

02

Adapting ongoing mathematics professional development to foster and sustain improvements

ERO's 2016 report **School Leadership That Works** explains how effective leaders focus on a small number of priority improvement goals that are based on an analysis of student data and information about teaching practice. They analyse how school practices may be contributing to the current situation and consider research evidence about what is effective in raising student achievement. Effective leaders introduce improvement strategies supported by a coherent change management approach that interweaves pedagogical change, organisational change, and the building of leader and teacher capability.

The leaders at **HOON HAY SCHOOL** carefully trialled new approaches before spreading those that were successful across the school. This narrative shares the change management strategies that supported teachers to look deeply into their existing practices and make changes that were necessary for raising student achievement.

At Hoon Hay School the mathematics programme had been a priority for many years. It was, however, only after trying a variety of approaches that led to short-lived achievement gains that leaders and teachers finally introduced strategies that were both successful and sustainable.

Strategically managing change

Changes to mathematics teaching occurred over many recent years as they trialled and implemented new approaches and strategies.

Timeline for change

Year	Actions and approaches
2011	<p>Leaders made use of research to determine the best practices for teaching the most able mathematicians.</p> <p>Two key ideas emerged:</p> <ul style="list-style-type: none"> > What is good for the most able mathematicians is good for all mathematicians. > Streaming is detrimental for the majority of students.
2012	<p><i>This year was focused mainly on short-term gains.</i></p> <p>Mathematics was the focus of professional learning and development (PLD).</p> <p>Lifting school-wide achievement and removing the disparity in Māori and non-Māori achievement were made charter targets.</p> <p>Teachers stopped streaming. Each teacher now had a number of target children whose mathematical progress they were responsible for accelerating.</p> <p>Mathematics evenings were held for parents.</p> <p><i>By the end of the year, 94 percent of all children and 94 percent of Māori children were achieving at the expected level.</i></p>
2013	<p>Leaders started an inquiry to answer the question: 'How can we create sustainable, quality mathematics provision that sees all our children succeeding with and enjoying mathematics?'</p> <p>Two mixed-ability classes introduced mathematics talk, using different approaches. The effectiveness of the two approaches was then evaluated.</p>
2014	<p>Teachers introduced a mixed-ability, problem-solving approach in Years 5 and 6.</p> <p>The introduction of the new approach was supported by teacher modelling and by observations and reflection.</p> <p>The approach was the focus of PLD on a teacher-only day.</p>
2015	<p>Teachers introduced the approach to Year 4 children.</p> <p>Leaders developed mathematics teaching expectations with teachers.</p> <p><i>A student survey identified that mathematics was the second favourite school subject of seniors (behind physical education).</i></p>
2016	<p>The school provided release for teachers of Years 1–3 to work with the deputy principal on the new strategies and approaches.</p> <p>Year 1 to 3 teachers used some of their classroom release time (CRT) to observe Year 5 and 6 mathematics lessons.</p>

From the beginning, the deputy principal played a key role in supporting teachers to change their mathematics teaching practice.

During study leave, she visited other schools and examined research to learn more about programmes for gifted and talented students. It struck her as inequitable that very able children often had much greater opportunities to experience rich and authentic learning and leadership. In some schools, giftedness entitled students to better programmes and teaching ratios, which she considered was a form of elitism.



Our deputy principal and I found that really hard to understand as we had a philosophy that every child should have a chance to shine. I am always asking, “Who in your class hasn’t had a chance to shine?” I’ll work with that child. It takes away the hierarchy of learning.

Principal

The deputy principal recognised that, when working with gifted and talented students, teachers focused on what they could do and built on that, but when working with ‘bottom’ students they tended to focus on what they could *not* do. This meant that some children never got the opportunity to solve real problems or engage in the rich mathematics activities that their gifted and talented peers experienced. To change this, teachers need to promote a ‘not yet’ attitude when working with target children, so that children habitually tell themselves, ‘If I don’t get it, I need to try a different approach.’



“A competent mathematician is one who knows what to do when they don’t know what to do.”

