Achievement in technology

Summary of results from the 2016 National Monitoring Study of Student Achievement for teachers and principals

Wānangatia te putanga tauira
National Monitoring Study of Student Achievement

Purpose

The National Monitoring Study of Student Achievement (NMSSA) is designed to assess and understand student achievement across the *New Zealand Curriculum* (NZC) at Year 4 and Year 8 in English-medium state schools.

What we assessed

In 2016, we assessed technology in Years 4 and 8 using nationally representative samples of about 2,300 students from 100 schools at each year level. Up to 27 students in each school completed an assessment called the *Technological Literacy (TELI)* assessment. The assessment covered three strands of the technology learning area: technological practice, technological knowledge, and the nature of technology.

Scores on the assessment were located on the TELI measurement scale (see graph at top right). A curriculum alignment exercise with a panel of experts was used to define the minimum scores on the TELI scale that indicated students were, on balance, meeting the achievement objectives at each of curriculum levels 2 to 4.

Students, teachers and principals responded to questionnaires to provide contextual information.

Key findings

- Percentage of students achieving at or above expected curriculum levels

Year level and curriculum level	All students %	Māori students %	Pasifika students %	Students with SEN* %
Year 4, level 2 and above	73	57	51	57
Year 8, level 4 and above	53	34	26	21

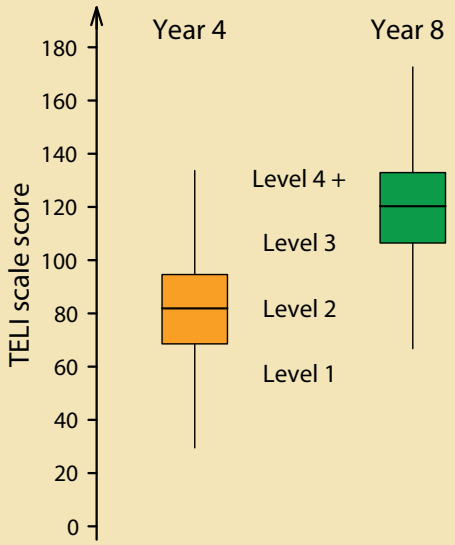
*students with special education needs

- The average for Year 8 students was 38 TELI units higher than Year 4 students. This indicates that, on average, students made about 10 TELI units of 'progress' per year between Year 4 and Year 8.
- There were statistically significant differences for students' gender and ethnicity, and school decile. At both year levels:
  - the average score for girls was about 6 TELI units higher than boys
  - the average score for Māori students was 11 TELI units lower than non-Māori students (equivalent to about one year of learning)
  - the average score for Pasifika students was about 14 TELI units lower than non-Pasifika students (equivalent to about one and a half years of learning)
  - the average score for students from low decile schools[1] was about 14 TELI units lower than students from mid decile schools, and 20 TELI units lower than students from high decile schools. This difference between low and high decile schools is roughly equivalent to two years of learning.

[1] The 'low' decile band comprised students in decile 1 to decile 3 schools, the 'mid' decile band, students in decile 4 to decile 7 schools and the 'high' decile band, students in decile 8 to decile 10 schools.

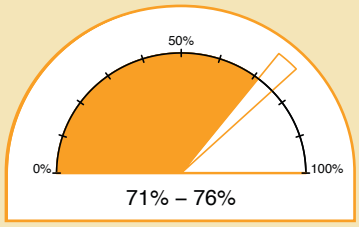
Study participants: About 2,300 students from 100 schools at Year 4 and at Year 8 were involved. More than 230 teachers at each year level completed the teacher questionnaire. In total, 182 principals completed the principal questionnaire; 91 from each year level.

Distribution of scores on the Technological Literacy (TELI) scale

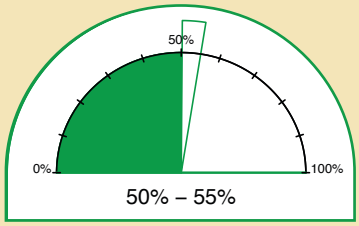


Note: The blurred lines show the boundaries between curriculum levels. The lines are blurred to indicate the margin of error associated with defining boundaries.

Percentage of Year 4 students achieving at curriculum level 2 and above



Percentage of Year 8 students achieving at curriculum level 4 and above



Note: The unshaded 'fan' on each dial is used to show the margin of error associated with the percentage reported.

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Example task: *Doofer*

The *Doofer* task consisted of four items. Reported for each item are the curriculum focus, the scoring categories, example responses and the percentage of students who scored in each category.

Students watched a video clip about an invention called a doofer and its special dispenser.

Item 1. Follow the instructions on your doofer to put it together.
What are two good things about the design of the doofer? Think about how it has been made.

Focus: Identify a technological product and describe relationships between the physical and functional attributes.

