about effective partnerships. Cautionary comment is also provided about the slow pace of developing policy–research–practice collaborations of this nature. The development of collegial accountability is offered as a useful trade-off for a long-term sustainable solution. Concluding remarks bring together an argument woven into the entire paper that a stronger evidence base of student achievement information will help ensure that collegial accountability is as critically challenging as it needs to be to help solve the underachievement problem among New Zealand’s disadvantaged students.

Introduction

A recent study found that the Numeracy Development Projects (NDP) are showing promise as an effective schooling improvement initiative (Annan, 2006). A schooling improvement initiative is defined in that study as a planned intervention designed to raise overall academic achievement of targeted students. That definition, derived from Gray, Hopkins, Reynolds, Wilcox, Farrell, & Jesson (1999), treats raising academic achievement as the primary purpose of schooling improvement. A priority group of students in New Zealand targeted for involvement in schooling improvement are those underperforming within economically disadvantaged communities, many of whom are Māori (New Zealand’s indigenous people) and Pasifika in origin (Alton-Lee, 2005). Interventions that tend to get labelled “schooling improvement initiatives” in New Zealand are typically those developed by small groups of schools working together in geographic clusters with local officials to solve common problems. One senior Ministry official likened the approach to helping schools customise their own solutions locally in much the same way that cottage industries operate (L. Whitney, personal communication, November 28, 2001). Since the mid-1990s, the schooling improvement division of the Ministry of Education has worked towards sponsoring about 20 cottage industry-style initiatives at any one time, involving approximately 10% of schools in New Zealand (Ministry of Education, 2007; Sinclair, 1999).

In recent years, the notion of schooling improvement has broadened to include a more diverse range of interventions. For instance, some national professional development strategies, including the NDP and the Literacy Professional Development Programme, are getting involved in this important work (Annan, 2006). So there is more of a national–local feel to schooling improvement. The important point here is that a combined national and local effort is more likely to impact positively on the disadvantaged student population than localised efforts alone. To take that point a little further, it
would promote the creation of a comprehensive solution for the underachievement problem among disadvantaged students if national strategies containing an element of schooling improvement in them become recognised as having dual functions. For instance, the primary function of the NDP is to provide professional development for all teachers in order to raise student achievement in mathematics (Loveridge, 2003), initially through improving teachers’ thinking about and understanding of number. The secondary function, how the NDP can impact more profoundly on disadvantaged students’ mathematical thinking, has come to the fore in recent years as the NDP have evolved (Irwin & Irwin, 2005).

The extent to which the local and national strategies can claim themselves to be effective in terms of schooling improvement depends on the evidence they develop to show that they have successfully impacted on disadvantaged students’ academic achievements. A robust way to develop strong evidence in this regard is to produce outcomes-focused studies that have three characteristics (Annan, 2006). The first characteristic is the calculation of positive and statistically significant gains in student achievement, the second characteristic is large sample sizes, and the third is replicating the findings in ten or more settings (five of which need to be comparison or third-party studies). Those three characteristics, which were found in meta-analysis methodology for schooling improvement overseas (Borman, Hewes, Overman, & Brown, 2003), provide a high degree of confidence in making claims of success about any given initiative.

The NDP are well placed to produce strong evidence of effectiveness for their schooling improvement function. They already have a well-established and accepted system for gathering and analysing achievement information. Diagnostic survey information from the Numeracy Project Assessment tool (NumPA) is already routinely collected, analysed, and used by teachers, school leaders, and national leaders to adjust lessons, school systems, and NDP developments. There is no reason why the existing achievement management system could not broaden to develop the sort of evidence that was outlined in the previous paragraph. That would simply require agreement to triangulate the diagnostic information with norm-referenced tools such as Assessment Tools for Teaching and Learning (aSTTle) and Progress and Achievement Tests. The NDP trialled this approach in 2004 with a group of 16 schools serving one community, Manurewa, which has a disproportionate number of disadvantaged students. Initial results of the trial indicate that those schools appear to be achieving better results than similar schools elsewhere in the country (Young-Loveridge, 2005). It may be that a greater intensity of analysis surrounding the triangulation exercise in those schools could account for some of the success in that district.

