

Policy and practice in New Zealand primary mathematics: Listening to two teachers' stories about the impact of education policy on their classroom programmes

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Abstract

This study explores how the stories of two teachers' classroom practice intersect with current policies relating to primary mathematics education in New Zealand. It is identified through this study that fully enacting policy in mathematics holds challenges for the participant teachers, particularly owing to the incoherence of policies relating to teaching mathematics. Teacher desire to do the best for their students is revealed as the teachers explain how they grapple with and creatively problem solve the confusing directives they receive.

Concerns about the quality of mathematics education in New Zealand have been an education focus of every government for the past 25 years (Openshaw & Walshaw, 2010, 2011). Primary teachers and their ways of teaching mathematics have borne the brunt of official criticism. They have also been the focus of extensive professional development in the hope that changing teacher practice will result in improving student outcomes in mathematics (Hattie, 2009; Thrupp & Easter, 2012; Young-Loveridge, 2010). Between 2001 and 2011, New Zealand primary mathematics education saw many significant policy directives from the Ministry of Education. The Numeracy Development Projects (the NDP) (Ministry of Education, 2001), *The New Zealand Curriculum (NZC)* (Ministry of Education, 2007a) and the *Mathematics Standards for Years 1–8* (Ministry of Education, 2009) are all education policies intended to impact and change the teaching of primary mathematics in New Zealand classrooms.

The focus of this study is to hear “teacher voice” about the impact of these policies on their teaching of mathematics. The aim is to listen to

how two teachers understand and experience these policy directives, and to hear how these teachers have consolidated the directives in their respective classroom programmes. Exploration into the experiences of these two teachers provides insight into the way that policy is received and processed into classroom practice.

Methodology

This is a study about how two teachers' stories intersect with the wider patterns of society as framed by education policy. The assumption underpinning this study is that the story of how an individual primary teacher understands what happens in his or her mathematics classroom can be triangulated with an analysis of policies relating to primary mathematics, and where the two intersect, a greater insight into the impact of policy on classroom practice may be gained.

There is also an assumption in this study that education policy is a product of the political context within which it is created. Education policy does not stand alone, but is part of a greater historical narrative. Therefore, an important consideration for the policy analysis is not only to read the policies and extrapolate their implications for teaching, but to also situate each policy in its historical context. This contextualisation supports the following analysis of policy impact on teacher experiences and teaching practice.

This research uses a case-study approach. A basic descriptive qualitative methodology is used to collect and analyse data with the aim of describing the lived experience of the participants (Denscombe, 2007; Stake, 1995). The purpose of this methodology is to make clear how personal experience is translated into socially validated knowledge. The steps taken in this study aimed to make this transformation transparent to both the participants in the study and the audience of the study.

Each participant was interviewed. This interview was audio recorded. The participants were invited to describe their respective professional-development experiences in mathematics over the last 10 years, and to offer explanations for their current practices in mathematics. Each participant teacher was then observed teaching mathematics. The lesson was video

recorded for a shared analysis of the observation. The participants then viewed their own lesson with the researcher and discussed the practices observed in the lesson in relation to their previous interview answers. This discussion was also audio recorded. The second discussion was used as an opportunity for the participant teachers to review, change or clarify their answers to the interview questions.

Participants and their schools have had their identities protected by the changing of their names. In this study the teachers have been given the pseudonyms of Jane and Rachel, and the schools have been renamed Green Hill School and Pohutukawa School.

Policy analysis

The policies that are directly pertinent to current primary mathematics teaching in English-medium classrooms in New Zealand are *NZC*, the *NDP*, and *Mathematics Standards for Years 1–8* (Ministry of Education, 2009). In this section, each of these policies is analysed focusing on three elements: how each policy came about, what the expectations of teachers are from each particular policy, and what critiques or concerns have been raised about the policy in practice.