Scoring category	Example responses	Year 4 %	Year 8 %
0: Inappropriate response or unable to respond.	'It holds a burger.' 'It's made to hold food.'	23	6
1: General statement/ observations. Describes the doofer but with no link to design.	'It's easy to make.' 'It's cool/fun.' 'Juices don't fall out.' 'It's made out of cardboard.'	66	72
2: Describes properties and how they related to the design choices.	'It's made from recycled sustainable materials.' 'It is a net which means it can be stored flat.'	11	22

Item 2. The doofer dispenser is a machine that enables the customer to get a doofer.
On the photo of the doofer dispenser label its parts.

Focus: Identify the components of a technological system and how they are connected.

Scoring category	Example responses	Year 4 %	Year 8 %
0: Inappropriate response or unable to respond.	'Magnet.'	57	26
1: Identifies parts – includes the handle and suction/sticky cup (plunger).		43	74

Item 3. Explain how the dispenser parts work together so a customer can get a doofer.

Focus: Identify the role each component has in allowing the inputs to be transformed into outputs within simple technological systems.

Scoring category	Example responses	Year 4 %	Year 8 %
0: Inappropriate response or unable to respond.	'Push.' 'Get a doofer.'	28	9
1: General description of function.	'Push the handle down and take a doofer.' 'Suction cup grabs doofer.' 'Lift handle to get a doofer.'	62	53
2: Deeper description describing how all three actions effect the transformation.	'Handle is pushed down so suction cup makes contact with the doofer and it is released from the pile, then the handle is pulled up with the doofer attached.'	10	38

Item 4. Why might Burger Fuel (the burger restaurant) have a dispenser for their doofers?

Focus: Describe possible users and functions of a technological outcome based on clues provided by its physical attributes.

Scoring category	Example responses	Year 4 %	Year 8 %
0: Inappropriate response or unable to respond.	'To help.' 'To get a doofer.'	52	23
1: Simple reasoning.	'To make it fun.' 'To keep it clean.' 'For easy storage.' 'To get one if they want it.'	40	50
2: Deeper reasoning that describes need.	'To have something other burger outlets don't have.' 'To be seen to be environmentally friendly by not giving every customer a doofer.' 'So people wouldn't take many – only one at a time.' 'To save costs in handling or constructing doofers.'	8	27

What students know and can do in technology

The graphic below shows the relationship between scale scores on the TELI assessment, and the knowledge and skills that were typically demonstrated by students in their responses to the TELI tasks. The descriptors show how the knowledge and skills typically demonstrated by students on the TELI assessment became increasingly complex as scores progressed from low to high.

Scale description of the TELI scale by technology strand

Scale score

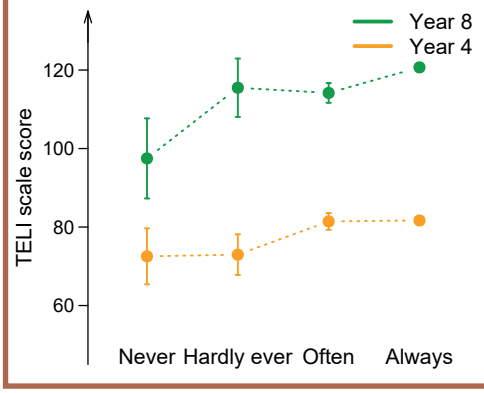
Scale score	Technological Practice	Technological Knowledge	Nature of Technology
200 – 160	• Make comparisons and evaluate the attributes of similar products • Describe how products feasibly combine to function successfully	• Give descriptions for testing functional models, including measuring and recording methods • Describe how the components of a system transform an input into an output • Describe the need for evaluation and modification of a design • Draw and label the main black box components of a technological system	• Recognise and explain how the attributes of an object allow it to function as intended • Describe properties of a design, considering design choices • Describe the potential impacts of technology on people's physical abilities • Describe the wider implications for use of a technological outcome, e.g. environmental, commercial • Describe positive and negative impacts of a technological system on wider society • Identify design faults in an everyday object • Describe the needs and wider impacts on society of a technological outcome • Explain why technological outcomes have changed over time • Compare functional and physical nature of similar technological products
140 – 100	• Describe attributes of a technological outcome • Explain how a design meets all needs outlined in a brief • Order key stages involved in the production of a given outcome • Describe modifications to a technological outcome considering a brief • Recognise key stages in the development of a given outcome	• Give reasons why prototyping is important in technological modelling • Describe implications of functional modelling • Identify the parts and describe transformation within a system • Identify benefits of functional modelling in computer assisted design • Describe simple methods for testing functional models • Draw and label components of a technological system including input, output and black box • Give reasons for the use of specific materials in technological products • Name parts of a technological system • Recognise how a technological product changes materials	• Describe and justify the impact of technology on society and the environment • Name general purpose of technological outcomes • Describe impact of technology on cultural practice • Recognise sustainable practice in the development of technological products • Name positive and negative impacts of a technological system • Describe how a technological outcome can be adapted for another purpose • Make connections between technological products and needs of potential users • Identify how the parts of an object work • Identify feasible users of a technological product • Name positive attributes of a system • Explain the need and direct impact of a technological outcome
80 – 60	• Show how a design meets some needs outlined in a brief • Give general description of a product's function • Name positive attributes of an outcome • Follow instructions to make a simple mock-up	• Give reasons for the use of different materials in a technological outcome • Describe in general terms how the parts of a system work together • Give general reasons for making a mock-up • Name general attributes and function of a design • Give general purpose of functional modelling	• Describe positive impacts of technology on society and environment • Name main parts of a technological outcome • Give simple reasons for the features of an object • Name a fault of a given technological outcome

What factors are related to achievement in technology?

