

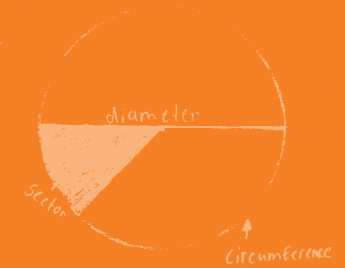
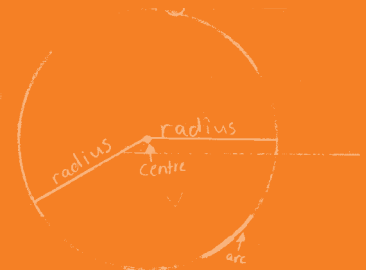
Mathematics in Years 4 to 8: Developing a Responsive Curriculum



February 2013

powerful numbers

- a. $5^2 = 5 \times 5 = 25$
- b. $8^2 = 8 \times 8 = 64$
- c. $3^3 = 3 \times 3 \times 3 = 27$
- d. $5^3 = 5 \times 5 \times 5 = 125$
- e. $2^3 = 2 \times 2 \times 2 = 8$
- f. $9^2 = 9 \times 9 = 81$
- g. $4^2 = 4 \times 4 = 16$
- h. $8^3 = 8 \times 8 \times 8 = 512$
- i. $4^3 = 4 \times 4 \times 4 = 64$
- j. $1^3 = 1 \times 1 \times 1 = 1$
- a. $\sqrt{64} = 8$
- b. $\sqrt{16} = 4$
- c. $\sqrt{81} = 9$
- d. $\sqrt{9} = 3$
- e. $\sqrt{36} = 6$
- f. $\sqrt{25} = 5$
- g. $\sqrt{100} = 10$
- h. $\sqrt{49} = 7$
- i. $\sqrt{4} = 2$
- j. $\sqrt{36} = 6$



The outside of a circle is called the circumference. Every point on the

Angle	Type	Size
	acute (sharp)	less than 90°
	right	90°
	obtuse (blunt)	between 90° and 180°

Ko te Tamaiti te Pūtake o te Kaupapa

The Child – the Heart of the Matter



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We welcome your comments and suggestions on the issues raised in these reports.



Foreword

The Education Review Office (ERO) is an independent government department that reviews the performance of New Zealand's schools and early childhood services, and reports publicly on what it finds.

The whakataukī of ERO demonstrates the importance we place on the educational achievement of our children and young people:

*Ko te Tamaiti te Pūtake o te Kaupapa
The Child – the Heart of the Matter*

In our daily work we have the privilege of going into early childhood services and schools, giving us a current picture of what is happening throughout the country. We collate and analyse this information so that it can be used to benefit the education sector and, therefore, the children in our education system. ERO's reports contribute sound information for work undertaken to support the Government's policies.

In this evaluation ERO used the mathematics learning area and associated standards to look at what schools were doing to raise the achievement of students in Years 4 to 8. The findings showed that schools were very good at identifying learners who were achieving below the mathematics standards, but that accelerating their progress was challenging for most schools. The report outlines the features of schools which are making good use of mathematics achievement information, or have a highly effective approach to reviewing and adapting the mathematics curriculum to respond to their priority learners. There are several recommendations for school trustees, leaders and teachers, and the Ministry of Education.

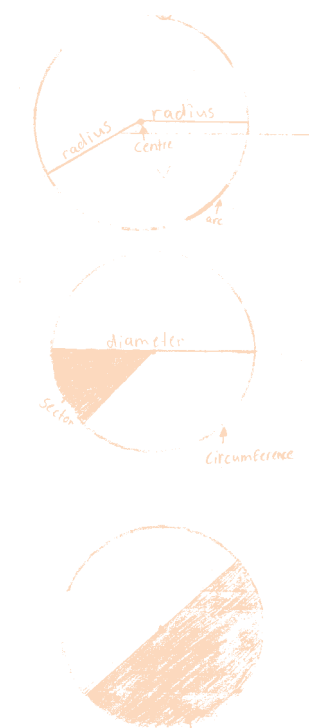
Successful delivery in education relies on many people and organisations across the community working together for the benefit of children and young people. We trust the information in ERO's evaluations will help them in their work.

Dr Graham Stoop
Chief Review Officer
Education Review Office

February 2013

Contents

OVERVIEW	1
NEXT STEPS	3
INTRODUCTION	4
FINDINGS	6
Part A: Reviewing the mathematics curriculum	6
Part B: Use of achievement information	11
Part C: Accelerating the progress of learners below and well below the mathematics standards	19
CONCLUSION	23
Next steps	24
APPENDIX 1: SAMPLE OF SCHOOLS	25
APPENDIX 2: METHODOLOGY	28
APPENDIX 3: A FRAMEWORK FOR SELF REVIEW	29
APPENDIX 4: REFERENCES	32



Overview

This national evaluation report focuses on the important connections between:

- the design and review of each school's mathematics curriculum
- the use of achievement information by trustees, leaders, teachers and students
- the acceleration of progress of priority learners.

The context is the learning area of mathematics and what is happening for students in Years 4 to 8.

The report is one of a series of evaluations the Education Review Office (ERO) has undertaken on how schools are working with the National Standards within *The New Zealand Curriculum*. In this evaluation, ERO used the mathematics learning area and associated standards to look at what schools were doing to raise the achievement of students in Years 4 to 8.

ERO gathered data for this evaluation in Term 4, 2011 and Term 1, 2012. Information was gathered during the scheduled education reviews of 240 schools catering for students in Years 4 to 8.

Reviewing the mathematics curriculum

A feature of *The New Zealand Curriculum* is the expectation that schools will review and design their own school curriculum in light of what they know about their learners. The notion of a curriculum that responds to all learners is one that schools were expected to embrace as they worked to implement the revised curriculum from 2010 onwards.

This evaluation shows that in many schools the leaders and teachers are involved in regular review of their mathematics programmes as part of their wider school curriculum. Teachers are assessing students' progress and achievement and are able to identify learners needing additional support or extension. This approach works for many, but not all of our priority learners.

Schools with highly effective processes for reviewing and adapting their mathematics curriculum used an integrated approach to using assessment to inform curriculum review and design. They used their information to decide which strands or concepts they should spend more time teaching, and to determine the most effective teaching practices for their learners. A culture of reflection and inquiry at board, leader and teacher level supported ongoing review of schools' mathematics programmes.

Many schools were yet to use such effective self-review processes to design their mathematics curriculum in response to what they knew about all their students. In about half the schools, leaders and teachers were collecting and analysing mathematics achievement data but were not yet using it to review and adapt their school's mathematics curriculum. Priority learners in these schools should benefit from a school curriculum that regularly adapts to learners' interests, strengths and next developmental needs.

Use of achievement information

In the schools where mathematics standards' achievement information was well used, leaders played a critical role in establishing school-wide processes. They developed assessment processes for multiple purposes that enabled trustees, teachers and students to reflect on progress and achievement and to identify any next steps for which they were responsible. Such use was integral to school-level self review and to teaching as inquiry processes. However, in two-thirds of schools achievement information could have also been used to make sound resourcing decisions, and determine the focus of professional development to build teacher capability.

Student involvement in understanding their achievement and knowing where they needed to improve remains an area of particular concern. Students were using mathematics achievement information well in only seven percent of schools. In 29 percent of the schools, students were not aware of their progress and achievement, or involved in assessing their own learning related to the mathematics standards. This is a recurring finding in ERO's series of national evaluation reports about schools working with the National Standards within *The New Zealand Curriculum*.

