Shifting Teacher Practices in Relation to Grouping: Gap Gazing or Strengths Focused Approaches

Louise Fitzgerald
Massey University

Jodie Hunter
Massey University

Roberta Hunter
Massey University

Both in New Zealand and internationally, there has been a focus on the use of differentiation in mathematics instruction to raise achievement levels and provide equitable outcomes. New Zealand has a long history of the use of ability grouping to provide differentiation. Recently, this practice has been challenged in a large scale professional learning and development (PLD) initiative entitled Developing Mathematical Inquiry Communities (DMIC) which focuses on shifting to strength-based, capability focused heterogeneous grouping practices. This article draws on a case study of five teachers involved in the DMIC PLD initiative to examine the enabling factors and barriers to shifting teacher beliefs in relation to mathematical ability grouping. The findings indicate the persistence of teacher beliefs related to fixed ability levels in mathematics. Assessment practices focusing on narrow domains in regard to success in mathematics appeared to act as a barrier to changing teacher beliefs. In contrast, a focus on strengths that students brought to a mathematical task and collaborative group-work appeared to be a key enabling factor to change in teacher beliefs and practices. A key implication of the article is that changes to assessment practices are required alongside changes to pedagogical practices to support teachers to move from gap gazing to recognising multiple strengths in the mathematics classroom.

Keywords · ability grouping · assessment · primary education

Introduction

A key question for educators, researchers, and policy makers in New Zealand and internationally, is how to effectively differentiate mathematics instruction within the classroom to raise the achievement levels of all students. In New Zealand for decades there has been a narrative constructed that relates to the achievement gap for Pāsifika and Māori students in mathematics. Pāsifika is an umbrella term to describe people of Pacific origin and ethnicity including both those born in Pacific Island nations or New Zealand. It refers to those who "identify themselves with their indigenous Pacific countries of origin because of ancestry or heritage, family and cultural connections with Samoa, Cook Islands, Tonga, Niue, Tokelau, Fiji, Solomon Islands, Tuvalu, and other Pacific countries" (Schuster, 2008, p. 12). Māori are the indigenous people of New Zealand. The narrative related to Pāsifika and Māori students has become a widely accepted part of beliefs constructed across multiple communities about students and schools and who can do and learn mathematics successfully. A key aspect that feeds into the narrative of the achievement gap has

been the widely used practice of within class ability grouping; that is grouping children within their classroom for instruction on the basis of a notion of ability, indicated by previous achievement levels. In this case, students are commonly given tasks of differing cognitive demand to complete in their groups, potentially further extending achievement gaps (Bobis et al., 2021). The use of ability grouping in mathematics lessons is described by Webel and Dwiggins (2019) as a persistent challenge to equitable practices in mathematics.

The practice of ability grouping in New Zealand was a prescribed part of the New Zealand Numeracy Development Project (Ministry of Education (MoE), 2004; 2008), a nationwide initiative from 2000 to 2009. In this initiative, a number framework was developed to categorise student's strategies for solving numerical problems. Teachers used an individual diagnostic interview to assess students' numeracy "stage" and students were then allocated into strategy-based groups according to their numeracy stage. In these strategy groups, students were taught prescribed activities for their stage.

In more recent years, a professional learning and development initiative developed within New Zealand, Developing Mathematical Inquiry Communities (DMIC), focuses on a shift in pedagogy from wide-spread use of ability grouping practices towards complex relational and responsive pedagogy. Within this approach, teachers allocate students to heterogeneous groups based on strengths and capability and students are provided with challenging mathematical tasks to solve. Strength based and capability focused grouping is determined through a broader perspective of what it means to have strengths in mathematics, including content, dispositional, and communication based strengths (Kobett & Karp, 2020). Complex relational and responsive pedagogy is focused on communication and participation and the development of children's ability to use mathematical practices as they engage in productive struggle to collaboratively solve rich mathematical tasks (Cobb et al., 2001; Hunter et al., 2020; Sullivan et al., 2015). Within this instruction, a classroom culture is developed where students support one another and work collaboratively, establishing and developing socio-mathematical norms to engage in the use of mathematical practices and develop mathematical reasoning (Cobb et al., 2021). Instruction is differentiated through challenging, open-ended tasks where students work together through a community of learning to productively struggle and think about the mathematics, facilitated by teacher prompts and accompanied with plenty of opportunities for students to make mathematical connections (Bobis et al., 2021).