Deputy principal

In 2012 the board of trustees made improving mathematics achievement a target – too many children had ‘switched off’ mathematics. The school introduced a variety of mostly short-term strategies to help those who were not achieving well. The deputy principal took on the role of mathematics specialist teacher (MST), withdrawing children from Years 4 to 6 for additional mathematics, and the associate principal took extra mathematics sessions with children in Years 2 and 3. The practice of cross-grouping in Years 4 to 6 was abandoned, with the result that all teachers became responsible for teaching mathematics to all the children in their class. Every teacher now had a group of target children to focus on and monitor. Progress was rapid, attributed in part to the extra teaching provided by the MST and the associate principal.

The following year the focus shifted from helping children who were not succeeding to improving teaching. The MST worked with groups of children in the classroom so that teachers could observe her practice.

One surprise consequence of dropping the many out-of-class interventions and bringing all mathematics teaching back into the classroom was an initial dip in achievement.

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“As trustees we were shocked. We thought the maths data might drop a bit after we stopped the interventions with children and it did. Then we had to rethink and do something with all the staff and the leaders said we should start with the Year 5 and 6 team.”

Trustee

Introducing the best practices that the deputy principal had brought back with her following study leave required careful change management. Leaders decided to work first with teachers of Years 5 and 6 because this would enable them to use the available expertise while not overly extending their ability to grow capacity.

Leaders worked on building teachers' confidence with the new strategies before changing too much in the classrooms. They also reviewed their data regularly to see if the new practices were actually working for the children. Finally, they wanted teachers across the school to see the impact and usefulness of the changes. As an overarching aim they were looking to create a climate where teachers would be continuously looking deeply into their practices to determine their impact on children's achievement.

Classroom Expectations have changed

In the past ...

Silently work through a 'worksheet' or page of the book

Work individually at own desk

Focus on the answer – either right or wrong

Best practice today ...

Talk about maths
Work collaboratively
constructing and sharing
reasoning

Learn with, and from, each
other

Focus on the reasoning and
process

'Maths talk' between students enhances maths understanding and achievement

The change management process consisted of seven distinct phases:

1. examining the research
2. sharing the research and proposed approach and strategies with one teaching team
3. trialling the approach and strategies in that teaching team
4. examining the gains for students in the trial classes; comparing these with results under the previous regime
5. working with teachers to fully implement the approach and strategies across the teaching team
6. extending the approach and strategies across the whole school
7. setting shared expectations about how mathematics will be taught in the school.

Trialling and spreading the new mathematics programme

Work with the Year 5 and 6 team began in 2013. The deputy principal shared her research with team members and they discussed what they might be able to trial.

The outcome was a 'maths talk' trial, carried out in two classes. The first class ('the trial group') focused on maths talk and problem solving in mixed-ability groups. The second class, taught by a capable mathematics teacher, was given a more traditional programme in which children were assigned to groups that matched their stage on the number framework.

The mathematics Progressive Achievement Test (**PAT**) was used to measure and compare the progress of the two classes over the year-long trial period, with a movement of two or more stanines being interpreted as accelerated achievement. In the trial class 41 percent of children made a shift of two or more stanines; in the more traditional class 17 percent of children made a comparable shift.

Children in the trial class said they:

- > enjoyed maths
- > liked working in different groups
- > enjoyed the 'maths arguing'
- > listened to each other and addressed their statements and questions to each other.

Spreading the practice across the school


After the trial, the data was shared more widely across the teaching team. The deputy principal spent a day with the Years 5 and 6 teachers before the teacher-only day in January 2014. During that day, initial strategies were shared about:

- > *talk moves* and the importance of giving children 'wait time' to decide on problem-solving strategies
- > prompts and strategies for children who were reluctant to be involved in mathematical discussions
- > managing instructional lessons or workshops where children were invited to join the group lesson, or teachers worked with an intentionally mixed-ability group of children
- > selection of tasks with different levels of complexity so that all students have a measure of success and confident mathematicians are fully challenged