Accelerating the progress of learners below and well below the mathematics standards

Accelerating the progress of students working below or well below the mathematics standards was challenging for most schools. In a few schools, leaders and teachers were focused on using teaching strategies that were proving to be effective in accelerating progress for these learners. Some of these schools were using research evidence to rethink what they were doing to support learners, particularly in relation to identifying teaching strategies.

However, this was not the case in most schools where a 'business as usual' approach to supporting priority learners prevailed. The majority of these schools were able to identify those learners who were not achieving the mathematics standards but continued to use the same teaching strategies, programmes and initiatives they had tried before. Most used ability groupings within or across classes or resourced teacher aides. Few had evidence that such programmes, initiatives and interventions, or additional staffing, such as teacher aides, actually accelerated the progress of their priority learners.

These findings reflect those of ERO's 2008 report *Schools' Provision for Students at Risk of Not Achieving*¹ in which concerns were expressed about what schools were doing to evaluate their support for identified learners.

As part of its Better Public Services^a programme the Government has set 10 targets to be achieved over the next five years. One of these is that 85 percent of 18 year olds will have achieved National Certificate of Educational Achievement (NCEA) level 2 or an equivalent qualification in 2017.

The findings of this evaluation highlight the need for urgent action to ensure students currently in Years 4 to 8 receive the necessary support to accelerate their progress so they can attain future qualifications.

^a See www.ssc.govt.nz/better-public-services

Next steps

ERO recommends that the Ministry of Education supports schools to:

- better use student achievement information to review and adapt their school’s curriculum so that it is responsive to all learners
- access and use research findings, such as that in the Best Evidence Synthesis (BES) publications, particularly the BES exemplars, to introduce different teaching practices that have been shown to accelerate learners’ progress in New Zealand schools.

ERO recommends that school trustees, leaders and teachers:

- examine their use of achievement information to ensure it promotes improved outcomes for their priority learners
- regularly use their achievement information to review and adapt their mathematics curriculum to ensure it is responsive to the strengths and needs of all students
- review the extent to which all learners are developing the capacity to understand and monitor their own learning and progress through their involvement in goal setting, and are being supported to identify their next steps
- evaluate the extent to which the progress of learners who are below and well below the mathematics standards is being accelerated by specific initiatives, programmes, interventions and additional staffing such as teacher aides.

Handwritten student work titled "Maths Revision".

1. A table with the rule: $x^2 + 4 = y$

x	3	4	12	5	6	
y	13	8	5	32	29	40

2. You can pour 15 200ml glasses of juice from 3 litre

3. A handwritten addition problem:

$$\begin{array}{r}
 63.5 \\
 56.9 \\
 5.006 \\
 6.05 \\
 + 5.69 \\
 \hline
 134.146 \\
 \text{The total is } 134.146, \text{ Rounded} \\
 = 134.15
 \end{array}$$

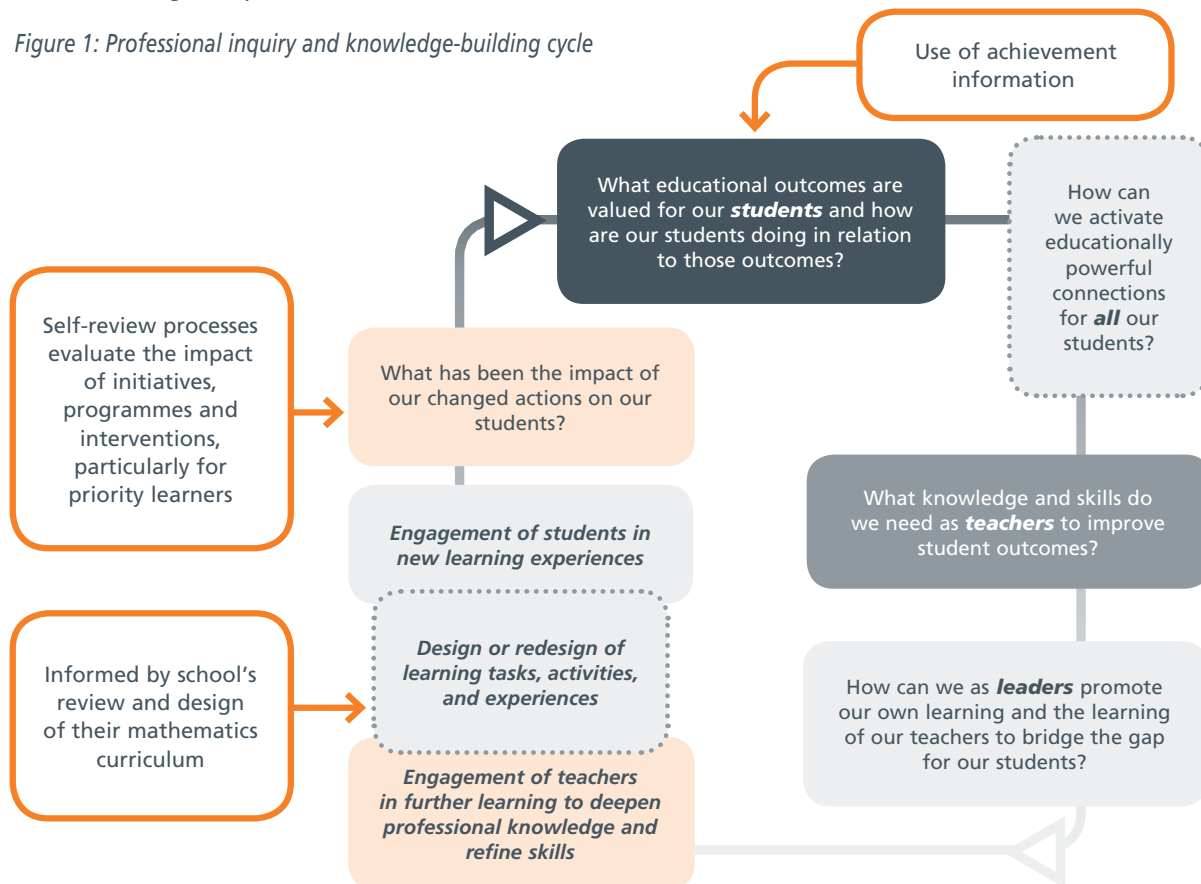
Introduction

This national evaluation report focuses on the important connections between the design and review of each school's mathematics curriculum, the use of achievement information by trustees, leaders, teachers and students, and the acceleration of progress of priority learners. The context is the learning area of mathematics and what is happening for students in Years 4 to 8.

ERO was interested in how effectively schools reviewed and designed their mathematics curriculum in response to what they knew about students and their progress and achievement in mathematics. In particular ERO investigated what was happening for students in Years 4 to 8 identified as achieving below or well below the mathematics standards.

As part of the Best Evidence Synthesis (BES) programme, a framework has been developed to help leaders and teachers use change processes that respond to the needs of diverse learners (see Figure 1.)² This framework implies that each school's curriculum is responsive to all students and that some change may be necessary in how the curriculum is designed to ensure that learning tasks, activities and experiences improve outcomes for all students, with a particular emphasis on each school's priority learners.

Figure 1: Professional inquiry and knowledge-building cycle



A 2010 ERO report *Preparing to Give Effect to The New Zealand Curriculum*³ showed that most schools were in a good position to give full effect to *The New Zealand Curriculum*. This report noted that many schools had:

- increased their understanding and appreciation of the intent of *The New Zealand Curriculum*
- successfully consulted a range of groups in the school's community
- effectively reviewed their vision and values and integrated these, along with key competencies, into planning and teaching
- comprehensively reviewed school curriculum documentation, before developing achievement objectives in each learning area and making connections between them across the curriculum
- made progress with aligning their school systems, policies and procedures to *The New Zealand Curriculum*
- engaged staff in implementing teaching strategies that further promoted student learning.

