Computers and maths anxiety in New Zealand maths teachers

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This is a summary of two articles, by Caygill and Zhao (2020) and ERO (2018), with respect to New Zealand maths teacher's anxiety and confidence. The articles were examined for relevant issues including computer use, statistics were extracted, and relevant sections were summarised or quoted in full.

Key finding regarding use of computers

Computer access
NZ had high availability of computers during maths – over twice that internationally. For Year 5 students (9 year-olds), availability in class was 92% versus 39% internationally (2X increase). For one-computer-to-one child, availability was 33% versus 13% internationally (2X increase). For older Year 9 students (13 year-olds), availability in class was 81% versus 37% internationally (2X increase). For one-computer-to-one child, availability was 61%.

Computers actually used in teaching
There was high usage. Compared to internationally there was 3-4 times more use at primary and 4 times more at secondary compared to internationally.

For Year 5 students (9 year-olds), daily use in class was 32% versus 7% internationally (5X increase). For weekly use, availability was 40% versus 14% internationally (3X increase). For older Year 9 students (13 year-olds), daily use in class was 21% versus 5% internationally (4X increase). For weekly use, availability was 41% versus 10% internationally (4X increase). For total use at least weekly rates were 62% versus 15% internationally (4X).

Compared to the international context, New Zealand students had very high regular usage of computers. At primary school, New Zealand had the highest weekly use. However, high use of computers does not necessarily lead to good maths outcomes.

What are teachers actually doing when they are just watching students using computers?
NZ teachers are *mostly just watching students rather than interacting with them or testing them* with feedback that improves learning.

Yr5
Observing 85%
Asking students to answer 62%
Short test 12% (56% internationally) – 5X *less*
Longer test 10% (51% internationally) – 5X *less*
Five times more testing internationally!

Yr9
Observing 81%
Asking students to answer 66%
Short test 23% (52% internationally) – 2X *less*
Longer test 41% (62% internationally) – 1.5X *less*
Two times more testing internationally!

These facts are remarkable. The excessive use of technology in New Zealand is no guarantee of learning success.

References

Caygill, R., & Zhao, B. (2022). *Progress and achievement and the context of mathematics and statistics learning in New Zealand.* New Zealand Ministry of Education. Wellington, New Zealand. (Link)

ERO (2018). *Teaching strategies that work – Mathematics*. Education Review Office. Wellington, New Zealand. https://ero.govt.nz/our-research/teaching-strategies-that-work-mathematics. (Link)

Caygill & Zhao (2022)

This paper used various sources 2012-2019:
PISA 2012, TIMSS 2014, NMSSA 2018, NCEA, and others.

Teacher anxiety and confidence and student anxiety and confidence are largely reciprocal and mutually-reinforcing issues. Therefore, student anxiety and confidence is mentioned first here, followed by teacher anxiety. Student anxiety cannot be completely separated from teacher anxiety. To understand the lack of student confidence in maths it is necessary to understand the methods of teaching, engagement, feedback, and assessment. To understand teacher anxiety and confidence, it is important to appreciate the way teachers are being prepared (or not) for teaching students maths.

Students' confidence

- International evidence suggests student mathematics anxiety starts before school.
- Primary students liked learning maths, and many felt confident in their maths abilities. However, **older children were less positive** than younger children.
- More New Zealand students were negative about maths than their international counterparts.

- Liking maths, being confident in doing maths, and valuing maths were all associated with higher achievement in maths. **But <u>confidence was more strongly associated with achievement than liking or valuing</u>**, particularly for older learners.

- There was no consistent pattern when confidence and attitude to maths were examined for each ethnic grouping. **For all ethnic groupings, students who had more confidence tended to have higher achievement** but there was no consistent pattern for other attitudes.

- Year 4 and Year 8 students with **special education needs** liked learning mathematics less, and felt less confident in their ability to do maths, than those with no special education needs.

