MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

He Whakaaro
EDUCATION INSIGHTS

How environmentally aware are New Zealand students?

Summary

In recent years there has been a rapid increase in the awareness of the changing environment and the impact of this upon humans. With sustainability and environmental issues embedded in the New Zealand Curriculum, schools can play an important role, both in raising awareness of the environmental challenges facing the world, and in preparing learners to make a difference.

New Zealand 15-year-olds report lower awareness of key environmental problems than other countries, and awareness has fallen.

This report uses data from the OECD's Programme for International Student Assessment (PISA) to examine the awareness of a range of environmental issues in New Zealand English-medium secondary students and how this has changed in the last decade. The report finds:

- New Zealand 15-year-olds report low awareness of key environmental problems compared with most other countries.
- New Zealand students' reported awareness of environmental problems fell between 2006 and 2015.
- In New Zealand and around the world, students who are more aware of environmental problems tend to be more pessimistic about these problems getting better 'in the next 20 years', and New Zealand students' level of optimism about the environment hasn't changed since 2006.
- However, New Zealand is one of the few countries with both low awareness and low optimism.
- Awareness of environmental issues is positively related to students' scientific literacy, socioeconomic status, and engagement in science-related topics and activities, as well as with science teaching practices.
- New Zealand students' drop in environmental awareness between 2006 and 2015 can be entirely explained by a corresponding drop in general science ability over the same period.
- 15-year-olds report that schools and media are the main sources from which they have learnt about environmental issues.

Environmental awareness is an important component of the curriculum, the Child Wellbeing Strategy, and our international obligations.

The context

Education for sustainability is a significant theme throughout the curricula. Ecological sustainability is explicitly included in the values of the New Zealand Curriculum and is implied in the future focus principle and the vision of students being connected and actively involved. Similarly, in Te Marautanga o Aotearoa, sustainability is implicit in the principle of ko te oranga taiao, he oranga tangata (the health of the environment is the health of the people) and the Pūtaiao and Hauora subject areas specifically refer to the environment and relationships of humans in the environment.

The current draft cross-government Child Wellbeing Strategy identifies environmental sustainability as a core driver of children's wellbeing. Children's environmental awareness and stewardship is therefore a key focus area for future policy work towards making New Zealand the best place in the world to be a child.

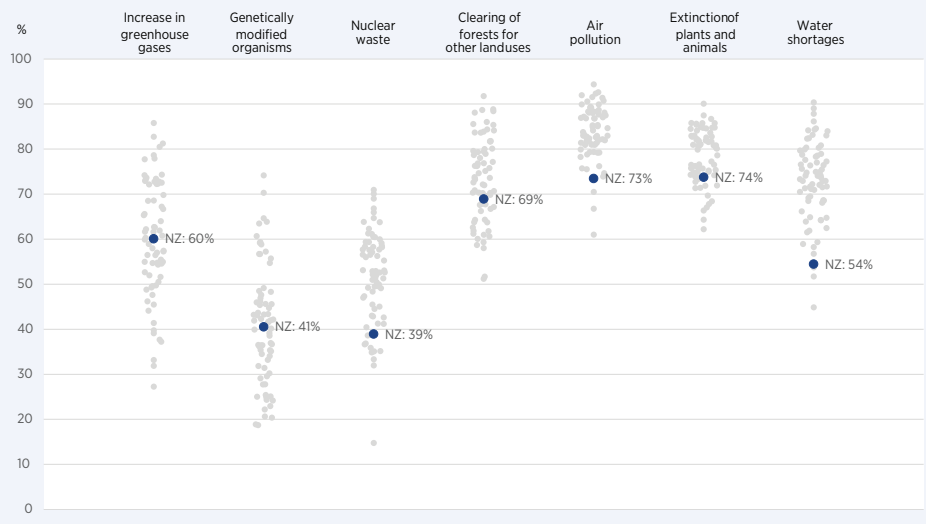
The Ministry of Education is currently working in partnership with the Department of Conservation and Ministry for the Environment in leading the Environmental Education for Sustainability (EEfS) action plan. Objectives of this action plan include providing guidelines, tools and professional learning and development (PLD) to support improved EEfS practices.