The next phase of each school's curriculum review and development process is to make use of information about student achievement and teacher capability to continue to review their curriculum and focus teaching programmes. Trustees, leaders and teachers need to know about:

- the progress and achievement of all learners
- the identification of learning priorities, and priority learners
- the capability of leaders and teachers to bridge the gaps through a responsive curriculum and associated teaching strategies
- the impact of change for identified learners.

Structure of this report

The findings of this evaluation are reported in three sections:

- Part A reports ERO's findings about the effectiveness of schools' review and design of their mathematics curriculum.
- Part B reports findings in relation to how trustees, school leaders, teachers and students were using achievement information in their respective roles and responsibilities.
- Part C looks at how teachers were accelerating the progress of learners who were achieving below or well below the mathematics standards.

Each section sets out a context for the findings that includes relevant background information and highlights why this is important.

A discussion of the findings provides a basis to identify next steps for schools and the Ministry of Education.

Appendix 1 shows the characteristics of the schools in the sample; Appendix 2 describes the methodology for the evaluation; and Appendix 3 provides a framework of evaluation questions and indicators schools can use as part of their self review.

Findings

PART A: REVIEWING THE MATHEMATICS CURRICULUM

Context for the findings

The New Zealand Curriculum is a statement of official policy about teaching and learning in English medium New Zealand schools. Its function is to ‘set the direction for student learning and to provide guidance for schools as they design and review their own [local] curriculum’.⁴

From the beginning of 2010, all schools were expected to develop and implement a curriculum for students in Years 1 to 13 that was consistent with the principles, values and key competencies outlined in *The New Zealand Curriculum*. The process of design and review is ongoing and responsive to each school’s context.

The New Zealand Curriculum empowers schools to exercise ‘the scope, flexibility, and authority they need to design and shape their curriculum so that teaching and learning is meaningful and beneficial for their particular communities of students.’⁵

Building into the curriculum aspects which have particular significance for school communities ensures that learning has meaning for students, and is supported by their families and the wider community. For this reason it should be reviewed regularly to ensure it adequately reflects the priorities for learners, and the vision and values of the communities in which they live.

The strands of the mathematics and statistics learning area of *The New Zealand Curriculum* provide a structure for the mathematics standards. The weighting given to the strands of mathematics changes according to year levels. For example the focus on the ‘number’ strand should be the focus of 60 to 80 percent of mathematics teaching time for students in Year 4. For students in Year 7 the focus on the ‘number’ strand changes to 40 to 60 percent of the teaching time. The weighting given to each mathematics strand should also be informed by what each school knows about the achievement of its students.

What did ERO ask?

How effectively is the school’s mathematics curriculum designed, enacted and reviewed to respond to the strengths and needs of all students and accelerate their progress and raise achievement?

What did ERO find?

ERO found variation in the extent to which schools effectively designed and reviewed their mathematics curriculum to respond to the strengths and needs of all students.

Table 1 outlines ERO’s findings about the effectiveness of schools’ curriculum review and design processes:

- Schools with the **most effective** curriculum review and design processes were those where assessment, curriculum design and teaching practices were highly integrated and connected.
- The schools with **partially effective** processes were focused on developing guidance for teachers and assessing student learning without the high level integration evident in the schools with effective processes.
- The third category of schools was those with **minimally effective** processes. For these schools the focus was on programme organisation.
- In the schools where processes were **not effective**, there was little evidence of any curriculum review and design of mathematics programmes.

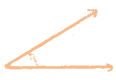









Angle	Type	Size
	acute (sharp)	less than 90°
	right	90°
	obtuse (blunt)	between 90° and 180°
	straight	180°
	reflex	between 180° and 360°
	revolution	360°

Table 1: Effectiveness of curriculum review and design

<p>Highly effective 11 percent</p> 	<p>In schools with a highly integrated approach to assessment, curriculum review and design, and teaching strategies:</p> <ul style="list-style-type: none"> • leaders collected, analysed and interpreted achievement information and what they knew about teaching practice in mathematics • leaders used the findings to make decisions about curriculum priorities, and about professional development for teachers • a collaborative approach to review sought input from teachers, parents and trustees and, in a few schools, students were also consulted • review of mathematics as a learning area was recent and linked to ongoing professional learning and development for teachers • leaders encouraged teachers to think about what would engage and extend students, and it was expected that the curriculum would be designed and adapted to achieve this • mathematics programmes integrated mathematics with other learning areas • mathematics contexts were relevant to students • students had opportunities to apply their mathematics knowledge in a range of tasks • students were helped to make connections between aspects of mathematics by teachers who taught the number strand through other mathematics strands • students' problem solving skills were developed through meaningful tasks.
<p>Partially effective 51 percent</p> 	<p>In schools where the focus was on developing guidance for teachers and assessing student learning:</p> <ul style="list-style-type: none"> • leaders concentrated on building teachers' knowledge about specific assessment practices such as moderation or how to make overall teacher judgements (OTJs) • review focused largely on the development of guidelines for teaching programmes and ensuring strand coverage and expected time allocations for topics • there was less of an emphasis on exploring best practice in teaching and assessing mathematics, particularly in the context of the mathematics standards.
<p>Minimally effective 32 percent</p> 	<p>In schools where the focus was on the organisation of the mathematics programme:</p> <ul style="list-style-type: none"> • some steps had been taken to review the mathematics learning area • the focus of review was on the mechanics of implementation, such as stipulating the time allocation for mathematics and ensuring all teachers covered the same content • few had developed guidelines to help teachers implement their mathematics programme • consultation was limited and often only involved teachers • few had accessed professional learning and development to build capacity, and pedagogical and assessment practices were poor.
<p>Not effective 6 percent</p> 	<p>In schools where there was minimal curriculum review:</p> <ul style="list-style-type: none"> • there was a high turnover of school leaders and/or teachers • information about student achievement was limited • there was little evidence of self review • curriculum leadership for mathematics was lacking.

ERO found that in most schools aspects of self review needed improvement. Often the focus of the inquiry neglected to look at aspects of teaching practice that might have impacted on achievement outcomes. Leaders often addressed the “what” (content) of the curriculum that should be taught, without considering the “how” (teaching approaches and strategies) or the “so what” (outcomes for learners). Self review should ensure that both learning *and* teaching come under scrutiny along with the impact for student outcomes.⁶

What are the implications of ERO’s findings for priority learners?

In the 11 percent of schools with **highly effective** curriculum review and design processes:

- Leaders and teachers made decisions about content and teaching and learning approaches.
- Teachers interpreted the curriculum in light of what they knew about the prior learning, emerging needs and the strengths and interests of students.
- Teachers adapted the curriculum so students experienced success and were fully engaged in their learning.
- Leaders gave teachers permission to exercise their discretion about both content and pedagogy.
- The school curriculum operated as a guide to what teachers could do, without restricting them in their responsiveness to students.
- In these schools, leaders and teachers successfully worked together to ensure mathematics programmes were relevant and tailored to all learners.

In the 51 percent of schools with **partially effective** curriculum review and design processes:

- Leaders and teachers had developed guidelines for mathematics programmes and were assessing students’ achievement and progress.
- Curriculum design focused mainly on coverage of, and time allocations for, the mathematics strands rather than on what leaders and teachers knew about students’ progress and achievement, particularly for those learners below or well below the mathematics standards.
- These schools had all the assessment data they needed to develop a curriculum that responded to the needs of priority learners.
- They did not necessarily have the confidence to move away from using predetermined long-term curriculum plans.

Many students will achieve and progress in schools that use the same programme outline each year. However, priority learners benefit from a more responsive curriculum.

Just over one-third of the schools had **considerable work to do** in reviewing and enacting their mathematics curriculum to respond to students, particularly learners who were achieving below or well below the standards in mathematics.