Drawing on relational and responsive pedagogy requires shifts in teacher beliefs as well as practice. It has been well-documented that the beliefs of teachers pose a challenge to reforming mathematics teaching and learning (Boyd & Ash, 2019; Louie, 2017; Stipek et al., 2001; Sullivan et al., 2015). Previous research studies have focused on teacher and student beliefs about ability grouping as described in the following sections. Despite this, there has been limited research studies which focus on the enabling factors and barriers to shifting teacher practices and beliefs in relation to ability grouping. The study reported in this article will address this gap in the literature by investigating the following research question: What are the enabling factors and barriers in relation to shifting teacher practices and beliefs from using ability grouping towards teaching mathematics using heterogeneous groups within relational and responsive pedagogy?

Teacher Beliefs about Ability Grouping

Commonly, school wide streaming or within class ability grouping utilise pedagogical approaches which are aligned by a common perspective, one that views maths ability as fixed (Anthony & Hunter, 2017; Boaler; 2014; Clarke, 2021; Hunter et al., 2020; Macintyre & Ireson, 2002; Marks, 2013). In this view, there is a perception that mathematical ability is pre-programmed or is genetically determined (Boaler, 2016; Ollerton & Watson, 2001). In many countries, the ingrained beliefs that mathematics ability is fixed are the driving force behind

grouping practices in mathematics education (Marks, 2013). It has been documented in previous research studies (e.g., Cooney, 2001; Pajares, 1992 as cited in Grootenboer, 2008) that such beliefs are often firmly entrenched and resistant to change. A study by Bradbury (2019) with teachers and senior leaders found that for many teachers the belief that children were more or less able formed the basis of their grouping decisions. These beliefs about the fixed nature of ability were widespread and largely unquestioned by study participants. This is paralleled by the results of Webel and Dwiggins (2019) study with prospective teachers. These researchers argued that the use of within class ability grouping was seen by many of the prospective teachers as normative and unproblematic.

Results of some studies (e.g., Bradbury, 2019; Webel & Dwiggins, 2019) show that some teachers doubt the effectiveness or fairness of using ability grouping as a pedagogical practice. Nevertheless, they continue to use the practice within their classrooms. Interestingly, their doubts generally centred on the negative impacts of making differences visible to all students rather than questioning the idea of innate ability. A number of research studies (e.g., Boyd & Ash, 2018; Louie, 2017) show that the pervasive narrative of innate ability in mathematics education is difficult to shift. Both Boyd and Ash as well as Louie described how teachers reformed their practices to using whole class teaching and heterogeneous groupings yet persisted in describing their students with ability labels and sitting within a hierarchy of mathematical ability.

Ability grouping is often described by teachers and school leaders as the best way to address the diverse needs of learners. For example, McGillicuddy and Devine (2018) found that teachers described ability grouping as a tool for differentiation and a way to deal with the range of needs in the class. Positive outcomes were identified for the high ability learners in relation to not being held back or slowed down. Similarly, teachers in Forgasz's (2010) study argued that higher achievers could be extended, enriched, challenged and provided with good opportunities when put into an ability group because teachers do not have to be concerned about weaker students. Some teachers also believed the ability grouping catered for lower achieving students as they were less frustrated, had more time to understand maths, and were more confident to ask questions. In the New Zealand context, Anthony and Hunter's (2017) study found some teacher support for the practice of ability grouping. Specifically, out of 102 teachers surveyed, 54 teachers identified ability grouping as common practice within their school but only 12 of these teachers expressed support for this. These teachers cited their beliefs that the practice enabled them to cater for students with similar needs and abilities, and that this was easier for teachers in regard to management and planning. Additionally, teachers perceived that students were less intimidated in similar groupings and noted that it met parent expectations.

Why is Ability Grouping in Mathematics Classrooms an Equity Issue?

The practice of ability grouping in classrooms has been described as a form of symbolic violence (Archer et al., 2018; Jorgensen et al., 2014; McGillicuddy & Devine, 2018). As McGillicuddy and Devine (2018) demonstrate, teacher perceptions of students inform how they assign them to ability groups essentially funnelling and filtering the students. This then also reinforces the expectations that teachers hold for their students. For example, teachers may have expectations of bad behaviour from students in low ability groups, and a view of low achieving learners as problematic, unmotivated, and lacking in skills. Similarly, a study by Mazenod et al., (2019) found that teachers perceived low ability students as requiring more nurturing and having a neediness which meant that teacher expectations needed to be lower. There was a lack of belief that students labelled as low ability could be independent learners and an assumption that they would need a slower pace of instruction, have greater dependence on the teacher, and need to constantly focus on revising learning. These beliefs in turn limit the opportunities for learning for students.

