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OECD Programme for International Student Assessment
Monitoring Knowledge and Skills in the New Millennium

# PISA2009
# Digital Readers at age 15:
## Results from the PISA 2009 Electronic Reading Assessment

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# Digital readers at age 15:
# An overview of the PISA 2009 Electronic Reading Assessment

## About PISA 2009 ERA

### What is the PISA 2009 Electronic Reading Assessment (ERA)?

The Programme for International Student Assessment (PISA) is an international study that assesses how well countries are preparing their 15-year-old students to meet real-life opportunities and challenges.[1] PISA assesses three key areas: reading, mathematical and scientific literacy. Students participating in PISA to date have all responded to print (paper)-based assessments. In 2009 countries were offered the option of assessing some of the participating students in reading using a computer-based assessment – the Electronic Reading Assessment (ERA).

The ERA is a new and innovative component of PISA that acknowledges the increasing relevance of electronic text and recognises its importance as a feature of reading. Those students who took part in the ERA were given a 10 minute practice session and then asked to complete a 40 minute computer-based test. The texts used in this test were hypertexts. Hypertexts are where the user has navigation tools and features that allow them to move through pages of text freely in numerous possible ways. An example of one of the questions from the ERA can be found in Appendix 3 at the end of this report.

### Who took part in this study?

Of the sample of randomly selected schools in New Zealand with 15-year-old students enrolled, 163 took part in PISA 2009. The international research consortium randomly selected the schools for each country and customised software was then used in individual countries to randomly select students within schools. In New Zealand 4,643 selected students took part in the print-based assessment, and a smaller subset of students randomly selected from each school took part in the ERA (1,752 students in total).

Altogether 19 countries and economies took part in the ERA component of PISA 2009. The Organisation for Economic Co-operation and Development (OECD) countries that participated in the ERA were Australia, Austria, Belgium, Chile, Denmark, France, Hungary, Iceland, Ireland, Japan, Korea, New Zealand, Norway, Poland, Spain and Sweden. The partner countries and economies that took part were Colombia, Hong Kong-China and Macao-China. Around 36,500 15-year-old students from these countries and economies participated in this assessment.

### What additional information is gathered?

Background information is also gathered in each PISA cycle from questionnaires completed by students and school principals. Of particular relevance to the ERA, 45 countries (including 17 of the countries that also participated in the ERA) collected information on students' knowledge about and use of information and communication technology (ICT). This covered such things as students' familiarity with computers, the internet and various types of software, and tasks that can be carried out electronically. The information gathered from these questionnaires enables the relationship between contextual factors and achievement to be examined.

### Where can I find out more?

The OECD PISA 2009 international report on findings from the Electronic Reading Assessment is called *Students On Line: Digital Technologies and Performance, Volume 6*, and it is available online at www.oecd.org/edu/pisa/2009.

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1 PISA is an initiative of the Organisation for Economic Co-operation and Development (OECD) and a collaborative effort of the participating countries. The Comparative Education Research Unit within the Ministry of Education's Research Division is responsible for the administration of PISA in New Zealand.

# PISA 2009
# Electronic Reading Assessment

## Key findings

- New Zealand 15-year-old students' overall performance in the Electronic Reading Assessment (ERA) was significantly higher than the average for the OECD countries that took part in this option. Of the 19 countries and economies that took part in the ERA, only one OECD country, Korea, performed better than New Zealand. Australia performed similarly to New Zealand and the other 16 countries performed at a significantly lower level.

- Almost one in five New Zealand students were top-performing digital readers (19% Level 5 and above). This was the same proportion as Korea, similar to Australia, and higher than the 16 other participating countries.

- The proportion of New Zealand students with the lowest levels of digital reading proficiency was similar to that in Australia and Macao-China, but Korea and Japan showed smaller proportions.

- Girls outperformed boys in digital reading in every participating country, and New Zealand had the largest difference between girls and boys.

- There were Asian, Māori, Pākehā/European and Pasifika students who performed at the highest levels of digital reading literacy. Māori and Pasifika students were, however, over-represented at the lowest levels.

- Students were more likely to have higher digital reading achievement if they regularly spoke English at home (the language of the test), were born in New Zealand and/or had at least one parent born in New Zealand, and/or came from a high socio-economic background.

- Students' access to computers and the internet at home and at school has increased considerably since 2000. In 2009 very few students reported never having used a computer.

- New Zealand students had less positive attitudes to computers and were also slightly less self-confident carrying out high-level ICT tasks than the OECD average. Boys had more positive attitudes than girls, but both genders had equivalent confidence levels in carrying out high-level ICT tasks. New Zealand Asian students were the most positive and the most confident of the four ethnic groupings.

# Introduction

With the ever-increasing availability and prevalence of digital devices, it is inevitable that the skill of effective reading has extended beyond the standard print medium. Almost all digital technologies involve some form of text and the online activities that most people take part in on a regular basis involve text processing, be it filling in online forms, ordering products from online stores, or involvement in social networking.

In the 2009 cycle of the Programme for International Student Assessment (PISA), New Zealand students were assessed for the first time on their digital reading skills on an international scale. This report presents the main findings from that study and how the background characteristics of New Zealand students and their access to technology contribute to their ability to navigate through and process electronic texts.