Speed versus Deep Thinking

In the past ...	Best practice today ...
Believed that being fast meant you were good at maths	Maths requires processing, thinking, time to 'unpack'
	Maths requires deep thinking

Too many children still believe being fast at maths means you are good at maths, and of course, the reverse ☹️



Any problem worth solving requires time

https://www.ted.com/talks/dan_meyer_math_curriculum_makeover

- > the need for explicit instruction in problem-solving strategies and the language of mathematical discourse
- > the advantages of collaborative planning and team teaching
- > the case for 'no hands-up' classrooms in which any student can be called upon to explain why their group used a particular strategy and how they arrived at their solution or conclusion.
- > prompts that children can use to reflect on their learning and how they are working with others.

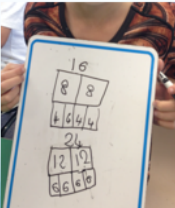
The expectation was established that every member of the team would incorporate two 'maths talk', problem-solving lessons into their weekly programme. Teachers were supported by the deputy principal, who modelled approaches, observed teacher practice and contributed to reflective discussions and planning.

Throughout the initial trial and ongoing development of the new approach and strategies children were asked for feedback, which was then shared with teachers, board members and parents.

When we spoke to children about their mathematics programme they told us they preferred working in pairs or small groups rather than as individuals.

Equitable classroom practices enable all children to feel good about their maths to 'take risks', grow and succeed

- No hands up (pair share support)
- Respectful classroom culture (accountable)
- Expectation of involvement
- Group responsibility for learning
- Providing challenge for **ALL** children
- Assigning competence
- Promote effort over ability
- Listening to, and building upon, each other's understandings



Why we talk about our maths - older children

When we talk about our maths it helps us to

- Organise our mathematical thinking
- Think more clearly so we can share our ideas
- Make sense of what others are saying
- Learn and use the language of maths
- Listen to other's thinking and strategies, which might be helpful



When we talk in pairs about our maths we can

- Practise before sharing it with the class
- Combine our ideas to help us solve the problem
- Help each other to understand, by listening, questioning and talking

Mathematicians use 'precise language' so they can communicate their maths reasoning and thinking.

ERO observed mathematics teaching in three classrooms across the year levels and saw children highly engaged in instructional groups and working in pairs or in small groups.

In a Years 5 and 6 class, we saw children excited about a new problem they had to solve. Before they rushed off to attempt the problem, their teacher reminded them that if it seemed too hard they were to talk and listen to each other, and think about what they already knew that could help them to solve the problem.

The teacher had paired or grouped children with different mathematical abilities as buddies. In one pair a child prompted another to help them recall a potentially relevant strategy.

Sophie: Okay Olivia what is $8+6$?

Olivia: 14

Sophie: What's $30+14$?

Olivia: I can't remember

Sophie: Can you remember how to add tidy numbers
or numbers to a 10?

Olivia: Yes, $30+14$ is 44.

In other groups, the buddies deliberately extended their thinking as they tried to find different strategies to solve to a problem or used equipment to demonstrate their strategy. Children practised explaining their strategies before returning to the larger group. They clearly understood that everyone would be expected to be able to contribute to the larger discussion. When the children joined the larger group, only two groups shared their strategies but many more contributed to the discussions, by starting with such comments as:

- > can you prove it using equipment...
- > I am noticing...
- > I agree because...
- > I disagree because...
- > they are the same because...
- > they are different because...

The teacher prompted the group to:

- > think about the part their group did first
- > discuss place value further
- > think about what you could do differently if you didn't know $70+50$
- > share a different strategy to the one the first pair shared.

Two children told us they liked working with a buddy because being able to talk with each other stretched their thinking. They explained that by working in pairs they could also do more challenging problems and they liked it when the problem was hard.

Working with parents

At mathematics evenings for parents, school leaders explained the changes that their children were experiencing and the reasons for them. During these parent evenings leaders shared:




- > how their children's mathematics programme was similar to/different from what they may have encountered when at school
- > how to help their children with their mathematics learning at home
- > how to look for mathematics in the everyday environment
- > some of the strategies and visual representations that the children use in mathematics.