Teachers' confidence

- International evidence shows that **many early childhood teachers have low levels of confidence** in their mathematical ability.
- Many primary teacher **trainees could not do the maths** they would be expected to teach to Year 7 and 8 students, though this motivated some to do better for the children they taught. [See Young-Loveridge data at end of report]
- **Few primary teachers had specialised in mathematics or mathematics teaching**. More secondary mathematics teachers had a maths specialisation, but **over a third of maths teachers did not and this was high compared to other countries**.
- Many **Year 9 teachers expressed feelings of being unprepared**, even though they were more likely to have a mathematics specialisation. At Year 9, teacher preparedness appeared to impact opportunity to learn. This lack of opportunity to learn was confirmed by 15-year-olds in PISA.

- Most **primary teachers liked teaching maths, but many primary teacher trainees could not correctly do the maths they needed** to be able to teach to Year 7 and 8 students and many expressed negative views towards doing mathematics. However, being negative about doing mathematics didn't necessarily negatively impact their attitude towards teaching maths.

- New Zealand teachers had **high levels of professional development compared with other countries** though fewer teachers experienced these opportunities in 2018 than in 2014.

Teachers' confidence and preparation, along with their teaching methods, appeared to have an impact on students' opportunity to learn and academic outcomes in mathematics.

In New Zealand:

Many primary teacher trainees couldn't do the maths they would be expected to teach to Year 7 and 8 students, though this motivated some to do better for the children they taught.

New Zealand had **lower levels of teacher specialisation in maths than other countries** and many primary and Year 9 teachers expressed **feelings of being unprepared**, which appeared to impact students' opportunity to learn and therefore their outcomes.

Students in New Zealand performed **better on statistical questions** than on other areas of the curriculum, though this was only relative to New Zealand performance (not that of other countries).

New Zealand teachers had **high levels of professional development** compared with other countries but we found that fewer teachers experienced these opportunities in 2018 than in 2014.

Teaching practice

- Many New Zealand students **reported teachers were clear and easy to understand** in mathematics lessons, **but the proportions were lower than their international peers**. Greater clarity of instruction and better student-teacher relationships were associated with higher achievement.

- Instructional techniques and activities differed between middle primary and lower secondary teachers. New Zealand teachers were **less likely to explain things to students or ask them to memorise things compared to their international peers**. Some teachers had students explain solutions regularly. **Setting challenging activities for students was not as common.**

- Compared with other countries, **more New Zealand primary teachers use same ability grouping/streaming regularly for mathematics instruction**, though this use had decreased since 2014, while the **use of mixed ability had increased**. Regular use of same ability grouping has been associated with lower achievement, but mixed ability grouping has the potential to increase learners' self-concept and achievement.

- **Computer availability for maths lessons was higher in New Zealand** than in other countries and they used computers for practising maths and to support learning. **Calculators were not used as much as computers**.

- **Assessment methods teachers used in middle primary classes differed** from both their international peers and their lower secondary counterparts. Around one-quarter (only!) of schools were found to use achievement information well at the upper primary level and **few schools were found to be highly effective at gathering and using achievement information at the lower secondary level to improve practice**.
- The **methods and strategies used by teachers in lessons varied greatly** across New Zealand classrooms and between primary and secondary teachers.

Early childhood

- From early learning through to secondary there are areas where New Zealand teaching and instruction differs from international practices, or from what some writers suggest is best practice and evidence shows works.
- International evidence shows that many **early childhood** teachers have high maths anxiety, aren't confident in their ability to teach mathematics, **aren't sure why they need to be able to teach maths**, or elected to teach early childhood because they thought maths was not part of the curriculum.

Deeper analysis

Comparing the NZ proportions to international values allows the discrepancies to become clear and suggests the extent to which New Zealand's unique teaching practices contribute to poorly prepared, anxious teachers, and consequently, poorly taught, anxious students.