Digital reading is considered a subset of reading literacy (see Appendix 1 for the PISA reading framework). The basic processes of reading, such as word identification and ability to recognise and understand grammatical structures, are applicable to both digital and print reading. At the same time, digital reading has some distinct and unique features, such as non-linear navigation through pages of text.

This report focuses on analysis that is specific to digital reading in New Zealand and how digital reading achievement compares between groups and internationally. There is often a discernible difference in achievement across various groups within the student sample. This includes differences based on gender and ethnicity, the latter being especially prevalent in New Zealand with its multicultural society. Much of the analysis in this report is broken down by gender and by ethnicity, as well as for the country as a whole.

## Structure of this report

This report begins by presenting the overall digital reading achievement of New Zealand 15-year-old students in relation to the other countries that participated in the ERA. The spread of achievement is examined in depth by looking at proficiency levels. Digital reading achievement is then discussed in the context of family background variables such as home language, immigrant status and socio-economic status. Lastly, trends in students' access to computers and the internet and students' use of technology provide further insight into how students are using, and feeling about the use of, computers.

It is important to remember that digital reading achievement is not isolated and separate from print reading, as variables such as gender affect both print and digital reading. The relationship between digital and print reading is briefly discussed towards the end of the report.
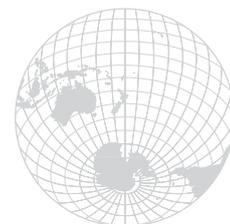
# New Zealand students' digital reading achievement

## Digital reading in an international context

New Zealand's 15-year-old students performed very strongly in digital reading literacy, with a mean digital reading achievement score of 537 points. New Zealand's mean score was significantly higher than the mean score for the 16 OECD countries that participated in the ERA (499), hereafter referred to as the OECD average or mean. New Zealand's score was the same as Australia and significantly higher than 16 other participating countries or economies, including Japan and Hong Kong-China. Only Korea (568) scored significantly higher than New Zealand.

In addition to presenting the mean scores, Figure 1 shows the range of the middle 90% of scores and the range of the middle half of scores.[2] Countries with relatively small ranges are considered to have equitable education systems. This means the outcomes for the main proportion of students are similar, regardless of other factors that may influence the range of achievement in other less equitable systems, such as socio-economic status and ethnicity.

The range of achievement (from the 5th to 95th percentile) in New Zealand was 323 score points. This was wider than most of the other countries that took part in the ERA, although it was narrower than Hungary (337), the same as Austria and similar to Australia (317). The inter-quartile range (from the 25th to 75th percentile) for New Zealand (126) was wider than 13 of the 18 other participating OECD countries. A wide inter-quartile range such as this means that, rather than most students achieving at a similar level, there are students who are achieving very well and students who are achieving very poorly across the main section of the student population.

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2    For comparative purposes, the middle 90% and middle 50% measures are more useful than full range measure because the distribution at both extremes can be erratic.

**Figure 1:    Distribution of digital reading achievement for ERA countries**

| Country | Mean digital reading score | Distribution of digital reading achievement | Range from 5th to 95th percentile | Inter-quartile range from 25th to 75th percentile |
|---|---|---|---|---|
| Korea | 568 (3.0) | | 220 | 88 |
| New Zealand | 537 (2.3) | | 323 | 126 |
| Australia | 537 (2.8) | | 317 | 131 |
| Japan | 519 (2.4) | | 236 | 95 |
| Hong Kong-China* | 515 (2.6) | | 262 | 103 |
| Iceland | 512 (1.4) | | 301 | 119 |
| Sweden | 510 (3.3) | | 291 | 118 |
| Ireland | 509 (2.8) | | 286 | 117 |
| Belgium | 507 (2.1) | | 304 | 133 |
| Norway | 500 (2.8) | | 273 | 109 |
| OECD average | 499 (0.8) | | 293 | 120 |
| France | 494 (5.2) | | 298 | 122 |
| Macao-China* | 492 (0.7) | | 219 | 89 |
| Denmark | 489 (2.6) | | 276 | 111 |
| Spain | 475 (3.8) | | 310 | 129 |
| Hungary | 468 (4.2) | | 337 | 141 |
| Poland | 464 (3.1) | | 295 | 125 |
| Austria | 459 (3.9) | | 323 | 137 |
| Chile | 435 (3.6) | | 295 | 123 |
| Colombia* | 368 (3.4) | | 271 | 113 |

200    300    400    500    600    700

**Percentiles of performance**

5th    25th    mean    75th    95th

Mean and 95% confidence interval (± 1.96 se)

*Notes: Asterisks (*) indicate partner countries/economies.*

*Standard errors are shown in parentheses. Standard errors provide a measure of the precision of the estimate; in this case, the mean.*

*Source: Data from OECD (2011), Table VI.2.4, p.259.*

## Digital reading achievement by gender

New Zealand girls outperformed boys in digital reading. This pattern was the same across the OECD countries that took part in the ERA. New Zealand had the highest gender difference, at 40 score points, compared with 28 points for Australia and 18 points for Korea, the two countries closest to New Zealand in overall achievement. Also, the distribution of achievement was wider for boys (344) than for girls (282), as shown in Figure 2.