The grouping and sorting of students into within class ability groups or settings across classes is influenced both by the ethnicity and socio-economic background of students. A key finding of Francis et al. (2017) in the United Kingdom was that the low ability classes predominantly consisted of black and working-class students whereas high ability classes consisted of white and middle class students. Similarly, McGillicuddy and Devine (2018) found that ethnic background was a key determinant for allocation into low and high groups in their study; Irish Traveller children were most likely to be in low ability classrooms. Within the New Zealand context, a study by Turner, Rubie-Davies and Webber (2015) found that teachers' expectations for mathematics achievement differed according to the ethnicity of the child. The majority of the teachers in their study held lower expectations of Māori and Pāsifika students and deficit perspectives of their family backgrounds. They blamed what they perceived as an achievement gap on the individual and their family rather than it being the teachers' responsibility.

What are the Barriers and Enablers to Changing Beliefs and Shifting Practices in Relation to Ability Grouping?

Evident in the research literature is that changing practices and teacher beliefs in relation to ability grouping is a challenging and lengthy process. As highlighted in the previous section, a key barrier in changing the practice of ability grouping to provide differentiation is the acceptance of this as a normal practice in mathematics classrooms. It appears in many Western countries that the idea that some children are 'more able' and some 'less able' in relation to mathematics is a normalised, unchallenged view across teachers, school leadership, parents, and the wider community. Given these views, there is both an assumption that providing different tasks is the only way to cater for students with different 'ability' levels and a fear of change from teachers in relation to disrupting a practice that aligns with the beliefs of the wider community (Bradbury, 2019; Taylor et al., 2017). Compounding this fear is the use of high stakes school inspection and assessment systems such as the SATs in the UK or the National Standards which were used in New Zealand (Boyd & Ash, 2018).

We can look across different research studies to begin to identify some of the enabling factors which support teachers to change their practice and potentially their beliefs. Interestingly, as Bradbury (2019) notes, we cannot assume that teacher practices and their beliefs in relation to grouping align. A number of studies (e.g., Boyd & Ash, 2018; Louie, 2017) show contradictions between teachers' use of language to describe students and the grouping they use in the classroom. Alternatively, other studies (e.g., Anthony & Hunter, 2017; Bradbury, 2019; Webel & Dwiggins, 2019) show that while teachers may believe ability grouping has a negative impact, they feel constrained in their teaching to move away from using this grouping structure. Although there is much research evidence for the negative impact of ability grouping in mathematics classrooms (e.g., Marks, 2013; McGillicuddy & Devine, 2018; Parsons & Hallam, 2014), the impetus for change across a school appears to require a strong base of localised evidence. For example, Bradbury (2019) describes how changes were made within one school after they had examined their own school data. Those placed in the high group were given what appeared to be a slight advantage to the disadvantage of all other students. After interviewing students, the teachers became aware of the negative impact that streaming the students was having on their disposition and beliefs.

Key to shifting grouping practices in the classroom is the support of a stable and committed leadership team (Taylor et al., 2017). Aligned to this, Bradbury (2019) highlights the role of professional capital where teachers are positioned as having expertise either from their teaching experience or through other avenues such as Masters level study and therefore trusted to make changes. Additionally, teachers require time and space as well as professional learning and

development support to make changes to their practices (Boyd & Ash, 2018; Bradbury, 2019; Hunter et al., 2020; Taylor et al., 2017).

There is some evidence that the act of changing teaching practice to heterogeneous groupings provides teachers with the opportunity to view their students differently (Boyd & Ash, 2018; Hunter et al., 2020). For example, Bobis and her colleagues (2021) found that teachers who had participated in a professional learning initiative that focused on using low-floor, high-ceiling challenging tasks to engage a diverse group of learners along with supportive teacher actions such as prompts had more negative perceptions of grouping students by prior achievement. Some of these teachers who also participated in interviews reflected that initially they had doubted that the approach would work for all their learners, however, they now recognised the significance of challenge and struggle to develop a growth mindset. Throughout these studies (e.g., Bobis et al., 2021; Bradbury, 2019) it is evident that there is an ongoing need to challenge the underlying beliefs of teachers in relation to the narrative of mathematical ability.