The New Zealand curriculum

In 1993 the *New Zealand Curriculum Framework* (Ministry of Education, 1993a) was launched, and the mathematics curriculum statement (Ministry of Education, 1993b) was published in the same year. Many in the education sector complained that the curriculum statements, with so many strands and achievement objectives over seven essential learning areas, were too cluttered for teachers to really do justice to in their classroom programmes. The concern was that the curriculum as it stood was too cumbersome for the realities of school and classroom practice and therefore ended up being too shallow when implemented (Barker, 2008).

Between 2000 and 2002 a review of the curriculum was undertaken, resulting in the *Curriculum Stocktake Report* (Ministry of Education, 2002). In 2007 the Ministry of Education launched *NZC*.

The following statement from the Ministry of Education *Annual Report* (Ministry of Education, 2007b) exemplifies the thinking behind NZC:

The shift to a knowledge-based society is impacting on the way we think, learn and live. We are moving rapidly away from last century's hierarchical, industrialised way of living to a place that is comfortable with rapid change, views technology as empowering and enabling, connects globally and values knowledge. (p. 8)

For teachers, the NZC offers a teaching as inquiry model (Ministry of Education, 2007a, p. 34) to structure the inevitable exploration of new territory that comes with creating learning programmes that are meaningfully responsive to student learning needs. Teaching as inquiry is a cycle, as evaluation of progress leads into the next inquiry. The expectation here is that teachers will design and measure their teaching programmes in direct response to student assessment data.

Concerns raised about the 2007 New Zealand curriculum document included questions about how teachers will know what content to teach at each level and also questions about if the development of different curricula in each school might cause greater inequity of access to knowledge (Macfie, 2008, February 9–15).

The NDP

The NDP launched in 2001 and were initiated in response to growing perceptions that New Zealand students were underachieving in mathematics (Openshaw & Walshaw, 2010). The explicit focus of the NDP was on developing teacher capability. Here, the idea was that teachers who are better teachers of mathematics will produce better achievement outcomes in mathematics from students (Young-Loveridge, 2010). This notion was promoted in both the *Report of the Mathematics and Science Taskforce* (Ministry of Education, 1997) and *In Time for the Future* (Education Review Office, 2000). To this end, the NDP provided a variety of tools to support teacher practice, including a number framework, a teaching model, and an assessment tool (Ministry of Education, 2008).

The teaching model is central to the effectiveness of the method of the NDP, and is also its point of difference. The teaching model takes students through a process: materials, “imaging”, and then number properties. The key to the teaching model is the effective use of imaging. Imaging is where the learner is supported to hold a picture in their head of the materials used to depict a mathematical concept. This is a step towards the learner understanding procedural methods (Young-Loveridge, 2010).

In 2009, the first phase of the NDP was complete. Extensive research and monitoring was conducted throughout the 8 years of implementation to measure the effectiveness of the project. Jennifer Young-Loveridge was the principal researcher documenting the outcomes of the longitudinal study of the NDP. In her final report, Young-Loveridge (2010) explains that the NDP have made a considerable impact on the achievement of primary-aged students in mathematics. On the whole, student-achievement data suggested that students were making improvement. However, students were not making enough improvement yet for most to reach the standards expected in the later years at school. Also evident in data was the continued gap between the levels attained by students in low socioeconomic areas in contrast with the levels attained by students in high socio-economic areas.

By the end of the project in 2009, nearly 250,000 New Zealand students had their data included in the NDP analysis. Most schools had been through the professional development that supported the NDP and all teachers who had come through preservice training since 2002 had been explicitly trained in the NDP model (Young-Loveridge, 2010). Data from the NDP were used to support the levelling of the National Standards in mathematics (Ministry of Education, 2010, May).

Teachers using the NDP approach are guided in their planning, teaching, and assessing through a set of curriculum support books, officially referred to as the Numeracy Books and informally referred to as the “pink books” because of their colour (Young-Loveridge, 2010). There are nine books in total.