**Figure 2:    Distribution of New Zealand 15-year-olds' digital reading achievement by gender**
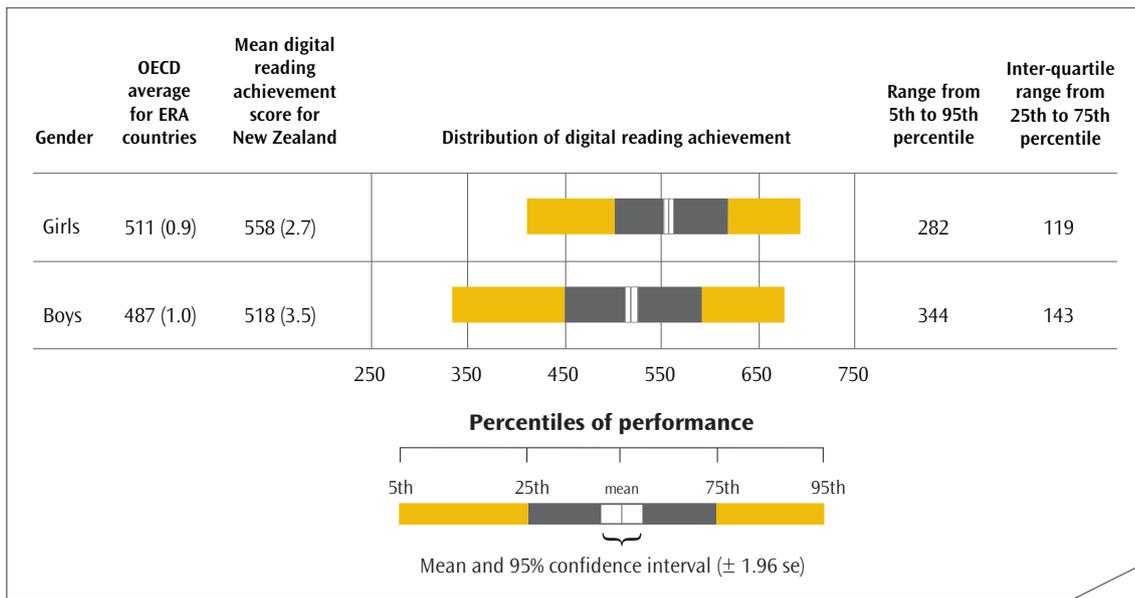
| Gender | OECD average for ERA countries | Mean digital reading achievement score for New Zealand | Distribution of digital reading achievement | Range from 5th to 95th percentile | Inter-quartile range from 25th to 75th percentile |
|---|---|---|---|---|---|
| Girls | 511 (0.9) | 558 (2.7) | | 282 | 119 |
| Boys | 487 (1.0) | 518 (3.5) | | 344 | 143 |

250    350    450    550    650    750

**Percentiles of performance**

5th    25th    mean    75th    95th

Mean and 95% confidence interval (± 1.96 se)

*Note: Standard errors are shown in parentheses.*

*Source: Data from OECD (2011), Table VI.2.4, p.259.*

# Digital reading achievement by ethnicity

The discussion in this section focuses on four main ethnic groupings: Pākehā/European, Māori, Pasifika and Asian. New Zealand students were asked to state which ethnic grouping(s) they identified with. Those who identified with more than one group were counted in each of those groupings.[3] For example, if a student identified as both Māori and Pasifika, they were included in both ethnic groupings for the purpose of this analysis.

As Figure 3 shows, the mean digital reading achievement scores for students identifying as Pākeha/European or Asian were higher than those of students identifying as Māori or Pasifika, and were also significantly higher than the OECD average for those countries that participated in the ERA. Overall, Māori students scored similarly to the OECD average, while Pasifika students scored lower.

**Figure 3:**     **Distribution of New Zealand 15-year-olds' digital reading achievement by ethnicity**



| Ethnicity | Mean digital reading achievement score | Distribution of digital reading achievement | Range from 5th to 95th percentile | Inter-quartile range from 25th to 75th percentile |
|---|---|---|---|---|
| Pākehā/ European | 556 (2.5) | | 295 | 118 |
| Māori | 502 (4.3) | | 314 | 127 |
| Pasifika | 472 (6.4) | | 318 | 130 |
| Asian | 538 (4.9) | | 325 | 136 |