New Zealand is also a signatory to the United Nations' Sustainable Development Goals. Five of these 17 goals focus wholly on aspects of environmental sustainability, and goal 4 (quality education for all) includes a target of 'ensuring all learners acquire knowledge and skills needed to promote sustainable development [and] sustainable lifestyles' (target 4.7).

NEW ZEALAND 15-YEAR-OLDS REPORT RELATIVELY LOW AWARENESS OF ENVIRONMENTAL PROBLEMS

Figure 1 compares the awareness of New Zealand students (the dark dots) with their peers in over 70 other countries (the grey dots). The students were asked how well they could explain seven environmental problems. New Zealand students report relatively low levels of ability to explain the environmental problems they were asked about, appearing poorly informed compared with their peers in other countries.

Figure 1. Percentage of students reporting they could explain this environmental problem 'generally' or 'well'.



Just under 75% of New Zealand students reported they felt informed enough that they could generally explain the problems 'air pollution' and 'extinctions of plants and animals'. These were the environmental issues that New Zealand students reported the most ability to explain, but across approximately 71 countries with data for awareness of these issues, New Zealand ranked 68th and 58th, respectively. Almost 70% of New Zealand students felt informed about 'clearing of forests for other land uses' and 60% about the 'increase in greenhouse gases in the atmosphere'. Just over half (54%) of students felt informed about 'water shortages'. Only around 40% felt adequately informed to generally explain 'genetically modified organisms' or 'nuclear waste'.

Part of this difference may be attributable to the effects of some of these problems being less visible in New Zealand (eg, nuclear waste, as New Zealand is a nuclear free country), whereas students in countries where the effects are more visible are likely to be more familiar with that problem. However, New Zealand students' low awareness is harder to explain on issues that one might expect them to be more familiar with (eg, extinctions of plants and animals).

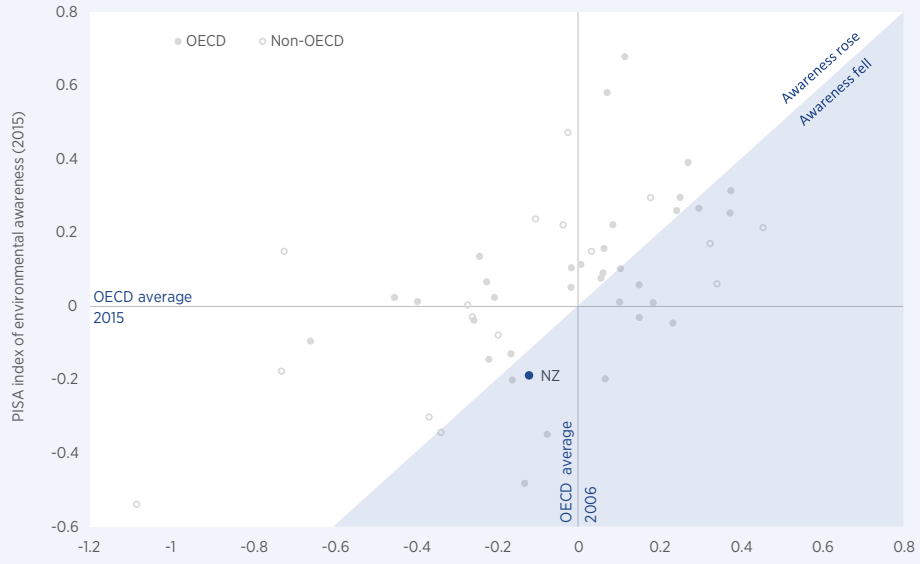
New Zealand was ranked 63rd of 71 countries in terms of environmental awareness in 2015.

Higher average national performance on the PISA scientific literacy assessment is generally related to a country's average student awareness of environmental problems, but there is only a fairly weak relationship between the two. This positive relationship does not hold for New Zealand. New Zealand students demonstrated relatively strong scientific literacy (ranked 12th of 72 countries in PISA 2015). However, their level of awareness of these environmental issues was very low (63rd of 71 countries with data on the PISA 2015 index of environmental awareness; 31st of 35 OECD countries).