For the schools (six percent) that had made **little or no progress**, fundamental barriers had to be addressed. These included retaining staff, building capacity to engage in curriculum design and review, and implementing high quality mathematics programmes for all students. Lack of effective curriculum leadership, was also an impeding factor. Until these issues are addressed, students in these schools are unlikely to make the necessary progress.

In many schools, leaders and teachers focused largely on the mechanics of the curriculum such as the coverage of mathematics, the percentage of time spent on number and other strands, and on developing planning formats. Such activity precluded teachers from focusing on the broader issue of what constitutes powerful and responsive teaching in mathematics. Most teachers followed their school's guidelines for teaching mathematics that often described the topics and/or strands that were to be taught. This predetermined or prescriptive curriculum did not always match the identified strengths, interests and learning needs of the current group of learners.

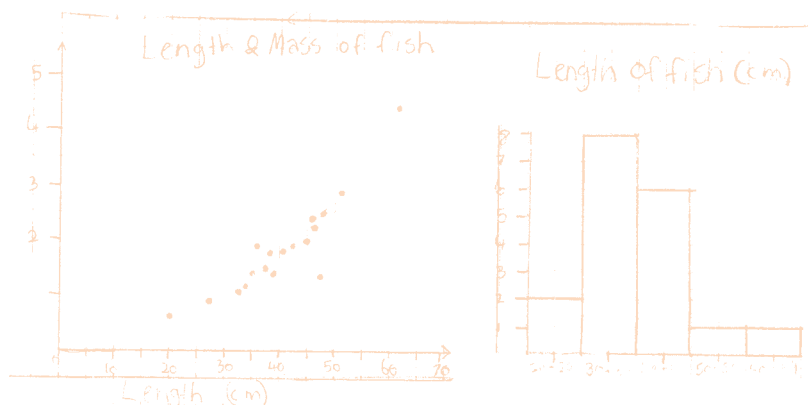
The implications of this for priority learners are profound. These students are already at risk because their achievement and progress is behind that of their peers. An unresponsive curriculum places them at even greater risk of failure and disengagement from school.

To improve current practice, schools must take a much more responsive and innovative approach to designing and enacting the curriculum. This means including rich content relevant to the diverse range of students in their schools. Teaching approaches need to be sufficiently attuned to the learners.

This reiterates ERO's recommendation in its August 2010 report *Working with the National Standards within The New Zealand Curriculum* which stated:

Ongoing review and design of each school's curriculum in relation to The New Zealand Curriculum is crucial to ensuring that teaching and learning programmes are responsive to what schools know about students' progress and achievement against the National Standards. Schools need support to implement robust self review that enables them to make their curriculum responsive to all students.

The findings of this current evaluation show that schools continue to need considerable support in this area.



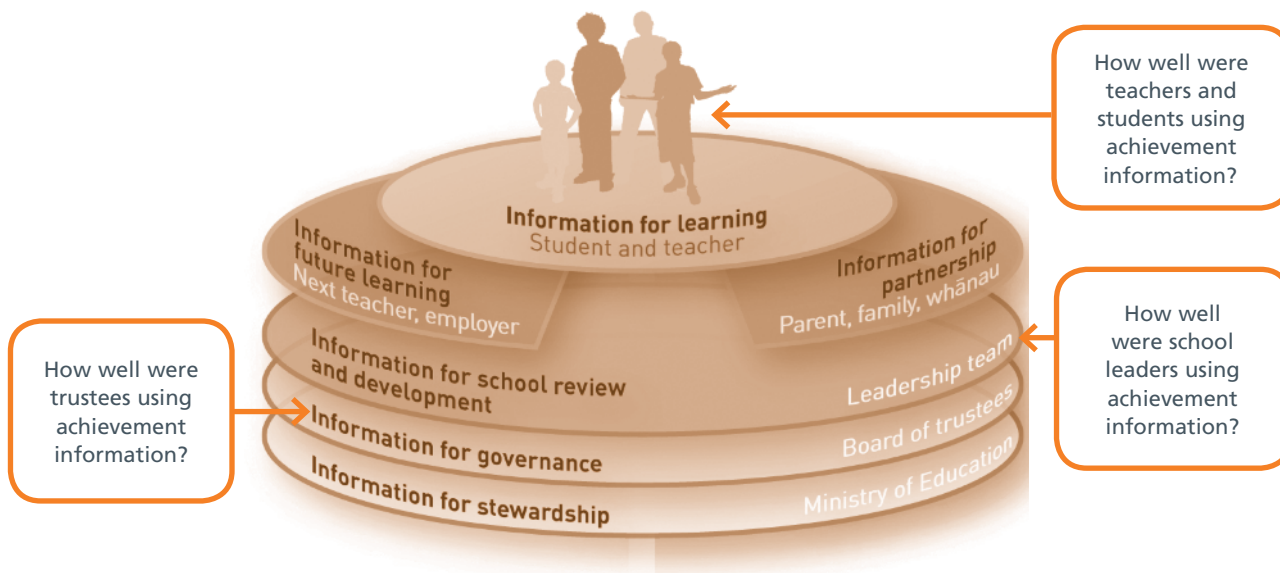
PART B: USE OF ACHIEVEMENT INFORMATION

Context for the findings

The New Zealand Curriculum states: ‘The primary purpose of assessment is to improve students’ learning and teachers’ teaching as both student and teacher respond to the information that it provides. With this in mind, schools need to consider how they will gather, analyse, and use assessment information so that it is effective in meeting this purpose.’⁷

Collecting, analysing and using achievement information should be part of a well-considered school strategy to improve learning and teaching. The following diagram illustrates how information can be used to contribute to improving outcomes for learners at all levels of the system.

Figure 2: The use of achievement information⁸



In this evaluation, ERO focused on how students, teachers, leaders and trustees used information about students’ achievement in mathematics (based on the mathematics standards) as part of their specific learning, teaching, management and governance roles and responsibilities.

Students’ involvement in goal setting, talking about their learning and knowing about their next steps are crucial to their success as learners.

The deliberate use of achievement information by **teachers** enables them to respond through their planning, make decisions about teaching strategies to use and determine how they involve students in their learning.

Leaders, on the other hand, need to have the systems and processes to gather, collate, analyse and use information about students’ progress and achievement, and teacher capability to improve teaching and learning.

Boards of trustees rely on timely, relevant, well analysed progress and achievement information, including National Standards’ information, which enables them to identify needs, trends and patterns that can inform decisions for future planning.

What did ERO ask?

To what extent is achievement information in relation to the mathematics standards used by:

- trustees to inform governance decisions
- school leaders to inform curriculum decisions
- teachers to inform their teaching
- students to inform their next steps in learning?

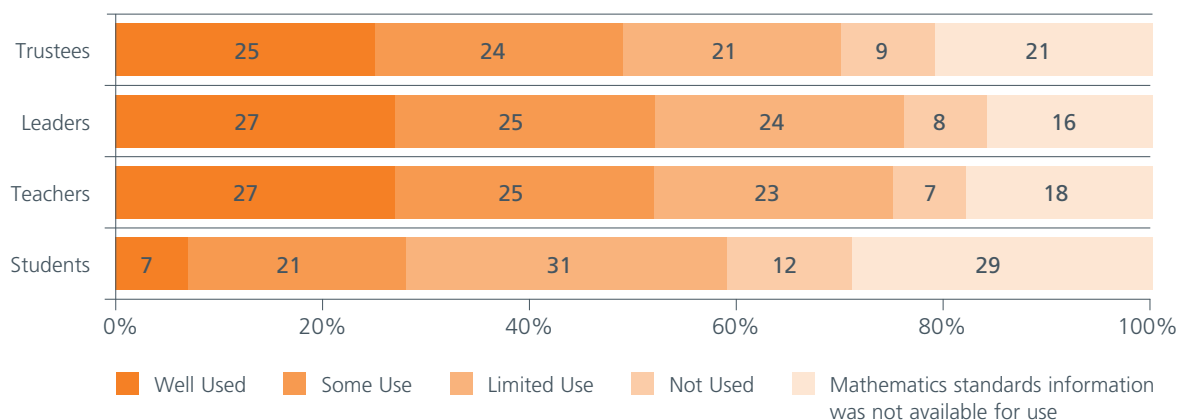
ERO’s findings on the use of achievement information to report to parents have been published in a separate report.⁹

What did ERO find?