250   350   450   550   650

**Percentiles of performance**

5th   25th   mean   75th   95th

Mean and 95% confidence interval (± 1.96 se)
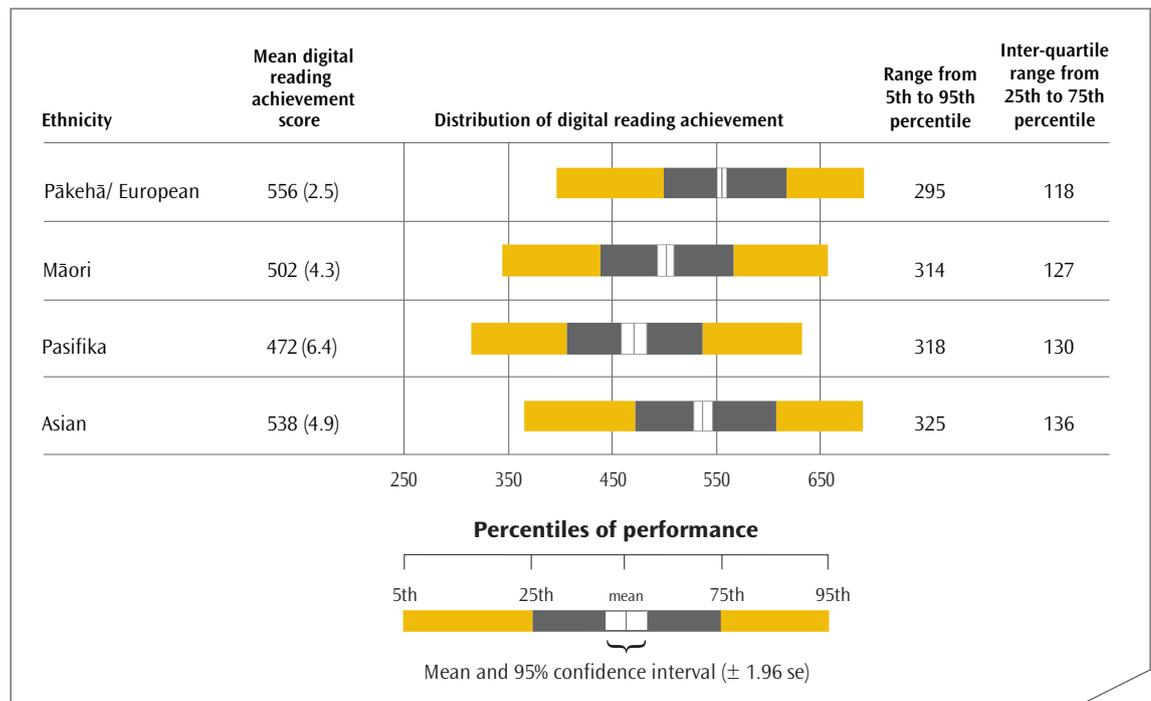
*Note: The students that were identified in the ethnic group "Other" are not reported in this table because the small size of the group makes it difficult to carry out viable analyses.*

*Standard errors are shown in parentheses.*

The spread of achievement within each of the four main ethnic groups was broadly similar.[4]

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3   Reporting of total response ethnicity data is consistent with the Statistics New Zealand standard but differs from the prioritised classification method used in earlier Ministry of Education Research Division publications.

4   The two groups with the largest ranges, Pasifika and Asian, have few students at either end of the distribution due to the smaller number of students in these ethnic groupings overall, so the numbers at the top and bottom 5% of the range of achievement should be treated with caution.
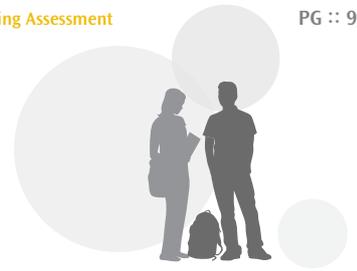
Within each ethnic grouping, girls had significantly higher digital reading achievement, on average, than boys. This was particularly marked for the Māori and Pasifika students, with differences of 47 and 52 score points respectively.

**Table 1:**     **Mean digital reading achievement of New Zealand 15-year-olds by ethnicity and gender**

| Ethnicity | Pākehā/European | | Māori | | Pasifika | | Asian | |
|---|---|---|---|---|---|---|---|---|
| Gender | Girls | Boys | Girls | Boys | Girls | Boys | Girls | Boys |
| Mean score | 574 (2.7) | 538 (3.6) | 527 (5.5) | 480 (5.8) | 499 (7.7) | 447 (6.9) | 555 (6.4) | 523 (6.5) |
| Difference between girls and boys | 36 (4.0) | | 47 (7.9) | | 52 (8.3) | | 32 (8.9) | |

*Note: Standard errors are shown in parentheses.*

# ERA achievement by proficiency level

For the ERA, the distribution of student achievement can be described by five levels of proficiency. PISA generally assigns students to one of six proficiency levels and has aligned the proficiency levels for digital reading with those for print reading to allow for direct comparison. For the ERA, however, the number of assessment items in the top level (Level 6) and bottom levels (Level 1 and below Level 1) was not sufficient to enable analyses at these levels. Accordingly, the analysis by proficiency levels is aggregated into five categories: below Level 2, Level 2, Level 3, Level 4, and Level 5 and above.

The proficiency levels provide an overview of the spread of student performance and link student performance to competencies by describing the types of tasks that students at each level can typically be expected to do (see Appendix 2). Students are assigned to the highest level for which they would be expected to answer at least half of the questions correctly. Those achieving a particular proficiency level are also considered to be proficient in digital reading at the lower levels.

Figure 4 shows the percentage of students at each proficiency level across countries. As is shown, 19% of New Zealand 15-year-olds reached the top levels of digital reading achievement (Level 5 and above – scores of 626 and over). This was the same proportion as Korea (also 19%), similar to Australia (17%), and higher than all other countries that participated in the ERA.

At the lowest level of proficiency, 10% of New Zealand students scored below Level 2 (scores less than 407), the same as Australia. All countries that participated in the ERA had students in this group, with Korea (2%) and Japan (7%) having the lowest proportion of students unable to reach Level 2.