Interesting as the development of strong evidence of the effectiveness of New Zealand’s schooling improvement movement is, this article is not about that. It is sufficient to state that the NDP is well placed to develop such evidence. This paper centres on an aspect of the NDP that is another important priority for schooling improvement endeavour in New Zealand: the learning system that has been developed so that participants in the NDP learn and use effective reform practices. An analysis of the learning system attached to the NDP reveals some interesting development and implementation characteristics that participants in the NDP may find interesting for making their learning system explicit and for reflecting on its effectiveness. The characteristics may also be of interest to project leaders of other initiatives who may be reflecting on how to help participants learn what and how to do things successfully.

Fundamental to the NDP’s learning system is the existence of a policy–research–practice collaboration. That means policy developers, researchers, developers, and lead practitioners work together in a non-hierarchical manner to design, implement, and evaluate the NDP. The remainder of this paper expands on this form of collaboration in three parts. The first part describes the methodology for
analysing the collaboration in the NDP, the second part describes the collaboration, and the third part highlights some of its strengths and limitations as a tool for advancing schooling improvement in New Zealand.

**Method of Analysis**

A conceptual framework developed by Stein and Coburn (2005) to explain research–practice collaborations was adapted to analyse the NDP (Figure 1). The framework is best read by following the three trajectories from the bottom to the top. The research and development community, the policy community, and the practice community are placed alongside one another with semi-autonomous trajectories. Each trajectory begins with past understandings and practices that feed into the present improvement tasks and ends with changes being made to the original understandings and practices. They are only semi-autonomous because there is interaction between the three trajectories that cause them to learn from one another.

The ovals in the middle section of the diagram represent five working spaces in which learning can occur among those involved in schooling improvement initiatives. The first space is the school community. It is the first space because that is the space where the students learn, and what happens for them is of utmost importance. The second and third spaces are allocated to the research and development community and the policy community respectively. The fourth space is a space in which policy developers, researchers/developers, and lead practitioners collaborate to develop strategic aspects of the reforms. The positioning of the policy community below the other two groups reflects an explicit policy intention in New Zealand to promote leadership of school improvement initiatives within the research, development, and practice communities but not within the policy community (Ministry of Education, 2003). The preference is for policy to influence practitioners as an underlying support mechanism rather than to direct them through rule-governed policies from above.

The fifth space is a research–practice collaboration whereby the research and development community interacts with the practice community. Fifth space research–practice collaborations break the mould of handover encounters whereby practitioners are the recipients of researchers’ findings and are left to work things out for themselves (Stein & Coburn, 2005). Instead, practitioners are reform co-constructors alongside researchers and/or developers. Initial connections between the two groups tend to help practitioners make sense of knowledge transfers to the point that they can make a start. Ongoing interactions help them acquire a deeper knowledge and sort out implementation problems as they arise. Similarly, ongoing connections help researchers understand practitioners’ successes and difficulties in trying to make changes in their classrooms. Researchers/developers are, in turn, challenged to help the practitioners deal with the difficulties and achieve further successes. Therefore, critical to the formation and development of this particular sort of collaboration is the “regular, ongoing and practicable” connections between researchers/developers and practitioners (Stein & Coburn, 2005, p. 8).
Figure 1: A framework for analysing policy–research–practice collaborations (Annan, 2006)
A Description of the Policy–Research–Practice Collaboration

The policy–research–practice collaboration attached to the NDP is presented in the diagram in Figure 2. The diagram is best read from bottom to top through the trajectories of the three groups listed at the bottom of Figure 2. The main participants fell into three main groups: the facilitators on the left, the collaboration of policy developers, researchers, resource developers, and publishers in the middle, and the teachers on the right. Information about the various groups and about the nature of their interactions with one another is organised into past, present, and future phases. In boxes at the bottom of the diagram is a description of their pre-intervention development needs from the past. In the middle of the diagram, there are a series of ovals that show the nature of the learning connections among various groups. Spaces 1, 2, and 3 represent the three groups and the set of reform practices that they used in the learning process. Spaces 4 and 5 represent the collaborations between the three groups to achieve the post-intervention understandings in the three future-focused boxes at the top of Figure 2.

