



science

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

Year 9 Science

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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 science 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 science are: biology, chemistry, physics, and Earth science. 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 higher science achievement than 25 participating countries, similar to 6, and lower than 10 countries.
- There has been no significant change in the mean science achievement of Year 9 students since the first cycle of TIMSS in 1994/95.
- 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 science achievement.
- New Zealand lower secondary students performed relatively better on *Earth science* questions and relatively worse on *chemistry* questions. The cognitive aspect of *reasoning* was a relative strength for Year 9 students while *applying* was a relative weakness.

Equity in the New Zealand system

- Year 9 boys had higher science 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.
- 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 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 Pasifika and Māori students since 2002/03.
- 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 science. Compared to other countries, on average, fewer New Zealand Year 9 students liked science, were confident in their ability to do science, and valued science.
- Students who were more positive about learning science had, on average, higher achievement than those who were more negative. The self-confidence of students had a stronger relationship with science achievement than how much they liked or valued learning science.
- Year 9 boys' enjoyment, confidence and valuing of learning science were all higher than that of girls in New Zealand.
- A greater proportion of Asian students reported liking and valuing science than any of the other ethnic groupings. Asian and Pākehā/European students were slightly more likely to report high levels of confidence in learning science than Pasifika or Māori students.

Teaching

- More New Zealand lower secondary science teachers felt well prepared to teach topics in science and expressed high levels of confidence in their ability to teach science compared with their peers in other countries.
- New Zealand science teachers tended to place less emphasis on science investigations than their peers in other countries.
- New Zealand science 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 science classrooms were less likely to have computers available for instructional use compared with other countries.

School leadership

- Principals of New Zealand schools with Year 9 students in them 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 science, particularly having disruptive or uninterested students.
- 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 overcrowded classrooms. New Zealand teachers were relatively positive about their working conditions compared to most other TIMSS countries.
- A lack of computers and computer software for science instruction were the resources most commonly seen by principals as having an impact on instruction.

Information

National Reports

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

Year 9 students' science 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 science 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 science, the documents listed below form a suite of reports about New Zealand's participation in TIMSS 2010/11 (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' mathematics 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 science (Martin, Mullis, Foy, & Stanco, 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.