A central theme running through discussions about the effective enactment of the NDP is the importance of training teachers not only in the NDP method, but also in developing greater mathematical content

knowledge. Young-Loveridge (2010) discusses how the complexities of the method, coupled with the mathematical understanding needed to make meaningful connections, meant that the 2-year professional development programme offered was probably not long enough to truly embed the approach. This is supported by research that identifies the complexity of supporting teachers to action new learning in their classroom practice (Timperley, Wilson, Barrar, & Fung, 2007). The biggest challenge occurs when teachers are asked to teach in a way that is at odds with what they know—or what they believe they know—about learning (Timperley et al., 2007). Young-Loveridge (2010) identifies this disconnection as being the case for the NDP:

It would be naïve to think that one or two years of professional development could miraculously change teachers' attitudes, feeling, beliefs, and values as well as their understanding of mathematics. It seems likely that many teachers may need considerably more professional development if they are to acquire the deep and connected understanding that they need to move a greater majority of their students closer to the expected levels of achievement. (p. 30)

In simple terms, the NDP approach involves considerable teacher training in content and methodology for teachers to be able to enact the programme correctly. Therefore there is a risk of teachers developing ad-hoc teaching approaches that are either ineffectual or detrimental to student learning.

Young-Loveridge (2010) identifies a major concern, highlighted in the longitudinal data, that a large number of students are slower to move through the stages than they should be. The subsequent effect of this lag is that many intermediate-age students are identified as working below standard for their year level. An added concern is that these students will not be ready to cope with secondary school mathematics and will get further and further behind.

National Standards

In 2008 an amendment to the Education Act was passed through Parliament to mandate National Standards (Thrupp & Easter, 2012; Openshaw & Walshaw, 2010). After the Act was passed, the development

of the standards began. In 2009 a critical friends group for the development of the mathematics standards came together, consisting of “key people in the mathematics education and assessment communities” (Ministry of Education, 2010, May). Several sources were used to set the level of the standards for mathematics across the strands including the student achievement data from a variety of tests within New Zealand, alongside international research into progressions in Geometry and Measurement and comparing expectations between National Standards’ levelling from overseas (Ministry of Education, 2010, May).

However, even as the consultation process was in progress and as the standards were being set, the issue of National Standards had become a political hotbed of controversy within the education sector. Hattie (2009) argued that National Standards had proven to be difficult to implement without negative side effects to the education sector in many countries and warned that if New Zealand did not want to fall into the same trap, standards would need to be radically re-envisioned for the New Zealand context. Over the course of 2009, stakeholder groups in education firmed up their thinking around National Standards and began to take action. In response, the government showed itself to be immovable on the issue and began drawing lines in the sand to force compliance across the sector (Thrupp & Easter, 2012). By 2010, the battle line over National Standards had been clearly drawn between the government and significant advocates in the primary education sector, and much of this battle was played out in public forums and in the media (Thrupp & Easter, 2012).

In simple terms, assessment and reporting are the areas where teachers are most affected by National Standards. Assessment of student achievement levels and reporting on student achievement levels to stakeholders are where teachers must directly enact the National Standards policy in their classrooms. To do this reporting, teachers are required to make an Overall Teacher Judgement (OTJ) for each student. To reach an overall judgement on students’ achievement against the National Standards, teachers must consolidate evidence of students’ performance from a variety of sources, including classroom observations, teaching and learning conversations, and results from formal assessment tools and Progressive Achievement Tests (Ministry of Education, 2011, October, p. 1).

The expectation from the National Standards policy is that teachers will triangulate assessment data from a variety of sources to come to a reliable statement about a student's achievement level in relation to the National Standards (Mitchell & Poskitt, 2010). Using an OTJ, a teacher must identify and report whether a student as above, at, below, or well below the standards for their year level at school.