Methodology

The current study uses a case study approach of five teachers who had been involved with the DMIC professional learning and development (PLD) initiative to examine the enabling factors and barriers to shifting teacher beliefs related to mathematical ability. All teachers volunteered to participate in the study. The teachers taught at a full primary school (Year 0 – 8) in a low socio-economic area with a high proportion of Pāsifika and Māori students which is representative of the cohort of schools electing to undertake the DMIC PLD. Table 1 shows the teaching experience of the teachers involved in the case study.

Table 1. Teacher participants in the research project

Pseudonym	Length of time teaching	Length of time in PLD
Jayne	4 years	4 years
Marama	11 years	5 years
Theresa	5 years	4 years
Hine	11 years	5 years
Kaia	4 years	4 years

DMIC PLD is a research informed approach to mathematics teaching and learning which involves culturally sustaining pedagogy and encompasses complex and responsive instruction with an aim to improve outcomes for diverse learners by addressing equity and improving teaching. The PLD focuses on supporting teachers to re-construct their pedagogical practices by engaging them in a range of activities. This includes professional development days in which teachers work together to undertake planning of mathematical tasks, anticipate student responses and solve tasks themselves. Embedded throughout the PLD is the expectation that teachers will be given access to research articles and will undertake professional reading in order to reflect on their own practice. Each teacher also receives in-class dynamic mentoring during mathematics lessons with the sessions video-recorded and then sent through to provide opportunities for self-analysis (for more detail, see, Hunter, Hunter, Bills, & Thompson, 2016). Threaded through-out the professional learning and development is an expectation that teachers will move away from using

ability-based groups to using strength-based, heterogeneous mathematics teaching. Specific areas of focus in the PLD sessions relate to assigning status to students, the use of some aspects of complex instruction, and drawing on student values of collectivism and collaboration to develop effective group work.

One 45 minute individual semi-structured interview was conducted with each teacher. The interview was designed to inquire into the teacher's beliefs about grouping structures and how these have changed throughout the time spent in DMIC PLD. Follow up probing questions were planned to help elicit more depth to responses in terms of teachers' beliefs. The questions were designed around key themes generated from a review of research literature and included: beliefs around grouping structures; the enablers and barriers to changing beliefs; and beliefs about the impact that grouping structures have on equitable access to high level mathematics learning, participation and engagement in the mathematics classroom. The interview questions which inform the current article include:

1. Describe how you had been teaching mathematics before you started the DMIC professional learning.
2. What did a typical mathematics lesson look like in your classroom?
3. What grouping practices did you use in your mathematics lessons before the professional learning? Why?
4. Tell me about the grouping practices that you use now.
5. What have the barriers been to implementing your grouping practices?
6. What impact has changing the grouping had on children's: access to maths, mathematical identity and relationships with each other?
7. When you think back to the beginning and where you are now – how has the change come about?
8. What has been the biggest learning for you personally?

In the findings section, we present excerpts from the interviews to illustrate the key aspects that were related to changes in practice and beliefs or the aspects which appear to be barriers to change.

The interviews were wholly transcribed and analysed using a mixed inductive and deductive approach. A deductive approach using the themes outlined in the interview questions was used to guide the initial analysis. This included examining teachers' views of ability, the changing classroom culture, student levels of participation and engagement and access to high level mathematics. An inductive approach was used to identify emergent or unexpected themes across the responses. Specifically, multiple levels of coding were used identifying key themes and sub themes which highlighted the changes teachers made to grouping structures, where these changes occurred and enablers and barriers to the change. This included ways of engaging with the PLD, teacher content knowledge and roles within the classroom. Following the second layer of analysis, further key themes were identified including beliefs about mathematics and who can learn mathematics, and assessment practices.

Findings

The findings draw on two contrasting case study groups of teachers to highlight the enabling factors and barriers to changing teacher practices and beliefs related to ability grouping. This includes three teachers (Marama, Theresa, Jayne) who reported changes in their pedagogical practices and provided responses which indicated shifting beliefs about the notion of ability in mathematics. The contrasting cases include two teachers (Hine, Kaia) who reported limited changes to their practices and appeared to maintain an implicit belief of fixed ability for mathematics and the need for ability grouping to teach mathematics effectively. All teachers had

engaged in the same professional learning and development sessions as part of DMIC and had spent a similar amount of time involved in the professional learning.