Few primary teachers had specialised in mathematics or mathematics teaching

Yr 5
students had maths teacher:
with specialisation in maths 14%
without specialisation in maths 79%

Yr 9
students had maths teacher:
with specialisation in maths (90% int)
without specialisation in maths 37% (10% int)

Shortage of teachers
Principals said:
Primary
30% students affected some or a lot by the shortage of teachers

Secondary
20% students affected some or a lot by the shortage of teachers

Impact of shortage
Students in New Zealand schools where PISA 2012 principals reported that instruction is hindered a lot by a shortage of qualified maths teachers **scored 26 points lower** than students in schools where instruction is not at all hindered by such shortage.

Confidence in teaching various maths:
Primary:

Most Year 5 teachers in TIMSS 2014 felt very well prepared to teach:
whole numbers adding, subtracting, multiplying, and/or dividing (94% students received).
angles comparing and drawing (63% students received)
decimals, including place value and ordering, adding and subtracting (68%)

Year 5 teachers felt better prepared to teach **data display topics** than number and geometric shapes and measures. However, when asked in 2018 about the topic areas in general, more teachers felt well prepared to teach:
number (91% of students) than:
statistics (75%)
geometry and measurement (74%)
algebra (56%)

According to their teachers, the mathematics topics covered by the fewest New Zealand Year 5 students in 2018 were geometry-related:
comparing, drawing angles (44%)
parallel and perpendicular lines (55%)
decimals, place value and ordering, adding and subtracting with decimals (60%).

Impact of being prepared
Those Year 5 students whose teachers felt very well prepared to teach the topics had significantly higher achievement than those whose teachers felt not well or somewhat prepared.

Problem areas
NMSSA produced a resource for teachers based on three focus areas: **spatial reasoning, fractions and percentages** and collaborative problem solving. The first two align with teachers' relative **weaknesses in terms of feelings of preparation**.
Spatial reasoning
Fractions
Decimals

On average, New Zealand students perform higher on tasks related to statistics but relatively lower in geometry and measurement

ODD FACT: **Most primary teachers said they liked teaching maths**
Most teachers in NMSSA agreed or strongly agreed that they liked teaching maths (94% at the Year 4 level and 96% at the Year 8 level with these two categories combined).

Many primary teacher trainees could not correctly do the maths they needed to be able to teach to Year 7 and 8 students
Many students training to be primary teachers couldn't successfully answer questions at level 4 of the curriculum - especially **fractions and percentages** - a third of students correctly answering these questions

Very few - 48% of student teachers expressed positive attitudes to mathematics.

ODD FACT: **However, being negative about doing mathematics didn't necessarily negatively impact their attitude towards teaching maths**

The relationship between general attitudes towards mathematics and attitudes towards *teaching* mathematics seems to be **complex and nuanced**. Some students were positive about mathematics, possibly having experienced success with school mathematics, but were anxious about the responsibility of teaching others, and hence negative about the prospect of teaching mathematics. Others were negative about mathematics because of unpleasant experiences learning school mathematics, but looked forward to teaching mathematics more effectively than their own teachers, so were positive about the prospect of teaching mathematics.

PLD

New Zealand teachers had **high levels of professional development compared with other countries** though fewer teachers experienced these opportunities in 2018 than in 2014.

Yr 5
2014:
PLD in previous two years:
Highest was 74% on mathematics content (45% internationally)
Lowest was 42% integrating IT into maths (36% internationally)

2018 – less than 2014
Highest was 61% for mathematics pedagogy/instruction
Lowest was 26% for integrating IT into maths

Yr9
2019 PLD:
40% on mathematics assessment (35% internationally)
66% on mathematics pedagogy/instruction (45% internationally)

Critical thinking and problem solving skills (UP from 2014)
37% - 2014
54% - 2019

Maths assessment (DOWN from 2014)
51% - 2014
40% - 2019

Clarity of instruction
Primary Yr5
"my teacher is easy to understand"
56% agreeing a lot

32% agreeing a little

"mathematics lessons had high clarity"
70% high clarity (74% internationally – 4 points behind)

Secondary Yr9
"my teacher is easy to understand"
37% agreeing a lot
36% agreeing a little

"mathematics lessons had high clarity"
39% high clarity (46% internationally – 7 points behind)

Engagement

Explaining to students
New Zealand teachers were **less likely to explain** things to **students or ask them to memorise** compared to international

Yr5
explained new maths **content** (29% vs 68% int) – less than half!
explained **how to solve** problems (23% vs 61% int) – third!
asked to **memorise** rules and facts (5% vs 37% int) – negligible!