The concerns about National Standards are many, varied and at times highly political (Thrupp & Easter, 2012). However, in this study the focus is on discussion that directly relates to the experiences of classroom teachers of mathematics. There is a concern among some researchers that the National Standards policy in meaning and intent is contradictory to the meaning and intent of *NZC* (Hattie, 2009; Thrupp & Easter, 2012):

[*NZC*] is more open and less specific about standards at each level—so given the tension between openness of interpretation and more prescriptive national standards, one might need to go (i.e., the national standards or the new curriculum). Openness and prescription do not readily march together. (Hattie, 2009, p. 2)

The difficulty here for a classroom teacher is answering the question of how to interpret contradictory messages when enacting policies in their practice.

There is also concern among researchers about the ability of classroom teachers to make consistently reliable OTJs. This is because of the variety of data used and the varied approaches to data collation between teachers and across schools. This concern also encompasses fears about the ability of teachers and schools to moderate their OTJs for consistency and accuracy. Research suggests that teachers and schools have grappled with how to make OTJs and how to moderate their OTJs and are looking to the ministry for greater support in this area (Mitchell & Poskitt, 2010; Thomas & Ward, 2011). In response to this concern the Ministry of Education is developing a consistency tool (Ministry of Education, 2011, October) to help support schools and teachers to make reliable and consistent OTJs.

Further to this, there has been some concern voiced that teachers will “teach to the test” and will therefore limit the curriculum to what can

be assessed so that students are more easily able to be identified as having reached the standards (Hattie, 2009).

Teachers' stories

Jane's Story

Green Hill School is a mid-sized full primary school situated in a high-income area. The school has a newly appointed principal who is leading the school through some significant changes. The main priorities for the principal are around building positive working relationships with the school's parent community and developing the school curriculum.

Jane is a teacher at Green Hill School. She is an experienced teacher with 8 years as a classroom teacher. Jane was taught the NDP methodology when she was training to be a teacher and has only ever used this approach throughout her teaching career. The first school she worked in as a provisionally registered teacher was very strong in the NDP approach to mathematics. This was where, Jane explained, she consolidated her understanding of the NDP through school professional development and also through observing other teachers' classroom practice in mathematics.

Jane currently teaches a senior class at Green Hill School. In this part of the school, the students are cross grouped for mathematics. Jane teaches the group of students who struggle most in mathematics, many who have been identified as achieving below the National Standards for their year at school.

The biggest challenge for Jane came from her sense of urgency to accelerate students so that they are ready for secondary school. She expressed a concern that students who struggle in her mathematics class now will be lost in secondary school mathematics classes and will get further behind.

I've got to try and get them to standard ... and I know that some of them are Year 8 who need to have all this understanding before they go to high school, because then they are probably not going to go back and cover stuff like this, they need to know that knowledge before they get there.

Jane also noticed that since they had begun reporting to parents using the language of the standards, she was feeling more pressure for the students to be at the standards. She explained she felt this pressure not because of the parents, but because the students put a lot of pressure on themselves. Jane explained that her students were very aware that they were working below the standards.

The kids in here have an expectation on themselves that they want to be just like everyone else, they want to be 'at' as well ... they know that they are behind ... they do feel the pressure on them more than any other maths class.

Jane described how she often finds she races through mathematics lessons more quickly than she would like in the hope that the students will get to cover more of the learning they need. She realised that it was sometimes at the cost of what she believes about good practice.

I'm trying to push them up. I'm trying to, you know ... come on, you've got to get this ... it's like I'm trying to push them ... instead of taking time to cover it more in detail, in depth.

Jane realised that in the effort to get students through as much mathematics content as possible so that she would have enough data to make a fair OTJ on their achievement levels against the standards, the students were missing out on the time to consolidate learning.

I find it hard trying to make an OTJ with lower ability kids. I try and collect as much data as I can to make it fair on them and try to give them the opportunity, like, so that they can be assessed, be made a judgement 'at', because I know they need to be at level 4 and sometimes they might be working at level 3. So it's kind of hard trying to push them on quite quickly to get them up to level 4 of the curriculum, so they are meeting the National Standards.