The use of achievement information in relation to the mathematics standards by trustees, leaders, teachers and students was variable.

Figure 3 shows that in about one-quarter of schools achievement information was well used by trustees, leaders and teachers. Students’ use of information was weaker with achievement information being well used by students in only seven percent of schools.

Figure 3: Use of achievement information by trustees, leaders, teachers and students



ERO’s findings about the extent to which achievement information was used by students, teachers, leaders and trustees are shown in Table 2 as a ‘continuum of use.’

Table 2: Use of mathematics standards achievement information by trustees, leaders, teachers and students

By Trustees			
Well Used	Some Use	Limited Use	Not Used
<ul style="list-style-type: none"> Boards received good quality information regularly from school leaders, and were active and engaged – independently questioning the data and seeking to further their own understanding. They used the data to inform resourcing decisions, which were targeted and responsive to areas of need. Boards also used the information to set appropriate targets to raise achievement and align them with strategic goals. Robust self-review processes were evident. 	<ul style="list-style-type: none"> Boards received information of varying quality from school leaders. Generally they were not pro-active in their approach to understanding the data. They were more reliant on leaders to guide them. Trustees used the data to inform resourcing decisions and to set targets, but these were not as well developed as boards in the <i>Well Used</i> category. For example, targets were not challenging enough and resourcing was not specific to priority learners. Some self review was evident. 	<ul style="list-style-type: none"> The information boards received from leaders was often of poor quality. Generally trustees did not question the information or show a high level of understanding of what it was saying. Boards in this category showed a less sophisticated understanding of the National Standards. They responded to data largely through resourcing decisions, which varied in terms of their efficacy. Data was not used to inform strategic planning, and many boards did not use data for target setting. There was limited evidence of self review. 	<ul style="list-style-type: none"> Boards received some information from school leaders, but this was not analysed and, in some cases, ERO had concerns about the validity of the data. Boards in this category showed no evidence of considering the information in depth or using it to inform resourcing decisions, strategic planning or target setting. This was sometimes due to paucity of information, and sometimes due to a lack of board capability. No evidence of self review.

Table 2 continued: Use of mathematics standards achievement information by trustees, leaders, teachers and students

By Leaders			
Well Used	Some Use	Limited Use	Not Used
<ul style="list-style-type: none"> Leaders regularly collected and presented comprehensive student achievement information across all strands of mathematics. Information was analysed to show progress over time and to assess the efficacy of interventions. The information was used to inform decisions around PLD and curriculum, allocate additional staffing and set targets. The information was used as part of school self review. 	<ul style="list-style-type: none"> Leaders collected and presented student achievement information, but this was more variable in quality, regularity and comprehensiveness. Not all leaders tracked progress over time. The progress of priority learners was not always reported on. Self review was limited. 	<ul style="list-style-type: none"> Leaders collected information but this was often poor quality. There was limited use of information to inform PLD or to review assessment practices. Many leaders in this category were developing their understanding of the mathematics standards. Information was mostly used to identify students who needed support. Some targets were made, but often they were too general to measure or not challenging enough. Very little evidence of self review was found. 	<ul style="list-style-type: none"> Most leaders had not collected and analysed the information. In many cases ERO had concerns about the validity of the data, or the robustness of the overall teacher judgements (OTJs). Data was not used to inform target setting or identify professional learning and development priorities.

Table 2 continued: Use of mathematics standards achievement information by trustees, leaders, teachers and students

By Teachers			
Well Used	Some Use	Limited Use	Not Used
<ul style="list-style-type: none"> Teachers collected high quality data from a range of sources in order to inform their OTJs. This information was used to plan programmes and identify teaching strategies. They focused on the learners requiring additional support. Teachers showed a commitment to and understanding of teaching as inquiry. They provided regular opportunities to involve students and their parents, whānau and aiga in learning conferences and goal setting in relation to mathematics standards. 	<ul style="list-style-type: none"> Teachers were making OTJs based on data but these were less reliable than those in the <i>Well Used</i> category, because they were based on fewer sources, or related only to number and not all strands of mathematics. There were some responsive practices, but variability of quality of practices among teachers, within each school. Some teachers were using teaching as inquiry processes. There was some regular reporting to parents, whānau and aiga, but less evidence of their involvement in their child's goal setting and in supporting their learning. 	<ul style="list-style-type: none"> Teachers had less understanding of the mathematics standards and were less confident making OTJs. Achievement information was often related to the number strand only. Schools in this category also showed wide variability in the extent to which teachers in each classroom used information. Although achievement information was used to group students, it was not used to identify deliberate teaching strategies for each of these groups. 	<ul style="list-style-type: none"> Teachers were either: making minimal use of assessment information to teach students with no clear link to the mathematics standards; or making no use of assessment information to inform their planning and practice.

Table 2 continued: Use of mathematics standards achievement information by trustees, leaders, teachers and students

By Students			
Well Used	Some Use	Limited Use	Not Used
<ul style="list-style-type: none"> Teachers had explained the mathematics standards for students. Students were therefore able to use assessment information to reflect on their own learning. Students could talk about where they were in relation to the standards and their next steps. Students took an active role in goal setting and participated fully in learning conferences along with teachers and parents, whānau and aiga. Students were well supported by teachers to understand their achievement. 	<ul style="list-style-type: none"> These schools had some of the characteristics of the <i>Well Used</i> category, but with marked variability in the extent to which they shared achievement information with learners. In particular, students were less likely to understand their next steps, be engaged in effective goal setting or have a clear understanding of the mathematics standards. Older students were more likely than younger students to use assessment information to understand what they had learnt and needed to focus on next. 	<ul style="list-style-type: none"> In addition to the factors identified in the <i>Some Use</i> category, these students were less likely to be able to talk about their learning. Additionally, they were less likely to find out about their progress and achievement directly from their teachers. Such information was often sourced entirely from their school reports. 	<ul style="list-style-type: none"> Students were not aware of how well they were achieving in relation to the mathematics standards or informed about their next steps for learning. They had limited or no knowledge of the standards. In some cases teachers did not share information with students. Students were not involved in activities such as goal setting or learning conferences.

Schools where achievement information in relation to the mathematics standards was not available for use

As shown in Figure 3, in up to 29 percent of schools, achievement information in relation to the mathematics standards was not available for use by all groups (trustees, leaders, teachers and students).

Of the 29 percent of schools:

- Achievement information in relation to the mathematics standards was not available for use by trustees, leaders, teachers or students in 13 percent.
- In the remaining 16 percent, availability of achievement information in relation to the mathematics standards varied. For example, in some of these schools, teachers and/or leaders had information about achievement in relation to the mathematics standards, but it was not being reported to the board of trustees. In other schools, teachers were making OTJs in relation to the mathematics standards that were available for leaders to use, but they were not using the information in their teaching or sharing it with students.
- Overall, students were the largest group (29 percent) to not be using information about their achievement in relation to the mathematics standards. In some of these schools, students were aware of and using achievement information, but it was not in relation to the mathematics standards.

What are the implications of ERO's findings for priority learners?

The variability in use of achievement information identified in this evaluation raises questions about the understanding of trustees, leaders and teachers about the purposes of assessment and the principles of assessment for learning.