Pre-intervention development needs

A key researcher contracted to inform the development and implementation of the NDP claimed that all three groups came into the NDP with specific development needs (Higgins, 2001). Facilitators tended to bring with them a tradition of putting teachers through generic professional development programmes at particular stages of their careers. They needed to shift the locus of control from themselves to the teachers so that the teachers developed an interest in understanding theories and practices in teaching number (Hughes & Peterson, 2003). The argument was that because most teachers had not been interested in theory-practice relationships, they had become stuck on written algorithms as the only way to teach students how to solve number problems. A major problem with that situation was that it was restricting the students’ thinking about appropriate strategies for solving mathematical problems. One teacher’s reflections on the over-reliance on algorithms showed how students’ understanding about number was being ignored at the expense of efficient methods: “If they [the students] are going to do it the algorithm way, a lot of what we teach them is just a method and so they do not necessarily have a great understanding” (Higgins, 2001, p. 39). Alongside those two groups, the policy, research, resource, and publication communities tended to work separately in their own communities, typically called “silos” in New Zealand (Higgins, Parsons, & Hyland, 2002). Those developmental needs made it somewhat inevitable that the NDP were going to evolve as the three groups learnt from one another.
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Figure 2: The policy–research–practice collaboration in the NDP

- **FUTURE**
  - Context-specific guidance of lesson content and pedagogy
  - Aligned development of numeracy policies, resources, publications, and research
  - Strong content knowledge and pedagogy in number

- **PRESENT**
  - **2nd Space**
    - Facilitators learned to:
      - model classroom instruction
      - explain mathematical concepts
      - guide teachers to use appropriate content knowledge, pedagogy, and resources
  - **3rd Space**
    - Policy developers, researchers, resource developers, and publishers co-constructed the design, development, and evaluation of the NDP with support from the international research community
  - **4th Space**
    - Policy developers, researchers, resource developers, publishers, facilitators, and lead practitioners:
      - agreed on domain knowledge, i.e., content knowledge and pedagogy in number (numeracy teaching model)
      - developed a Number Framework, diagnostic survey tools, and lesson guidelines
  - **5th Space**
    - Facilitators and teachers:
      - modelled and observed each other conducting knowledge and strategy lessons
      - talked, thought about, and used resource booklets and other resources to match lesson content and pedagogy to students’ number knowledge and strategies

- **PAST**
  - Delivered generic professional development programmes
  - Silo development of numeracy policies, resources, publications and research
  - Written algorithms the preferred way to solve number problems

Facilitators
- Policy developers, researchers, resource developers, and publishers
- Teachers
Fourth-space collaboration

The fourth-space collaboration was where important overarching reform decisions were made. An analysis of the acknowledgments in several key publications found that the membership was made up of many different communities (Ministry of Education, 2004a, 2004b, 2004c). They included representatives from the policy, research, resource publication, and international academic communities. The communities within New Zealand that became involved had some expertise to contribute to the design and development of the NDP. They also had a vested interest in seeing the NDP help improve New Zealand’s mathematics ratings against other OECD countries. For instance, success mattered for the policy developers in terms of government making credible investments just as much as it mattered to the companies publishing the teaching resources in terms of their market credibility with schools (Higgins & Parsons, 2005; Higgins, Parsons, & Hyland, 2002).