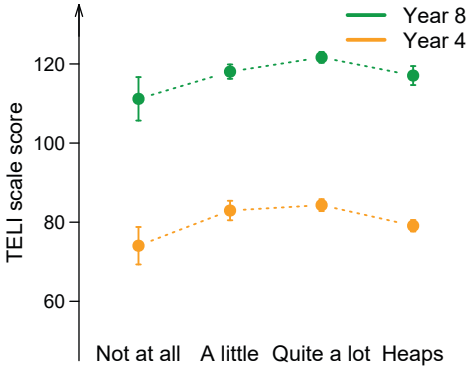
Achievement on the TELI assessment was related to several factors:

- How often students spoke English at home
  - Most NZ European, Māori and Pasifika students always spoke English at home.
  - The average score for students who 'always' spoke English at home was 10 TELI units higher at Year 4 and 25 TELI units higher at Year 8 than those who 'never' spoke English at home.
- How much students liked school
  - Most students liked school 'quite a lot' or 'heaps'.
  - Students who liked school scored, on average, higher than those who didn't like school at all.
- Particular learning opportunities at Year 8
  - Year 8 students' TELI scale scores were positively related to how often they talked about good and bad designs; explored and worked with different materials; and looked at and talked about a brief.

Average scores on TELI assessment, by how much students spoke English at home



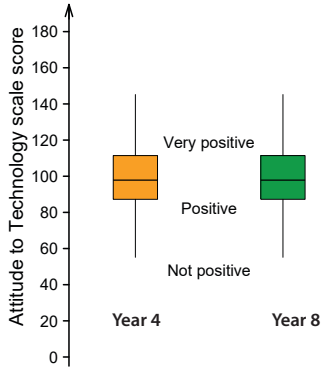
Average scores on TELI assessment, by how much students liked school



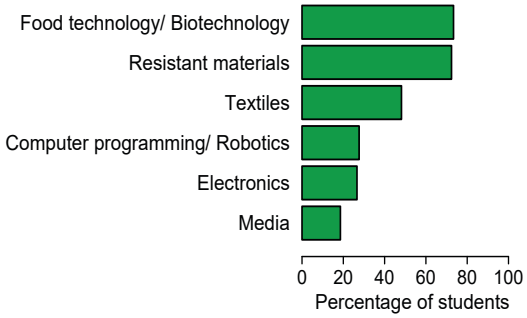
Attitude to technology

- Students at both year levels were positive about learning technology.
- Students with a more positive attitude scored higher on the TELI assessment than those who were less positive.

Distribution of scores on the Attitude to Technology scale,



Percentage of Year 8 students taking areas of technology



Opportunities to learn technology

- At Year 8, 70 percent of students took resistant materials and food technology/ biotechnology. Fewer than 30 percent took computer programming, electronics or media.
- There were more opportunities to learn technology at Year 8 than at Year 4.

Percentage of teachers reporting that learning opportunities in technology happened frequently, by year level

Learning opportunity	Year 4 %	Year 8 %
Talk about and make models of their design ideas	30	61
Learn how technology has changed the way people do things	48	70
Look at and talk about a brief	19	67
Explore and work with different materials	23	74
Talk about their own and others' work in technology	20	52
Talk about good and bad designs	26	56
Work in class with people from their community who know about technology	5	6
Go on school trips to learn about technology	7	7

Teachers' perspectives on technology

- Teachers were positive about technology and being technology educators.
- About half of Year 8 teachers and a fifth of Year 4 teachers had external, technology-focused professional learning and development in the last two years.
- Six percent of Year 4 teachers and 33 percent of Year 8 teachers rated the technology-related professional support in school as 'good' or 'excellent'.
- The majority of teachers were aware of 'Technology Online' on TKI, used it occasionally and found it easy to locate resources they needed.
- Few teachers were aware of the technology Indicators of Progression for assessing students' work. These can be found at: http://technology.tki.org.nz/Technology-in-the-NZC/Indicators-of-progression.

For teachers, principals and curriculum leaders to consider

- Which descriptors from the TELI scale best describe what your students know and can do in technology?
- How positive are your students about the different topics and activities in technology?
- How might you use the technology Indicators of Progression to plan and assess your students' work?
- Are there areas of the technology programme in your class or school where the teachers and students may have different views of the opportunities to learn?
- What types of professional support in technology would teachers in your school like? How could this be provided?

The full report on Technology can be found at **http://nmssa.otago.ac.nz** . For further information contact:
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