Trustees

Trustees rely heavily on school leaders providing timely and useful information that can be used to make evidence-based resourcing decisions. In almost three-quarters of the schools, boards were receiving information about achievement in relation to the mathematics standards. However, the quality of the data and the extent to which trustees used the data varied.

Trustees need to be able to understand what the information is telling them and ask relevant questions to help set targets and resource actions that will accelerate the progress of learners that are not achieving well. The variability in the use of data by trustees means that in some schools boards do not know if they are allocating funds for the right programmes and initiatives or the most useful teacher professional development. Further, when trustees do not receive information about the progress of identified learners, they are unable to determine whether allocated funding had resulted in the desired gains for learners that needed to make the most progress.

Leaders

School leaders play a critical role in supporting teachers, trustees, students and their parents to use achievement information to improve learning. Leaders establish school-wide guidelines for how assessment information will be collected and used.

In the schools ERO identified as using achievement information well, leaders put in place systems and clear expectations so that data collected was used by teachers, trustees and students. In many of the other schools, teachers collected data but it was not used to its full potential. For example, data was used to identify learners' achievement but was not used to review and develop the school's mathematics curriculum or to identify the most successful teaching practices. Teachers often invested considerable time and energy into assessment activities. School leaders need to ensure that the information gained from such activities is used to the fullest extent to benefit learners.

Teachers

The use of achievement information by teachers to inquire into their practice and inform their teaching decisions is essential to effective teaching. Some teachers were using the achievement information they collected to modify their programmes and to discuss progress and possible goals with individual students.

ERO's findings suggest that teachers need to move beyond using achievement information for grouping students and put more of a focus on inquiring into the effectiveness of their teaching strategies in terms of what works and what does not.

Students

Directions for Assessment in New Zealand highlights the importance of students being at the centre and notes 'all our young people should be educated in ways that develop their capability to assess their own learning.'¹⁰ ERO's findings in both this report and previous evaluations suggest that this remains a challenge for many schools.

Not all students get the opportunity to develop both the capability and motivation to assess, interpret and use information in ways that affirm and further their own learning. Students rely on their teachers to encourage and support them to take an active role in assessing their learning.

PART C: ACCELERATING THE PROGRESS OF LEARNERS BELOW AND WELL BELOW THE MATHEMATICS STANDARDS

Context for the findings

The literature on schooling improvement provides useful insight into how students' progress and achievement can be accelerated.

According to Lai et al¹¹ acceleration is:

- a rate of progress faster than the cohort to whom [an] individual belong[s]
- faster than the expected/normal rate of progress so that the [resultant] changed distribution comes to match an expected distribution^b
- made similarly by different subgroups within the total [target] group
- sustained for at least two to three years.

Alton-Lee notes that 'accelerated improvement requires a whole system to function as a collaborative learning community that is advancing progress on the four areas of leverage: pedagogy, educationally powerful connections, professional learning and leadership.'¹²

McNaughton and Lai (2009)¹³ assert that teachers who successfully improve students' literacy learning are knowledgeable and responsive in their approach to accelerating the progress of priority learners. Successful teachers draw on deep content knowledge, pedagogical content knowledge, and knowledge of students to "selectively and strategically apply known instructional procedures [and] are constantly refining and changing to be more effective." Along with the deep content knowledge, there is a disposition amongst expert teachers to be innovative and to problem solve in the pursuit of better teaching and learning.

Neill, Fisher and Dingle (2010)¹⁴ identified factors that contributed to the accelerated progress of low performing students in the pilot of the Accelerating Learning and Mathematics (ALiM) programme. These included:

- regular lessons that focused on gaps in knowledge, and on building students' use of mathematics strategies and language and memory
- opportunities for collaborative and peer supported learning that built students' confidence and sense of self efficacy
- activities that engaged students and were pitched at an appropriate level of challenge
- teachers with the necessary pedagogical content knowledge and disposition to be reflective and responsive to students
- coherence between ALiM and the overall school curriculum
- high levels of support from students' families.

^b The notion of shifting the distribution of achievement is further unpacked in a paper by McNaughton, S., & Lai, M (2009). A model of school change for culturally and linguistically diverse students in New Zealand: a summary and evidence from systematic replication. *Teaching Education*, 20(1), pp 55–75. The authors describe it as achievement in the school that matches the national distribution (the probability of being in any one part of the distribution such as high or low or average bands is no different for these students than what would be expected nationally).

As part of its Better Public Services^c programme the Government has set 10 targets to be achieved over the next five years. One of these is that 85 percent of 18 year olds will have achieved National Certificate of Educational Achievement (NCEA) level 2 or an equivalent qualification in 2017. For this to be achieved, a concerted effort is needed at both a system and a school level to provide the necessary interventions and support to accelerate the progress of those students who are currently working below or well below the National Standards.

What did ERO ask?

How are teachers accelerating the progress of learners who are below or well below the mathematics standards?

What did ERO find?

Generally, schools were very good at identifying learners in Years 4 to 8 who were achieving below or well below the mathematics standards. Most schools did this by looking into school-level collation and analysis of data, and by teachers using their classroom-focused analysis of achievement information. The exceptions were a few schools that either had no achievement data, the data did not pertain to the mathematics standards, or it only identified students below, and not well below the mathematics standards.

What happened for these students once they were identified did not necessarily accelerate their progress. This was partly because of a lack of understanding by leaders and teachers about what ‘accelerated progress’ actually means and partly because leaders and teachers did not know how to accelerate progress in mathematics.

ERO’s findings indicate that schools were tending to adopt a ‘business as usual’ approach to accelerating the progress of identified learners. There was more of a focus on giving learners some support than coming to grips with what it meant to accelerate progress, how to do this in relation to mathematics, and how to gather evidence about what does and does not work.

The most common approach to supporting learners who were below or well below the mathematics standards was by grouping for teaching. In many schools, teachers grouped students for teaching as part of the regular classroom mathematics programme. Some used cross grouping between classes across year levels based on data about students’ achievement in mathematics. Other responses included differentiating planning for individual students or groups of students, and using commercially available resources.

In at least half of the schools, teacher aides were working with learners who were below or well below the mathematics standards. They worked with individual students or small groups. Support was provided either in class or by withdrawing students, or a combination of both. Generally teacher aide support was undertaken under the guidance of the classroom teacher. The exception to this was

^c See www.ssc.govt.nz/better-public-services

where teacher aides had oversight of students engaged in independent learning activities, while the teacher worked with individual students or groups needing support.

A few schools took a more systematic and deliberate approach to accelerating progress. In these schools, leaders were questioning their previous use of resources such as teacher aides and exploring alternative solutions. Some were also exploring different teaching strategies, drawing on research and their own evidence of what works to better support learners.

ERO found minimal evidence of schools using robust self-review processes to inquire into and evaluate the impact of support programmes, initiatives and strategies, particularly where the intent was to accelerate learner progress.

What are the implications of ERO's findings for priority learners?

ERO is concerned that schools are continuing to use a range of programmes and initiatives with little or no evaluation of the impact for students involved in them.

These findings reiterate those in ERO's 2008 national evaluation report: *Schools' Provision for Students at Risk of Not Achieving* which stated:

ERO found that the majority of schools could adequately identify students at risk of not achieving, particularly in the areas of literacy and numeracy. There was a much wider variation in the quality and effectiveness of how schools addressed the specific needs of students, and monitored, reviewed and reported on the progress and impact of their provision. In particular, nearly half the schools in this evaluation needed to improve the way that they monitored and evaluated their initiatives or interventions.¹⁵

As noted in 2008, leaders and teachers generally know which learners need additional support and take steps to provide this. However, the issue lies with the nature of the support, the sense of urgency with which it is provided, and its effectiveness at accelerating learner progress.