The design and development team did not stop at collaboration between interested parties in New Zealand. That core team also developed learning connections with representatives of mathematics communities in England, the Netherlands, Australia, and the United States to help them along the way (Ministry of Education, 2004a, 2004b, 2004c). These extended connections meant that a multitude of communities were contributing to the design and development of the NDP. It was a complex arrangement in that some participants stayed in their own communities while others moved from one community to another. It was as if some could add greater value by staying in one space whereas others were of more value moving from one space to another. For instance, Dr Joanna Higgins from Victoria University of Wellington College of Education stayed in the research community to critique and inform the publications, processes, and outcomes (Higgins, 2001, 2002; Higgins, Bonne, & Fraser, 2004; Higgins, Irwin, Thomas, Trinick, & Young-Loveridge, 2005; Higgins & Parsons, 2005). At the same time, developers such as Peter Hughes from The University of Auckland seemed to move among various activities. He made important content contributions to the Number Framework, the diagnostic interview tools, and the resource booklets (Ministry of Education, 2004a, 2004b, 2004c). He also produced important background information for the professional development programme and helped train the facilitators.

Meanwhile two officials from the Ministry attached to the NDP worked to make sure that the various activities in the fourth and fifth space collaborations had a common and consistent policy foundation. Four foundation policy principles were outlined in a conference paper written by one of the researchers and one of the officials involved in the project (Higgins & Parsons, 2005). The writers were reflecting on the way the leaders of the NDP had gone about transferring ownership of the project from the centre to practitioners. The first three principles focus on pedagogy and teacher learning, while the fourth one centres on systemic connectivity. The principles are: (i) increasing the sophistication of mathematical ideas and teaching and learning strategies among teachers and students; (ii) ensuring that teaching decisions are informed by evidence of students’ thinking; (iii) constructing teacher knowledge in their own context of practice; and (iv) adhering to a “participatory dynamic that arises from the collective agency of a complex network of overlapping groups participating in the project” (Higgins & Parsons, 2005, p. 6).

It is that latter principle that underpins the fluid movement and interactions among the participants in the strategic fourth-space collaboration operating in the NDP. Higgins and Parsons (2005) expand on the nature of the network:

The key mechanism for the development of the collaborative process is a network of nationally coordinated groups that include a range of expertise drawn from the mathematics education community. Some of them have been established for specific purposes, that is, they are “fit for purpose”, and their brief has been to address specific policy formulation, implementation or evaluation/research issues involving the schemas and resources of the project. Other groups are
ongoing and their primary focus is aspects of the evolving design of the project. For example, the development and refinement of the explanatory conceptual framework, the diagnostic interview and the teaching model have occurred over the course of the project, incorporating new research and feedback from teachers and facilitators. (Higgins & Parsons, 2005, p. 8)

Further explanation in those conference proceedings of the network and an attached appendix explaining the make-up and purpose of the various groups (Higgins & Parsons, 2005, p. 12 of Appendix A) did not indicate that fluid movement within the network was consciously planned so that some members operated across various communities and others stayed in one. Higgins and Parsons (2005) appeared to be writing about the phenomenon after the fact. The extent to which fluidity within networks such as this one can be planned rather than just letting learning connections evolve is worthy of further investigation. It may be that planning for fluidity constrains participants’ spontaneous urges to connect at the moment when they most need help to solve a presenting problem. On the other hand, it may make explicit the value of fluid movement within networks and encourage more learning connections to occur.

Among the numerous design and development decisions that the members of the fourth-space community of practice made, two were particularly important if the practitioners were to learn effective reform practices. One was deciding on the priority domain knowledge that needed to be spread among practitioners. They agreed that it should be content knowledge and pedagogical knowledge (Higgins, 2001). The second was to develop a framework, a set of standardised practices, and a set of tools to help the learning process in the fifth-space collaboration and, more importantly, to help practitioners work more effectively in their classrooms (Ministry of Education, 2004a, 2004b, 2004c). They were important decisions above others because they created a sharply-focused intervention as opposed to a general one. They also ensured that practitioners had supports for planning, implementing, and evaluating their instructional effort (National senior advisor for numeracy, New Zealand Policy Developers’ Feedback, 2005). Those supports included the use of common assessment tools across the schools and the storage of aggregated achievement information (from the diagnostic surveys) in electronic databases in consistent ways for analysis and reporting purposes.