Yr9
explained new mathematics **content** (50% vs 68% int)
explained **how to solve** problems (47% vs 63% int)
asked to **memorise** rules and facts (14% vs 36% int) – less than half

Explaining to teacher
ERO (2018) on effective mathematics teaching reported that **having students explain solutions can increase** learners' ownership of their learning.

NMSSA student reports of explaining their thinking to teacher "almost every day":
Yr4 33%
Yr8 34%

TIMSS
Yr5 72%
Yr9 60%

PISA
Yr11 35%

Setting challenging activities for students was not common
About a third of students said this happened daily.

Impact

Both in New Zealand and internationally, **the clearer and easier to understand** the middle primary and lower secondary students found their mathematics lessons, the higher the achievement.
The link between teacher–student relations and maths **achievement** found in New Zealand classrooms was **one of the strongest** among the PISA participants.

Same ability grouping/streaming

New Zealand primary teachers Yr5 use **streaming more than internationally**

2018 (2014) vs int	
daily	NZ 29% (47%) vs 15% int
half of lessons	NZ 39% vs 28% int

Whole class mixed ability grouping	
2018 (2014)	
daily	30% (13%) vs 40% int
half of lessons	33% (29%)

ERO (2018) reported that schools with **improved performance had implemented mixed-ability grouping**. Children who had previously been in 'bottom' groups told ERO how their **confidence and enjoyment of mathematics had increased** since working in mixed-ability groups.

…a move to mixed ability grouping, along with other aspects of class climate, enabled a slight increase in student self-concept. The other changes to class climate included

- promoting choice of learning activity
- facilitation of a collaborative rather than competitive class climate
- teacher positivity,
- buddy-system where students encouraged peer responsibility for the classroom climate.

Computers

Computer access
NZ had high availability during maths – over twice that internationally
Yr5
Available in class: 92% (39% int) – 2X+
One-to-one: 33% (13%) – 2X+

Yr9
Available: 81% (37%) – 2X
One-to-one: 61%

Computers actually used in teaching:
High usage – compared to internationally 3-4 times more at primary and 4 times more at secondary!
Yr5
Daily 32% (7% int) – 5X international!
Weekly 40% (14%) – 3X
Total (at least weekly): 72% (21%) – 3X

Yr9
Daily 21% (5%) – 4X!
Weekly 41% (10%) – 4X
Total (at least weekly): 62% (15%) – 4X

In an international context, New Zealand students had **very high regular usage of computers**; at **middle primary New Zealand had the highest weekly use.** For comparison, around one-fifth of teachers on average internationally used computers to support learning at least weekly (middle primary 7% daily and 14% weekly; lower secondary 5% daily and 10% weekly).

Calculators
Access to calculators – 2X – 4X
Yr5
Restricted 65% (33% int) – 2X
Unrestricted 9% (2%) – 4X

High use of computers/calculators = poor outcomes

Note: It will be interesting to consider how mobile phones (as super-charged calculators) have a detrimental effect and how their banning will improve maths outcomes.

Q. What are teachers actually doing when they are just watching students using computers? Below…

Assessment methods

NZ teachers are **mostly just watching students rather than interacting** with them or testing them with feedback that improves learning.

Yr5
Observing 85%
Asking students to answer 62%

Short test 12% (56% int) – 5X *less*
Longer test 10% (51%) – 5X *less*
Five times more testing internationally!

Yr9
Observing 81%
Asking students to answer 66%
Short test 23% (52% int) – 2X *less*
Longer test 41% (62%) – 1.5X *less*
Two times more testing internationally!

