



# mathematics

## Key findings from the Trends in International Mathematics and Science Study (TIMSS) 2010/11

### Year 9 Mathematics

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### What is TIMSS?

The Trends in International Mathematics and Science Study (TIMSS) measures trends in mathematics and science achievement at the fourth and eighth grades (Years 5 and 9) as well as monitoring curricular implementation and identifying the most effective instructional practices from around the world. Conducted on a regular 4-year cycle, TIMSS has assessed mathematics and science since 1994. More than 300,000 students from 44 countries and 14 benchmarking participants around the world took part in TIMSS 2010/11 at the lower secondary level.

### What does TIMSS consist of?

TIMSS consists of assessments of students' achievements in mathematics and science. Each student answered a combination of mathematics and science questions. The assessment was a pencil-and-paper test containing both multiple-choice and constructed-response questions. Following this, students were given a questionnaire containing questions about themselves and their opinions about mathematics and science. Principals and teachers were also given questionnaires to gain further information about the context in which mathematics teaching and learning take place. In New Zealand, the assessments and questionnaires were conducted in English.

The TIMSS assessments are organised around two dimensions: a content dimension specifying the domains or subject matter to be assessed within mathematics and science; and a cognitive dimension specifying the domains or thinking processes to be assessed. The content dimensions for mathematics are: number, algebra, geometry, and data and chance. The cognitive domains are: knowing, applying, and reasoning.

### Why participate in TIMSS?

Although it is often assumed that the international studies are only useful for international benchmarking purposes, the real value of TIMSS lies in its ability to provide a rich picture of mathematics and science achievement within the New Zealand context and over time.

TIMSS (along with other international assessment studies) can provide information about the performance of the New Zealand education system at the national level and in a global context. The information from studies such as TIMSS is used in the development and review of policy frameworks and also to inform and improve teaching practice. Developments arising out of previous cycles of TIMSS include resource materials for schools and teachers along with teacher in-service training programmes.

# Key Findings

## Achievement in an international context

- New Zealand Year 9 students had mathematics achievement around the middle when compared with other participating countries, lower than 14 countries, similar to 4, and higher than 23 countries.
- There has been no significant change in the mean mathematics achievement of Year 9 students since the first cycle of TIMSS in 1994/95, although due to a non-significant decrease it is now significantly below the TIMSS scale centre value.
- In the international context, the range of achievement within New Zealand was moderate. This is in contrast to the 15-year-old students assessed in PISA where New Zealand has one of the widest ranges of achievement.
- There was a relatively high proportion of very low achievers (students who did not reach the low benchmark) in this cycle of TIMSS compared with countries with similar or higher mean mathematics achievement.
- Instructional hours in mathematics in New Zealand lower secondary classrooms was about average when compared to other countries.
- New Zealand lower secondary students performed relatively better on statistics questions (called *data display* in TIMSS) and relatively worse on *algebra* questions. The cognitive aspects of *reasoning* and *applying* were relative strengths for Year 9 students while *knowing* was a relative weakness.

## Equity in the New Zealand system

- Year 9 boys had higher mathematics achievement, on average, than girls. Since the previous cycle of TIMSS (2002/03) there has been a significant decrease in achievement for Year 9 girls, and a small non-significant increase for Year 9 boys. This cycle (2010/11) is now the first to show a significant difference between the boys and the girls.
- There were advanced achievers and very low achievers in all ethnic groupings. However, there were proportionately more Pākehā/European and Asian advanced achievers compared with the Pasifika and Māori ethnic groupings. There were also more very low achievers among Pasifika and Māori groupings than among Pākehā/European and Asian groupings. There has been a significant decrease in mean achievement among Pākehā/European students since the first cycle of TIMSS in 1994/95.

- Regardless of the measure used to assess socio-economic status (SES), students with lower SES had lower achievement than students with higher SES. In particular, on an international measure of the SES of the school attended, students in schools with a greater concentration of affluent students had higher achievement than students in schools with a greater concentration of disadvantaged students. On this measure New Zealand had one of the highest differences in achievement between these two groups.

## Student attitudes

- Nearly all Year 9 students planned to get some form of qualification, some with expectations at the secondary level and some at tertiary.
- Year 9 students in New Zealand were generally positive about learning mathematics. Compared to other countries, on average, similar proportions of New Zealand Year 9 students were confident and valued mathematics, but fewer liked it.
- Students who were more positive about learning mathematics had, on average, higher achievement than those who were more negative. The self-confidence of students had a stronger relationship with mathematics achievement than how much they liked or valued learning mathematics.
- Year 9 boys' enjoyment, confidence and valuing of learning mathematics were all higher than that of girls in New Zealand. Nearly half of girls reported not liking and not being confident in mathematics.
- A greater proportion of Pasifika and Asian students reported liking and valuing learning mathematics, compared with Māori or Pākehā/European students. Asian students were more likely to report high levels of confidence in learning mathematics than students from any of the other ethnic groupings.