The effect of this was that she felt she was often racing across the surface of learning rather than taking the time for students to form deeper understandings about the mathematics concepts they covered.

Yeah, trying to move them on quick ... like sometimes I know I'd really love to spend extra time with them on a certain aspect, but in the back

of my mind is the end of the year, and I've got to try and get them up to level 4 to push them ahead. I know I've missed bits where they could be needing to focus on.

Rachel's Story

Pohutukawa School is an urban primary school that services a mixed socioeconomic community. The school has an established leadership team who have worked with stakeholders in the school community to co-construct the school curriculum.

Rachel is an experienced teacher with 12 years as a classroom teacher and has been at Pohutukawa School for 9 years. Rachel participated in school-wide NDP professional development and believes she then consolidated her understanding and use of the NDP through the school's participation in a 4-year professional learning contract for assessment for learning. Rachel currently teaches a Years 5 and 6 composite class at Pohutukawa School. Students are not cross-grouped for mathematics at Pohutukawa School, so all students stay with their classroom teacher for their mathematics lessons.

Rachel identified that her beliefs about good practice for teaching mathematics are heavily influenced by the NDP methodology and assessment for learning.

I had done the numeracy project so I was aware of what should be in a good lesson and we have a very strong philosophy around assessment for learning. All of our lessons sit around that philosophy.

Rachel acknowledged that becoming conversant in the NDP was not a simple process and she found that it took her many years to truly understand the methodology and materials. Rachel explained that it was her work with assessment for learning that consolidated her understanding of the NDP.

At the beginning I didn't really know what I was doing and I feel like my own knowledge of how to teach maths has really grown over the time ... If I see something that needs to be done a different way, then I've got enough scope to do that whereas when I started I would have just been following the steps I think and not really knowing why.

We have had a lot of professional development about assessment for learning and it impacts on all subject areas.

I do it [assessment for learning] full heartedly because I think it really works.

Rachel also identified that in a good practice mathematics lesson the modelling book for each group is a very important tool for formative assessment. In the modelling book, Rachel records the learning intention, examples to help students understand the strategy being taught, student thinking, and anecdotal notes about what students can do and when they can do it. The modelling book is used by each group of students to support them in their independent follow-up activities.

I see it [the modelling book] as a hugely important thing actually so there are anecdotal notes in it, observations of what children can do, recording of what they have done, when they've done it.

The kids see them [modelling books] as a tool so they will take them with them when they are doing their work and will refer to it.

Rachel's greatest concern was about how to reconcile making an OTJ against National Standards with her firmly held beliefs about assessment and *NZC*.

It [an OTJ] is so broad, I mean, you know you've got a kid who is doing X, Y and Z in strand and they're on stage 8 and you have to make a level for the whole lot combined, I find it ... no ... it wouldn't inform my teaching. But I would use each individual thing [assessment] though [to inform teaching].

We did a lot of work with the curriculum and when the standards came out we tried to marry them up and we really struggled with that so for me the curriculum is the starting point, it's what we build things on.

My knowledge of where the child is at will be based around the numeracy project, what they say each stage looks like.

Rachel also highlighted a concern that moderating an OTJ is very challenging because of the variety of evidence that goes into making a judgement.

Say I had to make an OTJ today ... I don't find it [making an OTJ] easy I can tell you, because I think it's ... you know ... because it's when you are trying to take into consideration strand and all those other things as well and you are supposed to put that specific pinpoint in ... I find that really hard.

We've done staff meetings about what we would use [to make an OTJ], although it's not set in concrete...it's like, this is a list of the things [assessments] you could use.

... because one person surely would put a child there, and another person will put them somewhere completely different ... I don't think people out there realise how ridiculous it is ... it's really hard.