Many trustees, leaders and teachers do not have a clear understanding of what 'accelerated progress' means for learners in their school. The expectation that something different may need to happen for identified students to 'accelerate' their progress is not widely held or understood.

The prevalence of teacher aides working with identified learners (particularly those below or well below the mathematics standards) either through in-class support or in withdrawal programmes is highlighted in this evaluation. ERO found the use of the least qualified adults to work with the learners who need the most expert teaching is accepted practice in many schools. The findings also highlight practices whereby learners are grouped according to ability in class or across classes as a response to accelerating the progress of identified students.

Alton-Lee¹⁶ refers to research that shows that ‘business as usual’ teaching, among other things can do harm in education. She notes that “resources can be allocated in ways that exacerbate disadvantage through practices such as fixed ability grouping, streaming, grade repetition and the allocation of the least qualified teachers or teacher aides to work with the lowest achievers or students with special needs.”

Compounding this issue is the finding that shows schools do not have the evidence that practices such as cross grouping and use of teacher aides actually lead to accelerated progress. ERO’s 2008 report about what was happening for students at-risk of underachieving noted that:

Given the significant investment that many boards of trustees make when employing staff such as teacher aides and other additional personnel, schools need to be clear about why they choose particular options. Trustees need regular information about the use of additional staffing, and the impact that resources and programmes have on students at risk of not achieving. Boards need this information to determine the effectiveness of their investment to make decisions about the future resourcing.¹⁷

Four years on from the 2008 report this remains the case. The findings of this 2012 evaluation highlight the need for improved monitoring, reporting and evaluation of the ways in which schools are using resources to accelerate the progress of identified learners.

Given the significant investment which schools are making to raise achievement for priority learners, there needs to be more robust self evaluation of the effectiveness of resourcing decisions.

powerful numbers

a. $5^2 = 5 \times 5 = 25$
 b. $8^2 = 8 \times 8 = 64$
 c. $3^3 = 3 \times 3 \times 3 = 27$
 d. $5^3 = 5 \times 5 \times 5 = 125$
 e. $2^3 = 2 \times 2 \times 2 = 8$
 f. $9^2 = 9 \times 9 = 81$ ³64
 g. $4^2 = 4 \times 4 = 16$ × 8
 h. $8^3 = 8 \times 8 \times 8 = 512$ 512
 i. $4^3 = 4 \times 4 \times 4 = 64$
 j. $1^2 = 1 \times 1 = 1$

a. $\sqrt{64} = 8$
 b. $\sqrt{16} = 4$
 c. $\sqrt{81} = 9$
 d. $\sqrt{9} = 3$
 e. $\sqrt{36} = 6$

Conclusion

According to international studies New Zealand students, on average, achieve well in literacy and numeracy, particularly at secondary school. Our highest achieving students are comparable to the best in the world. However, the education system continues to under-perform for some learners and we have a wide spread of achievement compared to other high performing countries, particularly at primary school level.^d

Learners who are not achieving to expected standards need a targeted approach that ensures they are meaningfully engaged in mathematics programmes that build on what they already know:

- A deliberate and relentless whole school focus, involving trustees, leaders, teachers, students and whānau is needed to bring about improvement for those learners.
- ERO has identified that in many schools the processes associated with reviewing the curriculum, assessing learning, teaching, managing and governing are not well connected to bring about such improvement.
- It is the dynamic and important connections between these processes that need to be strengthened.

The findings of this evaluation highlight the need for improved monitoring, reporting and evaluation of **the ways in which schools are using resources** to accelerate the progress of identified learners.

Given the significant investment schools are making to raise achievement for priority learners, there needs to be more **robust self evaluation of the effectiveness of resourcing decisions**. Bringing about such a change could lead to considerable system-wide improvement in New Zealand schools.

In the schools where there was a high degree of coherence and connections between these processes, mathematics programmes had relevance for learners. Teachers were innovative in their teaching and open to exploring different approaches to inquire their practice and make changes based on meaningful information.

This evaluation identifies two further areas that could contribute to the wider shift needed:

- Improving self-review processes to better evaluate what is working well, and for whom, would enable better targeting of resources in schools.
- Learners should have more opportunities to develop a better understanding of what they have already achieved and what they need to focus on next.

^d See www.educationcounts.govt.nz

NEXT STEPS

ERO recommends that the Ministry of Education supports schools to:

- better use student achievement information to review and adapt their school’s curriculum so that it is responsive to all learners
- access and use research findings, such as that in the Best Evidence Synthesis (BES) publications, particularly the BES exemplars, to introduce different teaching practices that have been shown to accelerate learners’ progress in New Zealand schools.

ERO recommends that school trustees, leaders and teachers:

- examine their use of achievement information to ensure it promotes improved outcomes for their priority learners
- regularly use their achievement information to review and adapt their mathematics curriculum to ensure it is responsive to the strengths and needs of all students
- review the extent to which all learners are developing the capacity to understand and monitor their own learning and progress through their involvement in goal setting, and are being supported to identify their next steps
- evaluate the extent to which the progress of learners who are below and well below the mathematics standards is being accelerated by specific initiatives, programmes, interventions and additional staffing such as teacher aides.

Handwritten mathematical equations on a grid background:

$$7 + 2 + 5 = 14$$

$$2 + 7 + 5 = 14$$

$$14 - 5 - 7 = 2$$

$$14 - 5 - 2 = 7$$

$$6 + 5 - 4 = 7$$

$$7 + 4 - 5 = 6$$

$$15 - 10 - 1 = 4$$

$$4 + 1 + 10 = 15$$

$$15 - 11 + 3 = 7$$

$$7 - 3 + 11 = 15$$

$$3 + 5 + 6 = 14$$

$$3 + 6 + 5 = 14$$

$$14 - 6 - 5 = 3$$

$$14 - 5 - 6 = 3$$

Appendix 1: Sample of schools

This evaluation involved 240 schools in which ERO carried out an education review in Term 4, 2011 and Term 1, 2012. The types of schools, roll size, school locality (urban or rural) and decile ranges of the schools are shown in Tables 1 to 4 below.

Table 1: School type

School type	Number	Percentage of sample	National percentage ^e
Full Primary (Years 1–8)	118	49	49
Contributing Primary (Years 1–6)	104	43	34
Intermediate (Years 7–8)	4	2	5
Secondary (Years 7–15)	7	3	4
Composite (Years 1–15)	6	3	7
Restricted Composite (Years 7–10)	1	<1	1
Total	240	100	100

Table 1 shows that intermediate and composite schools were under represented, and contributing primary schools were over represented, in comparison to national figures. Full primary and restricted composite schools were representative of national figures. The differences were statistically significant.^f

^e The national percentage of each school type is based on the total population of schools as at August 2012. For this study it includes full and contributing primary schools, intermediates, secondary, composite and restricted composite schools with students in Years 4–8. This applies to roll size, locality and decile in Tables 2, 3 and 4.

^f The differences between observed and expected values in Tables 1–4 were tested using a Chi square test. The level of statistical significance was $p < 0.05$.

Table 2: Roll size

Roll size ^g	Number	Percentage of sample	National percentage
Very small	24	10	11
Small	69	29	26
Medium	89	37	37
Large	41	17	18
Very large	17	7	8
Total	240	100	100

Table 3: School locality

Locality ^h	Number	Percentage of sample	National percentage
Main Urban Area	108	45	51
Secondary Urban Area	10	4	6
Minor Urban Area	22	9	11
Rural	100	42	32
Total	240	100	100

Table 3 shows that main, secondary and minor urban area schools were under-represented and rural schools were over-represented, in comparison to national figures. The differences were statistically significant.