Teacher Beliefs Related to Mathematics, Ability Grouping and Assessment Practices

Three of the teachers (Marama, Theresa, Jayne) described significant shifts in their pedagogical practices related to teaching mathematics. A key similarity across these teachers was a personal belief that they expressed explicitly that everyone could learn mathematics. For example, Theresa said: "I have always believed that everybody could do maths but it always stumped me, confused me as to why some really, really struggled with it." This personal philosophy aligned with the principle of using heterogeneous groupings. The teachers also highlighted that from the DMIC PLD, they had moved towards using heterogeneous groupings in their teaching across the curriculum with Jayne stating: "it's actually fitting in perfectly into my teaching philosophy… it should be integrated into more areas."

In contrast, the two teachers who reported limited changes in their practice, Kaia and Hine, reported differing personal beliefs about who could 'do' mathematics. These teachers appeared to view individuals as having a fixed ability to engage in mathematics. For example, while Kaia expressed a belief that everyone can do maths, she tempered this with the statement: "but I think that some struggle more than others do." Similarly, Hine stated her belief that: "everyone can achieve, to the best of their ability" but then stated that mathematics was different from other curriculum areas and required ability grouping in order to be taught effectively.

Despite changes in pedagogical practices through involvement with DMIC, the school continued to use assessment tools and practices that aligned with a previous professional learning and development project, the Numeracy Development project (NDP). Its focus on narrow domains in representing success in mathematics, such as whether students remembered and applied a strategy correctly, appeared to act as a barrier in relation to shifting teacher practices and beliefs. Two of the teachers used the assessment results as a way to categorise students mathematically. For example, both Kaia and Hine consistently referred to their students as: "Stage Fours or Stage Sevens" which aligned with the New Zealand Numeracy Project describing a specific strategy stage the children had been identified as achieving at through an NDP assessment procedure. At other times students were referred to as: "belows, ats, and aboves" referencing the New Zealand National Standards framework in which teachers were mandated to record achievement levels of students as below, at, or above the curriculum level for their year group. These descriptors from the teachers could be viewed as pseudo labels of mathematical ability

For the group of teachers who reported shifts in their pedagogical practices, there was a more critical view of assessment practices. These teachers tended to problematise the assessment tools and the subsequent use for ability group placement. For example, Marama described: "there are groups that were stage three because of whatever testing we had." Marama also acknowledged her previous low expectations for specific groups of students because the label they were given aligned with assessment results: "they had ideas that I never gave them credit for because as far as I was concerned, they didn't know how to do it."

A key aspect promoted within the DMIC PLD which contrasts with what was promoted in the NDP, is the use of heterogeneous groups and challenging group-worthy tasks. For some of the teachers (n=3), providing their students with opportunities to work on mathematics beyond the expectations of their level as suggested in the assessment results, provided them chances to notice how student reasoning was elevated: as described by Marama "when we put them into the DMIC groups you know these kids shot up. They had made different connections and spoke

about different things." The teacher reflections illustrated how changes in pedagogical practices caused shifts in beliefs about student capability and notions of mathematical ability:

> This one kid that is just so quiet and has been labelled as the 'stage three doesn't know kid,' is being the one that is taking control. You give them that encouragement and then wow everyone's perception about him has changed. (Marama)

For these teachers changes in grouping practices offered them ways to view students differently.

In contrast, two teachers indicated that while they had made some changes, they maintained grouping arrangements based on notions of fixed ability in mathematics. Both expressed concerns related to differences in mathematical knowledge indicated by the NDP assessment tools. For example, Hine stated: "I cannot put my level 7 with my Level 4/5….it's too far, it is a very big gap, my below group is so far away from my ats." As a result, Hine described how she continued to give those students who were perceived as higher ability a different task than the rest of the class. Similarly, Kaia described: "For the students who are more able, I don't try and pair them with someone who is three or four steps below them." Kaia outlined how she grouped the students in their small groups based upon her perceived notions of their ability levels. Clearly, the assessment tools influenced their expectations. For these two teachers maintaining both the practice of differentiating mathematical tasks and grouping by the perception of student ability in turn limited their opportunities to notice their student's true capabilities or to have their own beliefs about student ability challenged.

The Effects of Using Different Grouping Practices

It is evident in the data that a key enabling factor to shifting three of the teachers' practices and beliefs about ability grouping was a focus on what strengths the children brought to a group, considering who worked well together and what combinations of students brought the best out in a group of learners. The three teachers who had changed their grouping practices saw heterogeneous small group work as an opportunity for all students to bounce ideas around and push each other. Jayne described the knowledge that the students had: "within their group, they've got like their own little experts." In this framing, differences were seen as beneficial and even necessary for learning: "they can have that quality conversation if they have got different ideas." An open mindset and strength based orientation appeared to allow the teachers to grow in their own pedagogical practices.