Findings

The policy analysis identifies that the key policies relating to current primary mathematics education are inconsistent and contradictory. This lack of consistency poses a challenge to teacher enactment of policy in their classroom programmes. Policy consolidation and enactment is a complicated and difficult process. Research the world over has identified that enacting effective and sustainable education reforms, particularly in mathematics, is challenging and highly complex (Anthony & Walshaw, 2007; Kennedy, 2005; Sinnema, 2011; Thrupp & Easter, 2012; Young-Loveridge, 2010).

It was evident in the stories of each teacher that, although they were confident about their teaching strengths in mathematics, they were also struggling to make sense of how each of the policies could work together and fit into their programmes with integrity. Each participant in this study selected different policies and different aspects of these policies to emphasise and enact in their respective classroom programmes.

Jane emphasised the NDP as the policy that had the most direct impact on her day to day teaching of mathematics. However, there were gaps in her knowledge about some aspects of the NDP owing to a lack of professional learning opportunities in this area. Jane's story of trying to reconcile a responsive methodology with her perception that she needs to

move rapidly through teaching content is an example of the complexity of policy consolidation and enactment. She saw these as conflicting imperatives and she struggled to reconcile them in her practice.

I think there could be a few different ideas going on, because the National Standards kind of say one thing, that they should be doing this, and it's like harder to get them there with the numeracy project, because there is just so much more I want to cover, it's just trying to get them there ... then they will still go on with missing gaps in their knowledge or strategies.

On the other hand, Rachel emphasised her school curriculum and the impact that using assessment for learning strategies had on her mathematics teaching practice. Rachel felt that the work she had done on assessment for learning had consolidated her understanding of the NDP material. Rachel admitted that she found it difficult to make a single statement OTJ as a report on a student's achievement across all areas of mathematics.

Much research has been done into the complexities of policy enactment in education (Timperley et al., 2007) and governments in New Zealand have been advised to take this into consideration when they are creating policy (Moore, 2008). It is a finding of this study that consolidating and enacting policies relating to primary mathematics education is a complex and challenging endeavour for classroom teachers.

It was evident that the two teachers participating in this study wanted to do the best for their students. Both teachers work incredibly hard to find creative solutions when faced with contradictory expectations of their teaching practices. This confirms, in these specific cases, the prediction by Hattie (2009, p. 3) that "there is no doubt that 2500 schools will *do their best* to implement national standards".

Jane has found that to make a fair OTJ she needs to cover more content so that she has more data to make her judgements. However, she is aware that this coverage is at the cost of allowing time for her students to consolidate their understanding of new learning. Jane is on a daily basis trialling new ways of approaching her lessons to try to get the balance right between coverage and consolidation.

Rachel, on the other hand, is grappling with balancing making OTJs for reporting on one hand with her strongly held beliefs about assessment for learning on the other. Both these teachers are solving the problems of consolidating contradictory directives in different ways. This is something that Hattie (2009) warns about:

... the interpretation of the standards will differ across schools. Where are the moderation processes that are essential to implementing standards, and why are they not part of the introduction and not a discovery to be tacked on later? The damage will be done by not seeing the assessment implications of national standards up front. Standards without assessment solutions are ineffective. (p. 3)

The participating teachers were motivated to do the best for their students. They used teacher creativity and problem solving to solve the inconsistencies of policy directives in their classroom programmes. A consequence of this was that each teacher had different solutions, particularly related to their solving of problems around making OTJs. This variation raises questions about how effectively moderation tools can be enacted in and across schools to support consistent judgements between teachers if teachers have already established diverse ways of working.

Conclusion

This study has found that for the two teachers who participated, the current policies relating to primary mathematics education are contradictory and lack coherence. It is the conclusion of this study that if policies relating to primary mathematics were developed with greater coherency, this would in turn significantly assist the difficult process of teachers' translating and enacting policy in their classroom programmes.

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