**Figure 4:** **The percentage of students at each of the digital reading proficiency levels across all of the ERA countries**

| Country | Mean | (SE) | Below Level 2 | Level 2 | Level 3 | Level 4 | Level 5 and above |
|---|---|---|---|---|---|---|---|
| Korea | 568 | (3.0) | 2 | 8 | 29 | 42 | 19 |
| New Zealand | 537 | (2.3) | 10 | 16 | 27 | 28 | 19 |
| Australia | 537 | (2.8) | 10 | 16 | 28 | 28 | 17 |
| Japan | 519 | (2.4) | 7 | 21 | 39 | 28 | 6 |
| Hong Kong-China* | 515 | (2.6) | 10 | 20 | 37 | 27 | 6 |
| Iceland | 512 | (1.4) | 13 | 21 | 32 | 24 | 10 |
| Sweden | 510 | (3.3) | 13 | 21 | 32 | 25 | 9 |
| Ireland | 509 | (2.8) | 12 | 23 | 33 | 24 | 8 |
| Belgium | 507 | (2.1) | 16 | 20 | 29 | 26 | 9 |
| Norway | 500 | (2.8) | 13 | 25 | 34 | 21 | 5 |
| OECD average | 499 | (0.8) | 17 | 22 | 30 | 23 | 8 |
| France | 494 | (5.2) | 17 | 22 | 32 | 24 | 5 |
| Macao-China* | 492 | (0.7) | 10 | 32 | 40 | 16 | 2 |
| Denmark | 489 | (2.6) | 16 | 27 | 34 | 19 | 4 |
| Spain | 475 | (3.8) | 23 | 25 | 30 | 17 | 4 |
| Hungary | 468 | (4.2) | 27 | 25 | 27 | 16 | 5 |
| Poland | 464 | (3.1) | 26 | 28 | 29 | 15 | 2 |
| Austria | 459 | (3.9) | 28 | 26 | 28 | 15 | 3 |
| Chile | 435 | (3.6) | 38 | 31 | 22 | 8 | 1 |
| Colombia* | 368 | (3.4) | 68 | 22 | 8 | 1 | |

Legend:
- Country mean significantly higher than New Zealand
- Country mean significantly lower than New Zealand

■ Below Level 2   □ Level 2   ■ Level 3   ■ Level 4   ■ Level 5 and above

**Percentage**

*Note: Countries are ordered from highest mean digital reading achievement score to lowest.*

*Standard errors are shown in parentheses.*

*Because results are rounded to nearest whole number, some totals may appear inconsistent.*

*Source: Data from OECD (2011), Table VI.2.1, p.256.*

## ERA proficiency levels by gender

New Zealand boys were more likely than girls to have low digital reading proficiency (below Level 2), and girls were more likely to be at Level 5 or above (see Figure 5).[5] A larger proportion of boys (15% compared to 5% for girls) achieved below Level 2, and a larger proportion of girls (22% compared to 15% for boys) achieved at or above Level 5.

The proportion of New Zealand boys whose scores placed them below Level 2 (15%) was smaller compared to many of the other ERA countries and economies. It was only the Asian countries Korea (3%), Japan (9%), Hong Kong-China (11%) and Macao-China (13%) and Australia (13%) that had smaller proportions of boys at the lowest levels. At the top, Level 5 and above, the only country that had a higher proportion of boys was Korea (16%), while Australia had the same proportion as New Zealand (15%).

Korea (1%) and Japan (4%) were the only countries that had smaller proportions of girls at the lowest proficiency levels than New Zealand (5%). New Zealand (22%) and Korea (22%) had the highest proportions of girls operating at the highest proficiency levels.

**Figure 5:    Percentage of New Zealand 15-year-old students at ERA proficiency levels by gender**
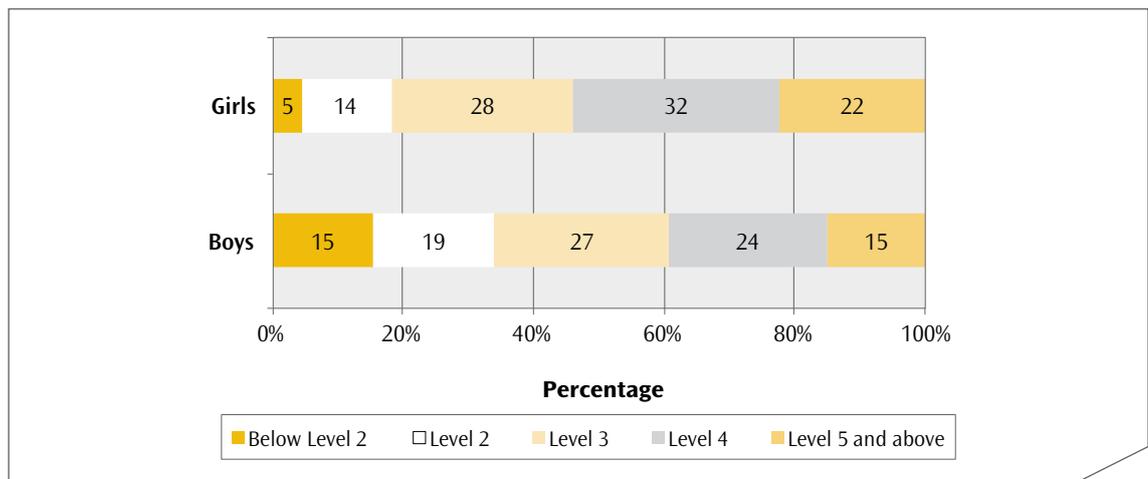