In contrast the other two teachers who reported limited shifts in their practice viewed the difference in mathematical strengths as problematic and framed these negatively. For example, Hine stated: "the aboves dominate, they will run away with it because they know it all." For these two teachers, continuing to use grouping structures that were based on a fixed view of mathematical ability limited them in promoting with their students the concept of developing shared expertise across a group that the other teachers had developed. Clearly, for changes to teacher expectations of student capabilities, they needed to be exposed to noticing what happened when their students were given different opportunities to participate and contribute. It appeared that the use of assessment practices which tied to previous ability grouping structures acted as a prop for two of the teachers to maintain their fixed mindset mode.

The use of assessment methods that still used labelling and levelling of students according to a single snapshot assessment test appeared to impact on the languaging the teachers continued to use. Four of the five teachers maintained languaging that referred to ability levels. For example, although Marama had fully integrated heterogeneous grouping within her class, she still used languaging when describing her grouping methods, which used ability levels concepts:

It's about ability alongside attitudes and personalities. If you have got someone who can be just so demanding…Then you don't want them with a child that is very submissive and all you want them to be challenged with someone that is probably in that mid-range but has an opinion of their own and will just no, will be challenging. Or if there is someone that's got their C ability then they can have that quality conversation if they have got different ideas.

Theresa also stated: "I have seen a huge difference it has made to like my students, not only my high but also my low." What was evident in the languaging used by the teachers was that they were slowly growing their own pedagogical practices. Although the use of changed groupings pressed them to notice changes in their students' participation and mathematical understanding, they were still interweaving long-held prior beliefs built around their own experiences as learners and teachers with newly constructed beliefs.

Engaging with Aspects of Professional Development

Evident in the data was the willingness for all teachers to engage in some aspects of the professional development with DMIC. Despite the different belief systems expressed, all teachers (n=5) emphasised the need to teach children how to work differently in a collaborative group setting to ensure that they were able to work productively to extend everyone's mathematical learning. Theresa contrasted the focus on collective learning with her previous classroom practices in mathematics: "I found it an individual thing under the old system, everyone is working on their own and so you have a lot of kids copying off each other." They all identified establishing and maintaining social group norms (one pen, one paper, take risks, mistakes are ok, no passengers, take everyone with you, ensure everyone understands and can explain) as sometimes challenging but essential to improved engagement. Furthermore, Hine, Jayne and Kaia described the need to draw on Pacific values, especially the value of family as essential to effective group work and improved participation. Hine described how she encouraged students to think of their peers as family: "okay think of this as your family okay, if I am stuck I will ask one of my family can you help me with this….so working together." These norms, which all teachers described as important, are part of the professional development with DMIC. They are important aspects of supporting teachers' shift from ability grouping towards grouping students heterogeneously.

A central part of the professional learning with DMIC is an emphasis on the students developing and using a range of mathematical practices as tools to engage with mathematical reasoning. Clearly noticeable in the data is the way in which the three teachers who had constructed productive pedagogical practices using heterogeneous groupings had also integrated mathematical practices into their expectations of the reasoned discourse they expected the students to use as they worked together. Moreover, they all connected the use of mathematical practices to ways their students needed to work in other aspects of the curriculum and even within their lives. For example, Jayne outlined her position on their use:

It's pretty much just, justify and question everything, but in a way that it's about the skills, so a big thing this year has been, arguing the maths not the person, so we've been looking at how we can integrate that norm into all areas, and so I've actually told them so if you're outside and you're playing a game of touch, someone forward passes, why do you argue the person, do you say they cheated or do you say, ok it's not your try because you passed the ball forward, what's the difference there, it's getting them to kind of integrate that skill into everywhere else, so that's kind of the take that I'm wanting to, with the kids.

Marama also referred to the link across all curriculum areas, however also recognised her own prior learning experiences and the need to give her students different opportunities when she said:

It is also connected to the strategies for comprehension. I mean it is something that is valued. It was really difficult in our time to kind of ask questions and all so it is about encouraging our kids to ask questions if someone is explaining something to be open minded, take risks.

Interestingly, neither of the two teachers who had not implemented heterogeneous grouping in their classrooms even referred to their students' use of mathematical practices, despite them describing how they had put in place classroom norms which supported students to learn to use practices such as asking questions and taking risks with reasoning. A clear picture that emerged in the data appeared to link to the teacher's own sense of self as users and doers of mathematics.