Using assessment
Primary Yr 4 – 8
Using assessment:
well 25% schools (ERO, 2013) (ie, for goal setting with students/families)
somewhat 25%

Secondary Yr9,10
Using assessment:
well 9% schools (ERO, 2012) (ie, for goal setting with students/families)
somewhat 57%

Early childhood

Teaching mathematics:
deliberate action vs. finding teachable moments in ECE settings –
A balance of the two is recommended (ERO)
But finding "teachable moments" requires teachers with good understanding of mathematics.

"Evidence suggests many children don't get sufficient or appropriate opportunities to learn maths and this may be related to teacher knowledge and confidence."

Summary (Caygill & Zhao, 2020)

"New Zealand teachers have a relatively low level of specialisation in mathematics, with primary much lower than secondary and both lower than on average internationally. They also felt less prepared to teach some mathematical topics than others and this seemed to impact students' opportunity to learn as some topics were less likely to be taught than others. Students in New Zealand performed relatively better on statistical questions than on other areas of the curriculum in international tests, though this was only relative to New Zealand performance not that of other countries. Some teacher trainees had negative views about mathematics, though this didn't necessarily negatively impact their attitude towards teaching mathematics. A relatively high proportion of New Zealand teachers had had professional development recently." (Caygill & Zhao, 2022)

ERO (2018)

Teaching strategies that work – Mathematics

The report was one of a series of reports on "teaching strategies that work." It featured strategies and approaches that they observed in 40 primary schools selected from across New Zealand. These schools came from a database of 129 schools, all with rolls of 200 or more, in which the proportion of students in the **upper primary years** (Years 5 to 8) achieving at or above the national standard had increased.

The report is a dense 60 pages with many individual cases and scenarios described in detail.

Regarding the points requested to find relevant material to summarise, this paper is less useful than Caygill and Zhao (2018) regarding teacher anxiety although it does have more discussion on how PLD can be used. However, most of the report is about students, although teachers and PLD are mentioned.

Although anxiety is not explicitly mentioned, reading between the lines and making obvious inferences, one can see how better teaching strategies will lead to better teaching…and therefore less anxiety for both the teacher and the student.

The start of the report summarised what ERO already knew (from earlier reports), especially regarding **grouping/streaming**:

ERO (2013) Mathematics in Years 4 to 8: Developing a Responsive Curriculum. February 2013 (ero.govt.nz)

ERO (2016) Early mathematics: a guide for improving teaching and learning | Education Review Office (ero.govt.nz)

"Most teachers used **ability grouping** within or across classes and many were relying on teacher aides to accelerate the progress of priority learners. Few had evidence that such strategies were actually working to enhance learning or achievement.

A key finding of the report was that grouping by 'ability', whether in-class or across classes, disadvantages students.

In schools where mathematics achievement was improving, and leaders knew the reasons for this improvement, teachers had usually participated in **well-planned and targeted professional learning and development** (**PLD**). Leaders had identified each teacher's strengths and needs and then organised internally or externally facilitated PLD to respond specifically to those needs. They carefully selected teachers from within the school who could lead development work successfully with their colleagues to spread the agreed practices. They made time available for these selected leaders to increase their own knowledge and to work with others.

Following discussions with the PLD facilitators about the pros and cons of this practice, and possible alternatives, teachers recognised that **streaming** had been disadvantaging children in the lower mathematics class. Not only were these children unlikely to experience the whole mathematics curriculum, they were unlikely to develop **positive attitudes** towards mathematics. It was decided therefore that, as from the beginning of 2016, teachers would teach mathematics to all the students in their own class. Prompts remind children of strategies to use. After making this change, teachers generally grouped their children by ability within the class when teaching mathematics. Because mathematics was no longer isolated from the other learning areas, teachers were able to integrate mathematics learning across the whole curriculum."