## School leadership

- Principals of New Zealand schools with Year 9 students were, on average, less likely than their international counterparts to report spending a lot of time on any leadership activity. .

## School climate for learning

- Year 9 students generally perceived their school to be a good place to be. More than eight out of ten students agreed that they felt like they belonged at school and were safe there. A higher proportion of girls than boys were positive about school and Pasifika and Asian students were the most positive of the ethnic groupings.
- Fewer New Zealand Year 9 students liked being at school compared to the average student internationally.
- Teachers and principals were generally very positive about their school climate for learning, including having a safe environment, knowledgeable staff, supportive parents, and well-behaved students. However, principals tended to be slightly less positive about the teaching staff and more positive about parental support than the teachers.
- The proportion of New Zealand Year 9 students experiencing negative behaviours at school was similar to the average internationally. A higher proportion of boys than girls experienced these behaviours but no particular ethnic grouping experienced these negative behaviours more than would be expected based on their proportion of the population.
- Teachers of Year 9 students indicated that there were several factors that presented at least some limitations to their teaching of mathematics, particularly having students with a lack of prerequisite knowledge or skills.
- More than half of the TIMSS Year 9 students had teachers who perceived various issues were at least a minor problem in their current school, particularly teachers having too many teaching hours or inadequate workspace. New Zealand teachers were relatively positive about their working conditions compared to most other TIMSS countries.
- A lack of computers and computer software for mathematics instruction were the resources most commonly seen by principals as having an impact on instruction.

## Teaching

- More New Zealand lower secondary mathematics teachers felt well prepared to teach topics in mathematics compared with their peers in other countries but slightly fewer expressed high levels of confidence in their ability to teach mathematics.
- New Zealand mathematics teachers tended to require memorisation of facts less frequently than their peers in other countries. Similarly, they used assessment less frequently than their peers in other countries, on average.
- New Zealand mathematics teachers tended to use textbooks more as a supplement rather than as a basis for instruction. In contrast, teachers in other countries were more likely to use textbooks as a basis for instruction.
- New Zealand mathematics classrooms were less likely to have computers available for instructional use compared with other countries.

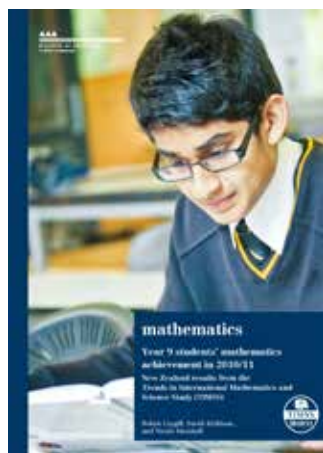
## Information

### National Reports

The key findings in this pamphlet summarise the information from the national report:

#### **Year 9 students' mathematics achievement in 2010/11: New Zealand results from the Trends in International Mathematics and Science Study (TIMSS)**

Authors: Robyn Caygill, Sarah Kirkham and Nicola Marshall



This report describes the mathematics achievement of Year 9 students in TIMSS 2010/11. New Zealand's achievement is examined, along with comparisons with other countries and trends in TIMSS achievement over time. Analyses of achievement by sub-groupings (such as gender and ethnicity) and background information are also presented.

Along with this report on Year 9 mathematics, the documents listed below form a suite of reports about New Zealand's participation in TIMSS 2010/11 ([www.educationcounts.govt.nz/goto/timss](http://www.educationcounts.govt.nz/goto/timss)). Further analyses and reporting will be undertaken in 2013.

### Other national reports



**Year 5 students' science achievement in 2010/11: New Zealand results from the Trends in International Mathematics and Science Study (TIMSS)**



**Year 5 students' mathematics achievement in 2010/11: New Zealand results from the Trends in International Mathematics and Science Study (TIMSS)**



**Year 9 students' science achievement in 2010/11: New Zealand results from the Trends in International Mathematics and Science Study (TIMSS)**

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### International Reports

International findings for mathematics (Mullis, Martin, Foy, & Arora, 2012) for TIMSS 2010/11 have been published by the IEA and are available from IEA <http://www.iea.nl/> and TIMSS & PIRLS study centre <http://timss.bc.edu/>.

*Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, (Eds.), 2011) contains a detailed account of the procedures for scoring, translation of materials, sampling, survey operations, quality assurance, sampling weights, item analysis, scaling, and reporting and can be found at <http://timssandpirls.bc.edu/methods/index.html>.

The *TIMSS 2011 user guide for the international database* (to be published in 2013) contains information on how to analyse the data.

TIMSS has also published the *TIMSS 2011 encyclopedia: a guide to mathematics and science education around the world* (Mullis, Martin, Minnich, Stanco, Arora, Centurino & Castle (Eds.) 2012) to provide a context in which the TIMSS results can be examined. This encyclopaedia contains short reports from each country describing mathematics and science education policies and practices in that country.