NEW ZEALAND STUDENTS' AWARENESS OF ENVIRONMENTAL PROBLEMS FELL BETWEEN 2006 AND 2015

In half of the countries with data from both PISA 2006 and PISA 2015, and on average across the OECD, students' reported awareness of environmental issues improved between 2006 and 2015. By contrast, in New Zealand, even though awareness was low in 2006, there was a moderate but statistically significant decrease over this 9-year period. New Zealand was one of 18 out of 51 countries where environmental awareness fell (as shown by the dots below the diagonal line in *Figure 2*).

Figure 2. Relationship between average environmental awareness per country in PISA 2006 and in PISA 2015.



The only issue on which New Zealand students reported higher awareness in 2015 than in 2006 was 'the increase in greenhouse gases in the environment'. New Zealand students are now around the middle internationally (36th of 72 countries; 22nd of 35 OECD countries[1]) on this issue. However, in 2015, 11% of students reported they have 'never heard of this issue' and an additional 29% said they would 'not be able to explain this general issue'.[2]

1 There are currently 36 OECD countries. At the time of the PISA 2015 data collection, however, there were 35.

2 It is possible that a small proportion of students did not take these questions seriously (eg, answering 'I have never heard of this issue' for all issues without considering whether they were aware of them), which would make these percentages over-estimates. There is some evidence that some students undertaking PISA do not devote as much effort to answering the assessment as they would if there were stakes attached to it (Akyol, Krishna & Wang, 2018). However, previous research looked only at the test portion of PISA (rather than the contextual survey that included these questions on environmental awareness), and found that the proportion of 'non-serious' students did not differ substantially between New Zealand and other countries. This means that even if some of these percentages are over-estimated, it is still likely to be the case that New Zealand has lower environmental awareness than most other countries.

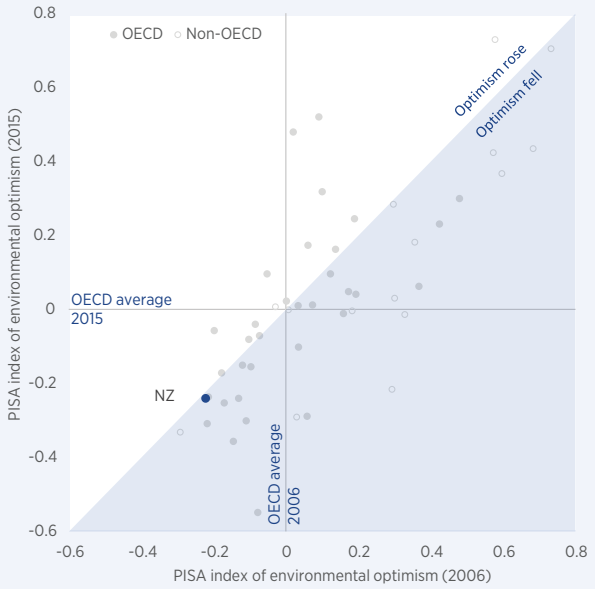
NEW ZEALAND STUDENTS ARE PESSIMISTIC ABOUT THESE PROBLEMS GETTING BETTER, AND THIS HASN'T CHANGED

In the majority of the countries where environmental awareness improved between 2006 and 2015, students became more pessimistic about whether these problems would get better 'in the next 20 years'. New Zealand was one of 16 OECD countries where there was little change from 2006 to 2015 in students' perceptions of whether these environmental problems will improve or not (*Figure 3*). In both years New Zealand students were, on average, among the least optimistic.

Unusually, New Zealand students report low awareness and low optimism.

Internationally, students and countries that report high awareness of environmental issues tend to have less optimism about those issues getting better (OECD, 2018). Given this relationship, New Zealand is unusual in that students here report both low awareness and low optimism. New Zealand was one of only ten countries to have below average values on the awareness and optimism scales. To the extent that effective action relating to the environment requires both awareness of the problem and hope for the future, this combination is concerning.

Figure 3. Relationship between environmental optimism in PISA 2006 and in PISA 2015.



In 2015, students were most pessimistic about air pollution and clearing forests, with more than two thirds of New Zealand students reporting they thought these issues would get worse over the next ten years (*Table 1*). Compared to 2006, New Zealand students in 2015 reported slightly more optimism about nuclear waste and slightly more pessimism about water shortages.

Table 1: New Zealand students' environmental optimism in 2006 and 2015.