*Note: Because results are rounded to the nearest whole number, some totals may appear inconsistent.*

*Source: Data from OECD (2011), Table VI.2.2, p.257; Table VI.2.3, p.258.*

5    Tasks that students are expected to be able to carry out at each level are described in Appendix 2. As mentioned in the appendix, a description for those at below Level 2 on the scale is not available from the OECD.
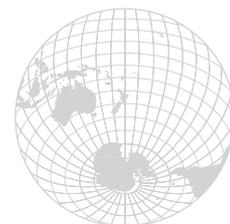
# ERA proficiency levels by ethnicity

Within each of the four major ethnic groupings there were students who scored at Level 5 and above as well as students who did not reach Level 2. A relatively large proportion of Pākehā/European and Asian students were proficient at Level 5 or above. As can be seen in Figure 6, the proportion of Māori and Pasifika students achieving at Level 5 or above was much smaller. The pattern was similar at Level 4. In total, around 50% of Pākehā/European and Asian students were proficient in digital reading at Level 4 or higher, but only 30% of Māori and around 20% of Pasifika students achieved these levels.

At the lower end of the scale, nearly 20% of Pākehā/European, almost 30% of Asian, 40% of Māori and over 50% of Pasifika students did not demonstrate proficiency above Level 2. Six percent of Pākehā/European, 10% of Asian, 15% of Māori and 25% of Pasifika students only demonstrated proficiency below Level 2.

**Figure 6:**     **Percentage of New Zealand 15-year-old students at ERA proficiency levels by ethnicity**
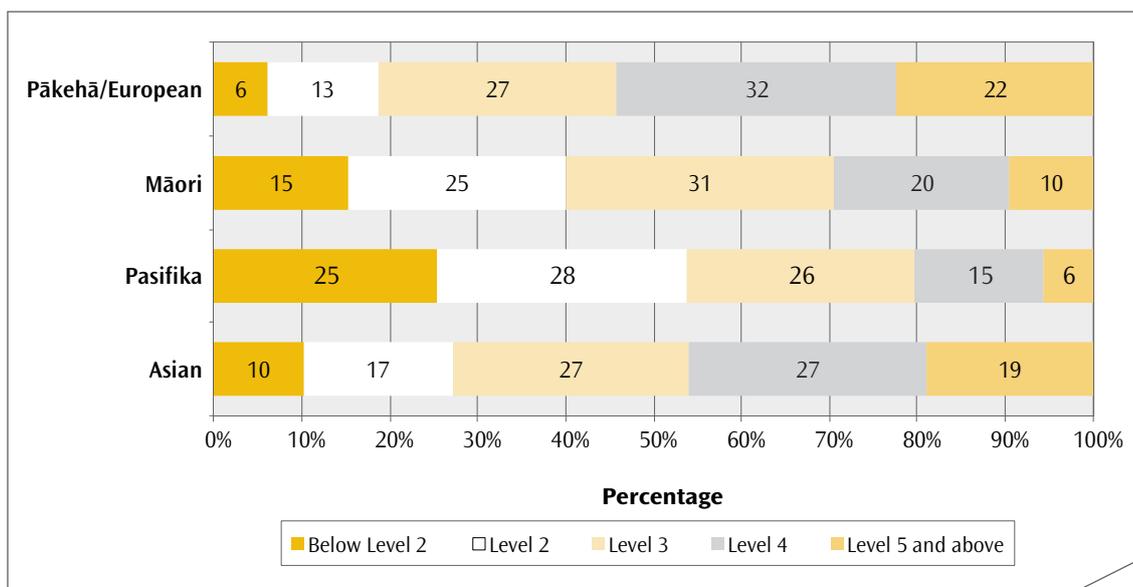


*Note: Due to the small size of the group Pasifika students at Level 5 and above, results for this group should be treated with caution.*

*Because results are rounded to the nearest whole number, some totals may appear inconsistent.*

Within each ethnic grouping, as for all New Zealand students, there was a higher proportion of girls achieving at Level 5 and above and a higher proportion of boys below Level 2. Over a quarter of Pākehā/European girls and just under a quarter of Asian girls scored at Level 5 or above. At the other end of the spectrum, just under a quarter of Māori boys and just over a third of Pasifika boys scored below Level 2.