Attempting to achieve consistency in assessment procedures across schools was a bold move made by the design and development team. They were encouraging schools to relinquish their own assessment tools in favour of common ones, which could have been interpreted as an attempt to set up unhelpful external accountabilities. Feedback from one policy developer attached to the NDP indicated that, apart from a little dissent among some principals from intermediate schools about that agenda in relation to year 8 and 9 results, opposition did not happen (national senior advisor for numeracy, New Zealand Policy Developers’ Feedback, 2005). A probable reason for the minimal dissent was because the assessment tools are diagnostic in nature, with the explicit purpose of helping teachers better understand the students’ numerical thinking (Ministry of Education, 2004b). With that purpose being the primary driver of the initiative, teachers seemed to feel comfortable with NDP leaders external to their schools aggregating the diagnostic information and reporting effect-size gains for students’ positive movements through the Number Framework stages. This situation reinforces the centrality of formative assessment as a lever for improvement in the minds of New Zealand educators.

**Fifth-space collaboration**

Those involved in the fifth-space collaboration put into action the strategic decisions made by the leaders of the NDP in the fourth space. Membership of the fifth space was more straightforward than the fourth space in that it involved learning connections between professional development facilitators and teachers. The facilitators had to move on from their generic traditions and work with teachers on context-specific problem solving to change their thinking. Of particular importance was
the need to support teachers to be more considerate of options beyond written algorithms to solve mathematical problems. Learning connections to do so centred on observing, modelling, talking, and thinking about the content and pedagogy used in mathematics lessons (Ministry of Education, 2004b). The approach relates to the third policy principle mentioned in the previous section, that is, constructing teacher knowledge in their own context of practice (Higgins & Parsons, 2005). Hence the connections occurred in and around classrooms. There was no one specific learning place, such as the staffroom or an off-site professional development seminar room, where practitioner learning is often assumed to be occurring. It was more a process of learning on the job.

Feedback from one policy developer attached to the NDP stated that the process was challenging, particularly at the outset of the professional development programme (national senior advisor for numeracy, New Zealand Policy Developers’ Feedback, 2005). The facilitators had to confront teachers’ prior beliefs and practices that were not consistent with the principles underpinning the Number Framework and diagnostic interview. Those principles centred on embedding into the minds of teachers four standard teaching practices that they should use back in their classrooms once they left the fifth space:

(i) using a diagnostic survey to find out what the students know and what strategies they use to solve number problems;
(ii) designing lessons that will address students’ knowledge gaps and increase their repertoire of problem-solving strategies;
(iii) teaching the lessons in such a way that the teachers’ and students’ thinking is made explicit;
(iv) checking that the lessons did what they were designed to do by using follow-up diagnostic surveys.

Researchers found that those practices successfully changed teachers’ thinking about the importance of growing understanding before teaching algorithms (Higgins, 2001; Higgins, Bonne, & Fraser, 2004). The change in thinking was well captured in teacher interviews conducted as part of evaluations for the initial trial of the NDP and once it was well underway. One quote, in particular, captures the shift in teachers’ thinking: “I think, for little kids, it’s probably really important not to introduce the algorithms until you’re sure they’ve really got it because it’s an easy way of working the answer out without actually understanding how the heck you got that answer” (Higgins, 2001). So the mind shift was more about understanding the process of solving problems than about inducting students into easy ways of producing the right response.

**Discussion**

A useful catchphrase for the four practices developed through the NDP is “developing evidence-informed collaborative inquiry”. This catchphrase is the title of a book chapter that explains the four practices and the theory underpinning them in several other schooling improvement initiatives (Timperley, Annan, & Robinson, in press). The four practices are intentionally sequenced in such a way that a problem analysis is at the forefront of any inquiry to improve teaching and learning. Additionally, the sequencing ensures that an outcomes-focused evaluation concludes such inquiries. That sequencing is essential to get away from a popular New Zealand cultural norm of just getting on with the job, regardless of the outcome (Annan, 2006). That norm is typically referred to as the “No. 8 wire approach” (Hopkins & Riley, 1998). Number 8 wire is a common type of fencing wire used in New Zealand to fix things around the house or farm. A less than desirable outcome is beside the point. At least the problem is dealt with and further tinkering can be done if necessary. This garden-shed approach may be a cost-effective way of handling many everyday problems in a small isolated
country with limited funding. However, it lacks the sophistication required to solve priority national educational problems such as helping a large number of mostly disadvantaged students who are unable to solve number problems and read at the level required to become successful (OECD, 2001). A more sophisticated scientific approach is better suited to solve those sorts of complex problems. Hence the sequencing of the four practices so that regular checks on student achievement trends are completed as a matter of course.