This issue will...	improve		stay about the same		get worse	
	2006	2015	2006	2015	2006	2015
Air pollution	10%	11%	16%	18%	74%	71%
Clearing forests	8%	10%	20%	20%	72%	69%
Extinctions	12%	11%	28%	26%	60%	64%
Greenhouse gases	---	12%	---	24%	---	64%
Water shortages	14%	12%	38%	34%	49%	55%
Nuclear waste	10%	15%	27%	35%	63%	51%
Genetically modified orgs.	---	20%	---	40%	---	40%

Note: Columns within each year add to 100%. Any apparent inconsistencies are due to rounding.

AWARENESS AND OPTIMISM ARE RELATED TO STUDENT CHARACTERISTICS AND TEACHING PRACTICES

We identified characteristics of students, schools and teaching practices that are significantly related to environmental awareness and optimism (*Table 2*). We used a statistical technique (linear regression model) to adjust for the effects of all the other characteristics, allowing us to isolate the unique effect of each characteristic. The results are presented as effect sizes, which are standardised measures of impact that can be more easily compared to other studies.

Higher science scores were significantly related to greater awareness.

Table 2: Effect sizes of various factors on reported environmental awareness and optimism (2015)

	Awareness	Optimism
Student		
Science score	**0.21**	**-0.22**
Interest in science topics	**0.21**	0.02
Engagement in science activities	**0.14**	**0.08**
Male	**0.11**	**0.22**
Māori	-0.01	0.06
Pacific	-0.05	0.02
Asian	0.08	0.10
Other ethnicity	0.21	-0.13
1st generation immigrant	-0.05	0.09
2nd generation immigrant	0.00	0.09
Socioeconomic status (SES)	**0.11**	-0.04
School		
Decile 1-3	-0.03	-0.05
Decile 8-10	0.03	-0.01
Secondary urban area	0.09	-0.10
Minor urban area	-0.04	-0.08
Rural area	0.29	0.02
Teacher		
Teacher-directed instruction	**0.11**	0.01
Inquiry-based instruction	**0.09**	**0.07**

Note: Statistically significant effects at the 5% level are shown in bold.
The science score effect size is the change in the awareness/optimism index associated with a 100-point increase in science score (approx. 1 standard deviation) That is, a 100-point increase in science score (approx. 1 sd) is associated with a .21 increase in the environmental awareness index, and a .22 decrease in optimism index. The effect sizes for student SES, interest and engagement in science and teacher variables can be interpreted as the change in the awareness/optimism index associated with a 1-unit increase in the variable index (approx. 1 sd). All other variables reported as the change in the optimism/awareness indices associated with students having this characteristic, relative to not having this characteristic (e.g. males compared to females).

The results show that New Zealand students who scored higher in their science assessment are statistically significantly more aware, but less optimistic, about the environment than similar students with lower science scores. This reinforces the negative relationship between awareness and optimism discussed earlier. More detailed analysis by individual issue (results not reported) showed higher science scores were significantly related to greater awareness in every issue other than nuclear waste and water shortages. Given this relationship between science ability and awareness, the drop in environmental awareness between 2006 and 2015 can be entirely explained by a drop in New Zealand students' science ability (17 points) over the same period.

Students' reported interest in a range of broad science topics and (to a lesser extent) engagement in various activities relating to science (such as watching TV shows, reading books, or visiting websites about scientific topics) were also significantly positively related to environmental awareness. This suggests that encouraging a general interest in science might be an effective strategy to increase environmental awareness, as well as changing or increasing environment-related content in the local school curriculum. Students who were more likely to engage in science-related activities (but not students who had higher interest in science) were also significantly more optimistic about the environment.

Boys report higher environmental awareness and optimism than girls.

Compared to girls, boys report both higher environmental awareness and higher optimism about environmental problems. Overall, at the national and international levels, students with higher awareness of environmental problems tend to be more pessimistic about these problems improving, which makes this inverse pattern for boys surprising. However, PISA research has found boys tend to 'overclaim' more frequently than girls about their knowledge, even on made-up concepts (OECD, 2015). Men may also generally tend to be more optimistic about the future than women (Jacobsen, Lee, Marquering & Zhang, 2014; Patton, Bartrum & Creed, 2004). As in any discussion of gender, the variation between individuals of the same gender can be larger than differences between group averages.