**Figure 7:**   **Percentage of New Zealand 15-year-old students at ERA proficiency levels by gender and ethnicity**
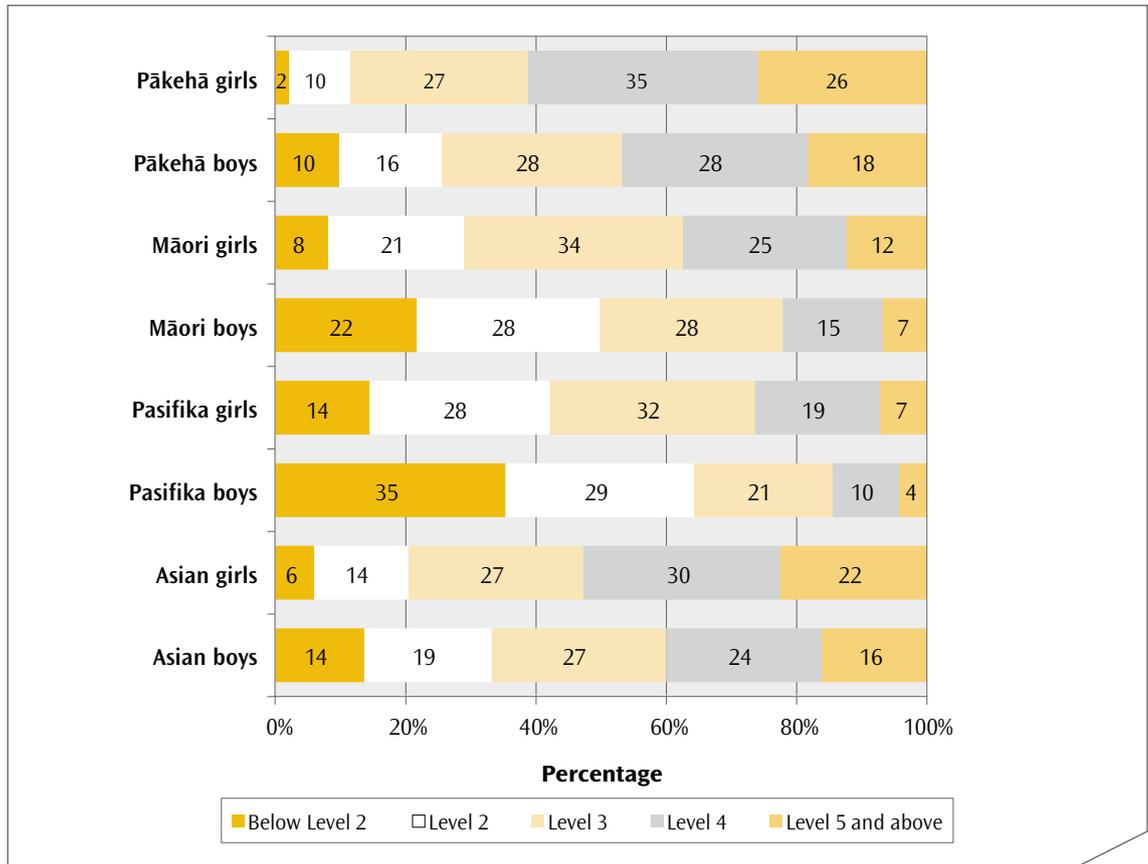


Note: Due to the small size of some of the groups (Pasifika girls below Level 2 and at Level 5 and above, Pasifika boys at Level 4 and at Level 5 and above, and Asian girls below Level 2), percentages for these groups should be treated with caution.

Because results are rounded to the nearest whole number, some totals may appear inconsistent.

# Special focus: Navigation in the ERA

Navigation through the electronic environment is one of the distinguishing features separating digital reading from its print equivalent, although the skills required for print reading are still important for interpreting text-based links in digital reading. To be effective, digital readers need to be able to move through non-linear page arrangements in a coherent fashion to make sense of what they are reading and to construct answers from the information they find.

The units that made up the ERA contained three main types of pages:

• relevant pages (either necessary or might be useful)

• necessary papers (need to be visited to complete the task and are a subset of relevant pages)

• irrelevant pages (clearly irrelevant to the task).

Compared to the OECD average, New Zealand students visited more relevant pages over the course of the assessment. At the same time, New Zealand students also made a slightly higher number of visits to these relevant pages.

There is a strong positive relationship between digital reading achievement scores and the average number of relevant pages that students visited over the course of the assessment.[6] A positive but less strong relationship also exists between digital reading achievement and the number of visits students made to the relevant pages. It is important to note that these relationships are non-linear. For example, a large increase in digital reading achievement score would be predicted for students who visited a moderate number of relevant pages over those who visited a low number. The predicted difference between those who visit a moderate number and those who visit a high number, however, would be much smaller (refer Figure 8 below). This is because those who visit too few pages might not find the required information, whereas those who visit too many pages are likely to be doing so aimlessly and due to lack of comprehension rather than in a thoughtful and careful manner.[7]