An advantage of evidence-informed collaborative inquiry is creating role clarity among groups partnering to do schooling improvement work. Partnerships often languish because they concentrate more on developing relationships in the name of collaboration than on allowing roles and relationships to evolve out of a priority task (Timperley & Robinson, 2002). In the NDP, relationships formed around the priority task of improving practitioners’ and students’ thinking about and understanding of number and how to use that understanding to solve number problems. Through an evolutionary development process, the various partners worked out their places in designing, implementing, and evaluating the initiative (Higgins & Parsons, 2005). The NDP ended up with two tiers of collaboration: a strategic tier that involved policy developers, researchers, developers, publishers, and lead practitioners taking responsibility to lead the design and evaluation of the NDP and a more practical tier involved facilitators and the practitioners implementing the NDP in classrooms.

Distributed responsibility and accountability of the nature established across the various groups involved in the NDP fits with a useful definition of partnership for schooling improvement put forward by Timperley and Robinson (2002): “We propose that entities are in partnership when they each accept some responsibility for a problem, issue or task and establish processes for accomplishing the task that promote learning, mutual accountability and shared power over relevant decisions” (p 15). What is really heartening about the partnerships formed through the NDP is that they have touched almost every teacher and student in the country (Higgins, Parsons, & Hyland, 2002). That is not to say that localised endeavours are not worthwhile. To the contrary, localised efforts often capture important context elements that national strategies can easily overlook (Kliebard, 2002). In this regard, the work that the NDP did with the local leaders in the Manurewa district to roll out the professional development and to triangulate their successes offers a way of getting the best of both worlds. That national–local collaboration shows how a local infrastructure can help contextualise a national solution.

A caveat for the way evidence-informed inquiry is developing through New Zealand’s various schooling improvement efforts is that an evolutionary process for working things out through partnerships without too much rule-governed supervision is a slow process. It has taken the best part of a decade to prioritise the inquiry practices outlined in this paper. The process of spreading them among all those that need to use them across the curriculum is largely work yet to do. What that long game means is that the NDP has done a good job of spreading them in numeracy and the Literacy Professional Development Project, coupled with numerous cottage industry initiatives, is starting to get a good spread in literacy. However, there is no guarantee that all practitioners will continue to use them as designed or will transfer them to other areas of the curriculum. In other words, programme integrity is discretionary (Annan, 2006). So even if the practices are spread more widely, practitioners can choose to go back to personally preferred but less effective practices. This is where collegial accountability is so important for the long-game approach to schooling improvement to be successful. It is imperative that practitioners check on each other for slippage from the effective practices established through an initiative.
Conclusions

Policy-research-practice collaboration in the NDP is successfully spreading evidence-informed inquiry practices that have proven to be central to effective schooling improvement. Promoting those practices is helping create the sort of critically challenging schooling culture necessary to solve complex underachievement problems. Accelerating a school culture change of this nature is a fairly urgent and important policy challenge if the underachievement problems are to be solved in the foreseeable future. One accelerator proposed in this paper is to help practitioners hold themselves and each other to account for the way they are performing in their various roles. Developing collegial accountability over external accountability helps situate the ownership of the problems among those most closely associated with having to solve them, that is, those working in and around classrooms. Important context-specific assessment work is under way in the NDP that will support practitioners to hold each other to account. Important triangulation exercises are underway to check the NUMPA results with norm-referenced evaluation tools such as asTTle. Replication of those exercises for all schools will help practitioners to analyse, critique, and challenge the effectiveness of their own, each other’s, and, most importantly, the students’ practice.

References