Students from more advantaged socioeconomic backgrounds[3] were more likely to report higher awareness of environmental issues. The effect of socioeconomic status (SES) was approximately half as large as the effect of science score or interest in science. However, SES was not significantly related to environmental optimism. Concentrations of disadvantage (as measured by decile) had no additional explanatory power on either environmental awareness or optimism, in contrast to being important in explaining overall science ability. That higher student SES is significantly related to greater reported environmental awareness, even after adjusting for science ability, suggests that previous research (Schmidt, Burroughs, Zoido & Houang, 2015) showing students from lower SES backgrounds have less exposure to key mathematics concepts may also extend to environmental awareness.

There were two factors that were not statistically significantly related to environmental awareness at the 5% level, but might still be important: student ethnicity outside of the four major ethnic groups[4], and whether the school was in a rural area[5]. The estimates in *Table 2* relating to these factors are very uncertain, due to the small size of these groups in the PISA sample. However, the best estimates we have of these effects are relatively large, being comparable to (in the case of other ethnicity) and approximately one-half larger (in the case of rural area) than the effect of increasing science score by one standard deviation. This means that, while we can't rule out that these factors have no effect, they equally have the potential to be very important in explaining environmental awareness. More detailed analysis by each individual environmental issue suggests that in rural areas there is greater reported awareness (statistically significant) by students of air pollution, extinctions, greenhouse gases and water shortages.

Students in PISA were also asked how often their science teachers use a variety of practices typical of teacher-directed instruction (eg, the teacher explains ideas, the teacher discusses questions, or the teacher demonstrates ideas) and inquiry-based instruction (eg, students have class debates, students design experiments, or students draw their

3 As measured by the PISA index of economic, social and cultural status.

4 Predominantly students reporting Middle Eastern, Latin American and African ethnicities (as opposed to Māori, Pacific, Asian or Pākehā).

5 Rural areas are defined as towns with populations of less than 1,000.

own conclusions). Students reporting more use of either instruction type also reported significantly greater environmental awareness. The magnitudes of the relationship with both types of instruction are similar and approximately equal to the effect of student SES. More use of inquiry-based practices is also associated with higher student reports of environmental optimism, which is surprising given the negative relationship between environmental awareness and optimism shown earlier. Further research is required to determine whether inquiry-based practices in science classes cause higher environmental optimism in students, or whether this relationship is driven by some unobserved factor.

SCHOOLS ARE A MAJOR SOURCE OF INFORMATION ON ENVIRONMENTAL ISSUES

Data from PISA 2006 showed that school was the main source from which New Zealand 15-year-olds had learnt about environmental issues, and the media was the second most commonly named source. However, compared to the OECD average, significantly fewer students named the media as a source of information on these issues. Very few students (fewer than 5% for most issues[6]) answered 'none of these, I am not sure what this is', suggesting that almost all schools are already teaching these environmental issues to some extent. These questions were not asked in 2015, so we don't how schools' teaching on environmental issues has changed since 2006.

In 2006, 93% of New Zealand students were in schools which reported integrating environmental topics into school curriculum via science courses (comparable to the OECD average). The same proportion were in schools where these topics are integrated into geography courses. This was much higher than other OECD countries, where 62% of schools reported integrating environmental topics into geography. In terms of additional activities organised by schools to teach environmental issues, 81% of students were in schools that organised outdoor activities for this purpose. About two-thirds of students were in schools that organised guest lectures or seminars (70%), organised trips to museums (65%), or organised trips to a science or technology centre (63%). About half of students were in schools that organised extracurricular projects for the purpose of teaching environmental issues (51%). These are all comparable to the international averages.

Environmental awareness alone is not enough to get people to change habitual behaviours and routines.

How can we encourage sustainability?

New Zealand students, on average, have surprisingly low awareness of environmental problems, given their high performance in scientific literacy. Being aware of environmental problems and the impacts of human behaviours on the natural environment provides an important basis for students to make informed judgements and consider appropriate actions to lessen the environmental problems facing our planet. We need to raise students' awareness of environmental problems. Since students report receiving most of their information on these issues from their school, increasing environmental content in curricula is an obvious response schools could take to this issue.