^g Roll sizes for full and contributing primary schools, and intermediates are: very small (between 1–30); small (between 31–100); medium (101–300); large (301–500); and very large (500+). Roll sizes for secondary, composite and restricted schools are: very small (1–100); small (101–400); medium (400–800); large (801–1500); very large (1501+).

^h Based on location categories used by the Ministry of Education and Statistics New Zealand as follows: Main Urban population > 30,000; Secondary Urban 10,000 to 30,000; Minor Urban 1,000 to 9,999; Rural < 1,000.

Table 4: School decile ranges

Decile ⁱ	Number	Percentage of sample	National percentage
Low decile (1–3)	71	30	30
Middle decile (4–7)	97	40	39
High decile (8–10)	72	30	31
Total	240	100	100

ⁱ A school's decile indicates the extent to which a school draws its students from low socio-economic communities. Decile 1 schools are the 10 percent of schools with the highest proportion of students from low socio-economic communities, whereas decile 10 schools are the 10 percent of schools with the lowest proportion of these students.

Appendix 2: Methodology

ERO gathered data for this evaluation in the context of the major evaluation question for education reviews in schools:¹⁸

How effectively does this school's curriculum promote student learning – engagement, progress and achievement?

The evaluation framework for this evaluation included the following questions.

- How effectively is the **school's mathematics curriculum** designed, enacted and reviewed to respond to the strengths and needs of all students and accelerate their progress and raise achievement?
- To what extent is achievement information in relation to the Mathematics National Standards used by **trustees** to inform governance decisions?
- To what extent is achievement information in relation to the Mathematics National Standards used by **school leaders** to inform curriculum decisions?
- To what extent is achievement information in relation to the Mathematics National Standards used by **teachers** to inform their teaching?
- To what extent is achievement information in relation to the Mathematics National Standards understood and used by **students** to inform their next steps in learning?
- How are teachers accelerating the progress of students who are working below or well below the Mathematics National Standards?

All data was collected by ERO review officers in the normal review activities.

ERO's *Framework for School Reviews* sets out the process for education reviews.¹⁹

Indicators to guide review officer judgements were drawn from ERO's *Evaluation Indicators for School Reviews*.²⁰

The **framework for self review** in Appendix 3 has been developed from ERO's evaluation indicators.

Appendix 3: A framework for self review

How effectively is our **school's mathematics curriculum** designed, enacted and reviewed to respond to the strengths and needs of all students and accelerate their progress and raise achievement?

- we have a clear rationale for the choices made in designing the mathematics curriculum and in selecting learning areas of emphasis
- our learning programmes show adaptations to support students with diverse needs
- teachers confidently use their knowledge of: learning area content; pedagogy; the deeper features of *The New Zealand Curriculum*; their students and their needs; and the school's vision, values and learning priorities when selecting content and designing their teaching approach
- teachers use evidence from: research; their colleagues; and their own past practice to reflect on and improve their teaching
- teachers recognise students' identities, languages, abilities and talents and ensure their learning needs are addressed
- teachers undertake regular professional learning relating to pedagogy, their teaching areas, and pedagogical content knowledge
- our school's community is reflected in school documentation, curriculum content and resources
- we use self-review processes to investigate the effectiveness of curriculum decision-making in improving student engagement and achievement
- the opinions and views of students, parents and whānau are incorporated as part of ongoing review and development of the curriculum and learning programmes
- board members are engaged in the design of the school's curriculum.

To what extent is achievement information in relation to the mathematics standards used by our **board of trustees** to inform governance decisions?

- the board receives comprehensive, clear, and accurate reports about achievement and uses this information to plan for improved student outcomes
- trustees are highly interested in progress and achievement information to identify needs, trends and patterns, compare progress over time and to inform decisions for future planning
- the board has an ongoing cycle of robust self review that identifies priorities for improvement, develops and implements plans, monitors progress, and evaluates effectiveness
- our strategic plan identifies the most urgent learning needs for all learners who are at risk of not achieving
- our targets are challenging and encompass year levels, learning areas, and key groups including priority learners
- the actions in our annual plan are focused on priorities likely to lead to improved student outcomes, and outline what will be put in place, who will be responsible and manageable timelines

PAGE 30

- we ensure that there is clear alignment from the strategic plan, through the annual plan, to curriculum implementation
- our board has clear expectations about the extent and timeliness of reports they should receive from school leaders about student progress and achievement
- strategic and other planning is based on analysed student achievement data and other information
- our self-review processes are well understood and embedded in a way that ensures their ongoing use.

To what extent is achievement information in relation to the mathematics standards used by our **school leaders** to inform curriculum decisions?

- student achievement information provides clear evidence of how well students are achieving in relation to the National Standards
- our analysis of achievement data identifies achievement patterns and trends, for the school, for cohorts, and groups of learners
- individuals or groups of students who need support or extension are identified
- our analysis of student achievement data (including separated data for Māori and Pacific achievement and special needs and abilities) is used to improve teaching and to identify areas for teacher professional development
- learning programmes have appropriate sequences and coherent progression over the class and year levels
- achievement data is analysed to improve future learning programmes
- we have a clear rationale for the choices we make in designing the curriculum and in selecting learning areas of emphasis
- we compare achievement for year levels from year-to-year to identify trends and patterns
- content taught in one part of the programme is well integrated with other parts of the programme
- we use self-review processes to investigate the effectiveness of curriculum decision-making in improving student engagement and achievement.

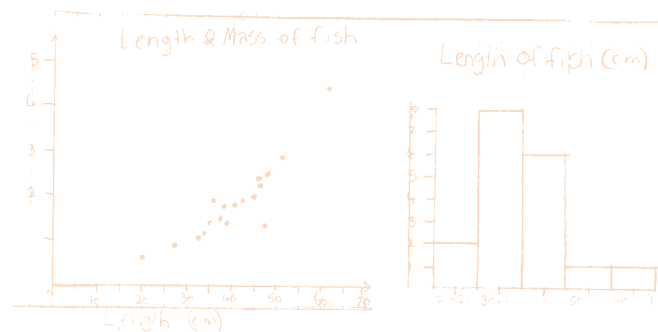
To what extent is achievement information in relation to the mathematics standards used by our **teachers** to inform their teaching?

- our student achievement information provides clear evidence of how well students are achieving in relation to National Standards
- assessment data is used effectively to inform planning, identify individual students for support or extension and to set goals with students and their parents/whānau, support staff or specialist teachers
- our learning programmes show adaptations to support students with diverse needs
- we analyse achievement data to improve future learning programmes

- teachers establish high expectations for learning
- all teachers demonstrate the belief that all learners can achieve regardless of their ethnicity, social background, gender, ability or needs
- teachers identify strengths and potential in all students to support their learning and development
- teachers use their knowledge of their students to decide on the teaching content and approach that will motivate and challenge them
- teachers develop clear learning goals based on knowledge of individual students
- learning activities and content are relevant, authentic and interesting for all learners
- students' learning is carefully sequenced to build on their prior knowledge
- deliberate acts of teaching are targeted to students' learning needs
- teachers provide timely, accurate and meaningful information to parents about their child's progress and achievement.

To what extent is achievement information in relation to the mathematics standards understood and used by our **students** to inform their next steps in learning?

- students can talk about their own learning and achievements and their next steps for learning
- teachers provide sufficient and effective opportunities for all students to engage in purposeful learning
- students understand and use processes, tools and strategies to learn new concepts and transferable skills
- assessment processes are fair and inclusive enabling all students to demonstrate their learning
- all students receive regular, specific and constructive teacher feedback that contributes to the next stage of learning
- teachers assist students to understand more about their own learning
- teachers encourage students to set high personal learning goals and take their share of the responsibility for achieving these
- exemplars are effectively used to help students understand what high quality work looks like.



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