According to ERO (2018), **student maths anxiety** is a negative emotional reaction to mathematics that can interfere with learning and performance. Some of the factors that contribute to maths anxiety in New Zealand are:

Students

- Negative experiences with mathematics in the past, such as feeling frustrated, bored, or confused
- Low self-confidence and self-efficacy in mathematics, such as believing that one is not good at math or that math is too hard
- Fixed mindset and fear of failure, such as thinking that one's math ability is innate and cannot be improved or that making mistakes is shameful
- High-stakes testing and pressure, such as feeling anxious about NCEA exams or being compared to others
- Unsupportive classroom environment, **such as having a teacher who is not enthusiastic, patient, or encouraging, or who uses ineffective teaching strategies**

Teachers

The ERO report suggested some **strategies that teachers can use** to reduce maths anxiety and foster positive attitudes towards mathematics, such as:

- Building positive relationships with students and creating a safe and supportive classroom culture
- Using a variety of engaging and relevant tasks and activities that cater to different learning styles and interests

- Providing clear explanations, feedback, and scaffolding to help students understand and master mathematical concepts and skills

- Promoting a growth mindset and a productive struggle, such as praising students for their effort, persistence, and strategies, and encouraging them to learn from their mistakes

- Developing students' metacognitive and self-regulation skills, such as helping them set goals, monitor their progress, and cope with their emotions

The eight "strategies that worked":

1. Using both long-term and short-term strategies to improve mathematics learning and achievement
2. Adapting ongoing mathematics professional development to foster and sustain improvements
3. Working collaboratively to develop and implement an agreed mathematics curriculum and consistent, high quality teaching practices
4. Raising expectations and improving outcomes for Maori and Pacific students
5. Improving children's mathematics learning and achievement through the use of flexible, multi-ability grouping of children
6. Supporting children's developing confidence with mathematics by establishing educationally powerful connections and relationships with families
7. Giving students explicit instruction about learning strategies helped them take control of their learning and developed their self-efficacy
8. Undertaking an inquiry to build and extend teachers' mathematics teaching capabilities

Anxiety vs confidence

These strategies did not explicitly address "teacher anxiety". They mentioned **PLD** but never with respect to anxiety. The word "anxiety" appears only once in 60 pages and then only with respect to children's anxiety. However, "confidence" appeared in 19 places but only about 6 instances refer to teacher or PLD confidence.

Most of the paper is a description and recount of what they did. Sections of relevance follow.

"This teacher was a keen learner and enjoyed good relationships with other staff, including those who were hesitant to make the required changes. However, she was not particularly confident with mathematics. To increase her **confidence** she **undertook a university mathematics paper.** She became excited about mathematics teaching and enthusiastically shared what she was learning with colleagues. This teacher's ability to learn new skills and work successfully with 17 children and teachers, and her empathy for those who were

struggling, were crucial when it came to supporting teachers to engage with new approaches and strategies and try them for themselves" (Strategy 1)

"School leaders closely monitored the teachers' progress and **confidence**. At the end of each **PLD** session or workshop they discussed with the providers what was working and for whom, who was disengaged, what needed to change, and what the next steps were for teachers. This helped ensure that all teachers were getting to grips with the new strategies and approaches…
This practice of **debriefing** was also observed after sessions facilitated by teachers or school leaders. An algebra workshop led by school mathematics leaders highlighted for them some of their own less successful teaching practices… In the whole-staff workshops the teachers practised voicing their thinking, asking questions and expressing their ideas in mixed-ability groups – the very skills they wanted the children to develop. Teachers did the bulk of their PLD as a whole staff, in their teams, or in house groups that included teachers from across the year levels" (Strategy 4).

"Throughout the programme the teacher used a **Teaching as Inquiry** model to formally reflect on what was working for both children and teachers, and for whom it wasn't working. This process helped her identify approaches and strategies that were effective in accelerating the progress of children who had previously been struggling. These approaches and strategies included:

>making connections between prior knowledge and new learning

> using equipment and visual representations to aid conceptual understanding and support discussion

> introducing purposeful tasks that connect mathematics with real life

> sharing and discussing mathematical thinking with peers

> using the Growth Mindset approach to increase **confidence** and self-efficacy" (Strategy 1)

"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. 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." (Strategy 2)