They were also shown the useful mathematics link we have shared below.

To help parents understand the different roles their children took on when working in pairs or small groups, and some of the strategies used, they were paired with another parent and given problems to solve. This proved particularly useful for the parents of capable mathematicians, who could see that working collaboratively and having to explain and clarify their thinking for others would deepen their own child's understanding.

As the result of the parents' new enthusiasm for problem solving, teachers started sending a mathematics problem home each week instead of basic facts lists. (Basic facts were, however, still viewed as very important and songs for learning them, together with guidance, continued to be provided on school blogs.) A parent trustee told us that, in their home, they would sometimes have dinner-time conversations with their child about strategies that could be used to solve that week's problem.

Maths is everywhere!

<p>We are surrounded by maths in our everyday lives.</p> <p>For example: bus timetables, number patterns, cooking, table setting, distance travelled, foreign exchange, time zones, the weather, card games, shopping, measuring, shapes, patterns, board games, going places, etc.</p>	<p>Families www.nzmaths.co.nz/families</p> <ul style="list-style-type: none">  Introductory video A video describing how you can support your child's learning in maths.  Supporting school maths Information to help you understand what your child is doing in maths at school, and ideas for ways to support this at home.  Maths at our house Suggestions of ways that you and your child can use everyday experiences to explore maths.  Maths kits Ideas for making a collection of free or low cost items that your child can use for exploring maths ideas.  Other resources Links to other parts of the website that may be of use to you.  Frequently Asked Questions for families Answers to questions that you may have about how to help your child with maths. 	
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Why a variety of strategies might be better ...

With the person beside you, discuss how you would solve these number sums.

1. Jill has a paper run after school. On the first week, Jill is given 673 papers to distribute after school on te Rāhine (Monday) and te Rātū (Tuesday). On te Rāhine Jill distributes 498. How many more does she need to distribute on te Rātū?
2. Last week Kevin sold off some old furniture. He sold 6 bookshelves for \$39 each. How much money did Kevin make?
3. HHS was preparing for a massive fundraising event. They had 256 replies saying people were going to attend. They needed to seat people equally around 16 tables. How many at each table?

Ongoing review and development

When ERO visited, the implementation of the new approaches and strategies was still variable across the school. Leaders were continuing to review and develop them to help clarify teaching expectations. Leaders, and teachers had developed a set of agreed expectations for mathematics teaching in their school. They referred to these as their 'must dos':

How the mathematics and statistics curriculum is taught in our school

The expectation is that all children will have the opportunity to engage in challenging maths tasks, have their mathematical thinking heard and valued, believe in themselves and experience success.

In every class, every day, all children will have:

- > the opportunity to be challenged, to struggle, to persist
- > opportunities to engage in mathematics discourse to clarify their maths thinking and reasoning and build upon other children's explanations
- > a combination of flexible grouping options including whole-class, small-group, pair or individual.

Teachers will:

- > be positive maths role models and use affirming language
- > use formative assessment information and knowledge of the learner to plan their teaching
- > have high expectations of all children
- > develop in children positive attitudes to maths and a willingness to take risks when solving problems
- > provide frequent opportunities for children to use 'maths talk' to enhance learning
- > take account of children's diverse cultural and linguistic backgrounds
- > build school and community partnerships
- > use flexible grouping options to ensure children experience all aspects of the mathematics curriculum
- > use authentic contexts to engage children in maths learning
- > question children to develop a greater understanding of their strategies and thinking.

Leaders acknowledge that the new practices were still developing, especially in the junior school. Leaders and teachers look separately at mid and end-of-year data for Years 1 to 3 and Years 4 to 6. They then collectively determine and document:

- > What they are noticing from the data
- > Things that are going well
- > Things for further consideration
- > Things that will make a difference.

The school's long-term improvement strategy had considerably reduced the need for out-of-class interventions. The shift in emphasis from providing support for children who were not succeeding to improving teaching practice had benefitted more children and was more sustainable.