However, awareness alone isn't enough to get people to change habitual behaviours and routines (Darton, Verplanken, White & Whitmarsh, 2011). Indeed, knowledge without empowerment can push individuals towards pessimism, which can lead to 'action paralysis'. This is especially a concern for New Zealand because students here already report some of the lowest rates of optimism, despite also reporting relatively low awareness.

Research into fostering pro-environmental behaviours suggests that programmes focussed only on raising knowledge or fostering pro-environmental attitudes do little to change long-term habits (Environment Waikato, 2002). To be effective, a participatory and action-oriented approach to environmental education is recommended, seeking to empower students to influence the institutional policies, layouts and constraints which shape group behaviour and norms (Ministry of Education, 2015). We recommend that school staff model desired norms and support students on the path to developing new routines and habits towards making these behaviours the social norm within the school (Darton, Verplanken, White & Whitmarsh, 2011; Long, Harre & Atkinson, 2014).

6 This was across the issues of 'air pollution', 'extinctions of plants and animals', 'clearing of forests for other uses', 'nuclear waste', and 'water shortages'. The issues of 'greenhouse gases' and 'genetically modified organisms' were not asked in this question in 2006.

References

Akyol, S., Krishna, K. & Wang, J. (2018). Taking PISA seriously: How accurate are low stakes exams? *NBER Working Paper* 24930, pp. 1-50.

Darnton, A, Verplanken, B, White, P and Whitmarsh, L. (2011). *Habits, routines and sustainable lifestyles: Summary report*. AD Research & Analysis for DEFRA, London. Retrieved from the DEFRA website: **http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=16189**

Environment Waikato (2002). *Promoting environmental behaviours through community interventions*. Retrieved from: **https://www.waikatoregion.govt.nz/assets/PageFiles/2493/tr02-13.pdf**

Jacobsen, B., Lee, J. B., Marquering, W. & Zhang, C. Y. (2014). Gender differences in optimism and asset allocation. *Journal of Economic Behavior & Organization*, *107*(B), pp. 630-651.

Long, J., Harré, N. & Atkinson, Q. D. (2014). Understanding change in recycling and littering behavior across a school social network. *American Journal of Community Psychology, 53*(3-4), pp. 462-474.

Ministry of Education. (2015). *Guidelines for environmental education in New Zealand schools*. Retrieved from **https://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability/Tools-and-resources/Guidelines-for-Environmental-Education-in-New-Zealand-Schools**

OECD (2015). *The ABC of gender equality in education: aptitude, behaviour, confidence*. PISA, OECD Publishing. Retrieved from: **http://www.oecd.org/education/the-abc-of-gender-equality-in-education-9789264229945-en.htm**

Patton, W., Bartrum, D.A. & Creed, P.A. (2004). Gender differences for optimism, self-esteem, expectations and goals in predicting career planning and exploration in adolescents. *International Journal for Educational and Vocational Guidance, 4*(2-3), pp. 193-209.

More about the data used in this report

PISA is a three-yearly education research programme run under the auspices of the OECD. Students completed a competency assessment covering scientific, mathematical and reading literacy, along with a questionnaire about their background, experiences, attitudes and opinions. To date, PISA in New Zealand is offered in New Zealand English, so schools and students at Levels 1 and 2 Māori immersion (50% or more of instruction in te reo) are not selected. In PISA 2006, a random selection of 4,824 15-year-old students from 170 New Zealand schools took part. In PISA 2015, 4,520 15-year-old students from 183 New Zealand schools took part, with over half a million students participating internationally.

To measure environmental awareness, students were asked, for several specific environmental issues, 'How informed are you about the following environmental issues?' and selected from one of 'I have never heard of this', 'I have heard about this but I would not be able to explain what it is really about', 'I know something about this and could explain the general issue' and 'I am familiar with this and I would be able to explain this well'.

To measure environmental optimism, students were asked 'Do you think problems associated with the environmental issues below will improve or get worse over the next 20 years?' and selected from one of 'Improve', 'Stay the same', and 'Get worse'. For both optimism and awareness, the OECD aggregated the responses of each of these issues and created indices, scaled to have an OECD average of 0 and a standard deviation of 1.

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For further data and information on the topic of PISA in New Zealand, please visit **www.educationcounts.govt.nz/goto/pisa**.
For PISA internationally, please visit **www.oecd.org/pisa**.

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