"We observed mathematics lessons at different year levels where children were working in **a mix of mixed-ability and streamed groups**. Leaders told us that they were gradually moving to mixed-ability groups, and that, from 2017, all children would be in mixed-ability groups for at least part of their programmes. In the Year 4 to 5 learning space we observed two workshops being led by two teachers while the third worked with individual children, checking, carifying and encouraging their efforts. Children had selected which of the workshops they would attend based on what they believed they needed to learn. The workshops had short, specified timeframes. The teacher leading the workshop either demonstrated strategies or got children to demonstrate and explain their use of a strategy. **Teachers also encouraged those who were still developing the confidence share their ideas to verbalise their thinking to the group**." (Strategy 3)

PLD

"At the same time as they were beginning to redevelop their mathematics programme, leaders were also reviewing the **impact of previous PLD** designed to improve students' writing. They observed that there had been a **considerable time lag** between identifying the challenges and implementing changes in the classroom. Leaders wanted to ensure that new mathematics practices were put in place more quickly, in all classes, so that the children could start benefiting from them.

Leaders and teachers worked closely with external PLD facilitators to improve mathematics teaching and learning. The facilitators extensively modelled new teaching strategies and supported improved leadership practices. **Facilitators always took a team leader with them** when they observed a teacher, and then reflected on their practice with them. Over the two years of the mathematics PLD, every observation was followed by a reflection in which the focus teacher was a full participant. **Some teachers initially found these two-person observations and reflections challenging because they were not used to their practice being under the spotlight** in this way. But it was by being involved at this level that team leaders came to understand the strengths and needs of each teacher and provide ongoing, responsive PLD. At the same time, leaders had numerous opportunities to develop their own coaching and mentoring skills, which helped strengthen the sustainability of the new directions

In the first year of the PLD mathematics achievement in some classes and levels did not improve as hoped. However, because the school leaders had worked so closely with individual staff they knew **which teachers were not confident** with the changes, and were able to provide them with additional support. Leaders were also aware that that they needed to overcome any change-induced confusion before the new approaches could be embedded and have a lasting positive impact on the children's learning. Leaders strategically partnered **confident** teachers with those who were less confident for the purpose of observing and supporting each other's practice. In many cases the benefits were reciprocal.

A mathematics support teacher was selected to help achieve improvement across all the year levels. Her role was to lead an intervention programme for Years 4 and 5 children and help teachers try the new approaches advocated by the **PLD**. This teacher was a keen learner and enjoyed good relationships with other staff, including those who were hesitant to make the required changes. However, she was **not particularly confident with mathematics**. To increase her **confidence** she undertook a university mathematics paper. She became excited about mathematics teaching and enthusiastically shared what she was learning with colleagues. This teacher's ability to learn new skills and work successfully children and teachers, and her empathy for those who were struggling, were crucial when it came to supporting teachers to engage with new approaches and strategies and try them for themselves."
(As reported under confidence section)

(Strategy 1)

ERO refers to this report:
Report examines origins of 'maths anxiety' (openaccessgovernment.org)

"But importantly – and surprisingly – this **new research suggests that the majority of students experiencing maths anxiety have normal to high maths ability**."

See also Centre for Neuroscience in Education at the University of Cambridge 2019:
Report examines origins and nature of 'maths anxiety' | University of Cambridge

-examines the factors that influence 'maths anxiety' among primary and secondary school students, showing that ***teachers and parents*** *may inadvertently play a role in a child's development of the condition*, and that girls tend to be more affected than boys.

Four out of five adults have low functional mathematics skills compared to fewer than half of UK adults having low functional literacy levels.

Primary-aged children referred to instances where they had **been confused by different teaching methods,** while secondary students commented on poor interpersonal relations.

Secondary students indicated that the transition from primary to secondary school had been a cause of maths anxiety, as the work seemed harder and they couldn't cope. There was also greater pressure from tests – in particular, SATS – and an increased homework load.

In a study published in 2018, the researchers showed that it is not only children with low maths ability who experience maths anxiety – **more than three-quarters (77%) of children with high maths anxiety are normal to high achievers on curriculum maths tests** - **the majority of students experiencing maths anxiety have normal to high maths ability.**