Teacher Content Knowledge and Roles within the Classroom

The two teachers (Kaia and Hine) who had not shifted in changing their pedagogical practices towards the use of heterogeneous grouping both described their concerns about their own content knowledge and their perceived pedagogical role. From the data it is evident that the perspective the different teachers held of their role and the role of students in the classroom were either enabling factors or barriers. For example, Kaia explained her apprehension in relation to being able to be responsive to a range of student thinking: "It's me developing my understanding around maths in general and picking up things that they have shown, that are misconceptions. Sometimes I don't see it because I don't feel strong in maths." These two teachers both described their comfort in a teaching role where they actively provided steps to the students while the students took a passive role. For example, Kaia described this as: "just filling them up" while Hine described how she put: "my thoughts, and my thinking, and my knowledge into the kid's head." In subsequent descriptions of their changes in practice, both Hine and Kaia perceived that in their newly structured pedagogical practices their role as a teacher became somewhat 'less', with students expected to "drive their own learning."

The three teachers (Marama, Theresa, Jayne) who described shifts in their pedagogy also saw shifts in their roles from provider of all knowledge towards learning facilitator. They made comparisons between what they had previously done and the changes they had enacted as a result of their learnings. For example, Theresa directly described her previous role as imparter of knowledge:

When I was teaching in the numeracy project it was like it had a defined learning intention like what I wanted the kids to learn but it also had the approach like I wanted them to learn this way. Yeah so, and if they didn't use it this way it was kind of like you have got to learn it this way…

She then outlined her new role as noticer and responder to student reasoning she had adopted within the professional development of DMIC:

It was under DMIC I realised I was kind of like working under what they already knew. So, kind of like yes, I have my big idea in my head of what you know I wanted to teach but it really kind of like worked around what they knew, and what they could do…but also moving them on so that extension in my big idea that I have planned for them. So, it was kind of like validating what they know…and kind of like taking that to the next step.

Here, Theresa is showing that although she had planned for significant learning, she was able to let what she noticed emerge in student reasoning drive the lesson, as students talked and worked together. She showed her willingness to allow student current understandings lead to the key mathematical concepts they focused on. Similarly, the other three teachers who had adopted changes in their pedagogical practices described their openness to what the students brought to the lesson and adapted their planning around these in flexible ways. They considered their role to be that of active and adaptive facilitators of the mathematical learning in their lessons.

By contrast, the two teachers who resisted change still wanted to follow their planning and drive the mathematical learning of their students according to what they perceived they would know at prescribed ability levels. Their descriptions of their practices instead outlined procedural teaching, and when they considered their 'possible' new role, they perceived that it would be limited to a passive one in which the students became wholly responsible for what they learnt.

Discussion and Implications

There is clear evidence world-wide that to support mathematical achievement for all students, differentiation opportunities need to be available (Bobis et al., 2021; Kobis & Karp, 2020). Two schools of thought have approached notions of how to differentiate differently. In New Zealand persistent adherence to the school of thought which subscribed to ability grouping to differentiate has occurred over many decades (Anthony & Hunter, 2017; MoE, 2004, 2008). Only in the most recent decade has there been a shift towards recognising how use of heterogeneous groupings allows all students to achieve through the many opportunities they are provided with to bring their own conceptual reasoning to mathematical activity and through shared discussion with others construct new understandings (Hunter, Hunter, & Anthony, 2020). Not surprisingly, shifts in pedagogical practices to support the use of heterogeneous grouping structures and differentiation is challenging for New Zealand teachers. Although this article describes only a small case study of five teachers, it provides many learnings about the affordances and barriers which support teachers to make changes in their pedagogical practices towards the use of different forms of grouping.

Considerable research has shown the ways in which teacher beliefs pose significant challenges to shifting pedagogical practices in mathematics education. Given all the prior experiences teachers in New Zealand have with their own mathematics learning occurring within streamed ability classes, or within class ability groups, and their prior teaching experiences using these same practices, it is to be expected that notions of fixed ability are going to be difficult to shift. From the findings it is apparent that such beliefs which pertained to notions that mathematical ability is fixed and genetically preprogramed were what dictated which aspects of the professional development the teachers chose to implement. Similar to what has been seen in many other studies (e.g., Anthony & Hunter, 2017; Bradbury, 2019; Webel & Dwiggens, 2019) these views had become normalised within the teaching community and therefore viewed as unproblematic. Consequently, we highlight teacher beliefs that focus on mathematical ability as fixed as a potential barrier to developing practices using heterogeneous groupings and drawing on relational and responsive pedagogies. In contrast, teacher beliefs that mathematical capability can be grown, potentially enable teachers to shift and change in pedagogical practices away from using in-class ability grouping.

Despite intensive professional learning and development that focused on strength-based approaches and heterogeneous groupings, for two of the five teachers in this case study, their responses continued to draw on ability 'labelling' of students. This parallels the findings of Boyd and Ash (2018) and Louie (2017) with their teachers indicating a belief in a hierarchy of mathematical achievement. In a similar manner to what McGillicuddy and Devine (2018) previously described in their study, the two teachers in this study who did not implement genuinely heterogeneous groupings considered that their use of streamed groups allowed them to differentiate across perceived levels of ability. It also supported them in their conception of their role as holder and imparter of all knowledge within procedural forms of teaching. The three other teachers also retained some elements of those long held beliefs as evidenced in the language they used to describe their students. As Bradbury (2019) cautions, we cannot assume that there is alignment between enactment of new pedagogical practices and beliefs. This is consistent with

results from Boyd and Ash (2018) and Louie (2017) who also noted the contradictions between teacher languaging about their students and the practices they used in their classrooms.

Strong and consistent school wide practices have been shown to support changes in pedagogical practices. Taylor and colleagues (2017) contend the need for a committed and involved leadership team to achieve change. Clearly shown in our findings is the strong relationship between the assessment practices used in the school and in wider policy settings and this ongoing ability 'labelling'. While leadership supported the new professional development with DMIC, at the same time they had not ensured that school-wide policies and practices matched. This meant that their assessment practices still supported a focus on narrow domains with regard to success in mathematics. This acted as a barrier to changing teacher beliefs in relation to fixed ability in mathematics. Although three of the teachers provided responses that indicated they had embraced a new view that all students had mathematical capability and the potential to achieve and learn mathematics at high levels, they still lapsed into language which indicated a more fixed view of ability. We argue for the need to develop new assessment practices alongside professional development which advocates responsive and relational pedagogy. We have some models for this in the use of comparative judgement (Jones et al., 2015), which offers the opportunity to assess student responses to open-response items or problem based items. Alternatively, other research studies demonstrate how rubrics based on mathematical reasoning can support teachers to view and assess reasoning in multi-dimensional ways (Davidson et al., 2019).

A key enabling factor for shifting pedagogical practices away from ability grouping to using heterogeneous grouping and relational, responsive pedagogies was focusing teacher attention on the multiple strengths that students can bring to mathematics lessons. For the teachers in this study, a focus on the strengths that students brought to a mathematical task and a collaborative group supported them to view students with a capability and growth focus. Like Boyd and Ash (2018) and Hunter et al. (2020) described in their studies, the teachers in this study who enacted heterogeneous grouping practices were then provided with opportunities to view their student's capabilities differently.

Professional development needs time and space for teachers to be repositioned in ways that support them to critically reflect upon their own beliefs related to mathematical ability. Future areas of research need to focus on the type of targeted support and activities that challenge teacher beliefs about mathematical ability and support them to re-construct their beliefs. As researchers and mathematics educators, we also need to consider how the language that we use such as the terminology of mixed ability grouping may continue to have implications on perspectives and language that teachers draw upon. For example, if we use the term 'mixed ability' to describe grouping, does this then infer that there are specific levels of ability in mathematics? A further challenge for mathematics educators are those teachers who cling to past pedagogical practices without even trying to implement shifts. What actions need to be taken to construct new practices in ways which maintain the teacher's own agency while also maintaining the integrity of the professional development? Finally, how can we as mathematics educators support teachers to develop assessment practices which focus on student strengths and capabilities rather than categorising and labelling students in regard to 'gaps' in their mathematical knowledge and understanding?

This article has added to the field of differentiation in mathematics education by interrogating the enabling factors and barriers to shift teacher beliefs in relation to ability grouping. Implications of the article are that alongside professional learning and development, new changes to assessment practices are needed to support teachers to move from gap gazing to recognising differing strengths and meeting these in equitable ways.

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Authors

Louise Fitzgerald
Massey University East Precinct
Albany Expressway, SH17, Albany, Auckland 0632, New Zealand
email: L.J.Fitzgerald@massey.ac.nz

Jodie Hunter
Massey University East Precinct
Albany Expressway, SH17, Albany, Auckland 0632, New Zealand

Roberta Hunter
Massey University East Precinct
Albany Expressway, SH17, Albany, Auckland 0632, New Zealand