**Figure 8:**  **Schematic illustration of the relationship between number of relevant pages visited and digital reading performance**
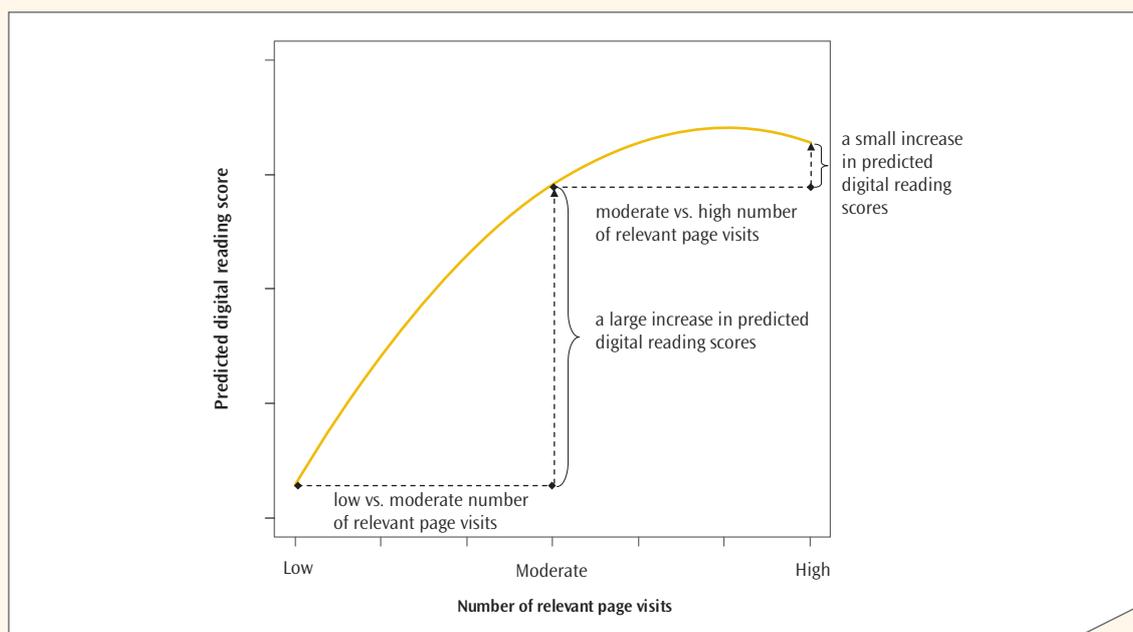


*Source: OECD (2011), Figure VI.3.1, p.93.*

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6    OECD (2011), Table VI.3.2, p.261.

7    OECD (2011), p.100.

# Digital reading achievement by family background

As part of the student questionnaire administered in PISA, contextual information about individual students and their families was gathered and analysed against digital reading achievement. The following section examines three important background variables created from this information: language spoken at home, immigrant status of students and parents, and family socio-economic status. These variables have been shown in other studies of educational achievement to have a relationship with achievement.

## Language spoken at home

Students were asked what language they spoke in their home most of the time. The large majority (86%) of New Zealand's 15-year-olds indicated their home language was English (the language of the test). Only two ERA countries had lower percentages of students who spoke the language of assessment at home: Austria (78%) and Spain (80%). All other countries had higher proportions.

Digital reading achievement was significantly higher (49 points), on average, among New Zealand students who spoke English at home most of the time.

## Immigrant status

PISA uses the term "native" to refer to students who were born in the country of the assessment and/or have at least one parent born in the same country. New Zealand and Australia were the only OECD participants in the ERA that had less than 80% of the participating students report that they were native; all other countries reported between 84 and 100% of students classified as native.

Overall, among New Zealand students, 17% were born outside New Zealand with parents also born elsewhere (first-generation students), and 8% were born in New Zealand but their parents were not (second-generation students).
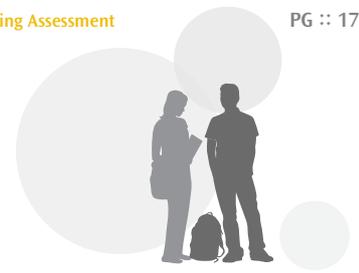
**Figure 9:** **Proportions of students of different immigrant backgrounds, New Zealand vs OECD average**
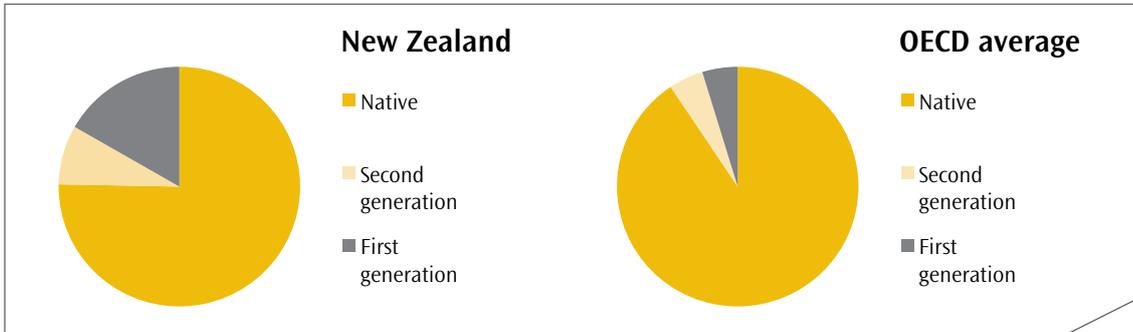


*Source: Data from OECD (2011), Table VI.4.4, p. 277.*

Although the native students' mean was higher than for second-generation students, this difference was not statistically significant due to the small size of the group of second-generation students and therefore the associated large standard error (see Figure 10). The difference between first-generation and native students was, however, statistically significant, meaning students who were born outside of New Zealand and whose parents were also born outside of New Zealand scored significantly lower than native students. Overall, New Zealand native students also scored significantly higher than students with immigrant status (second- and first-generation combined), and this pattern was also evident in the OECD average for the ERA participating countries.

**Figure 10:** **Mean digital reading achievement, by immigrant status**
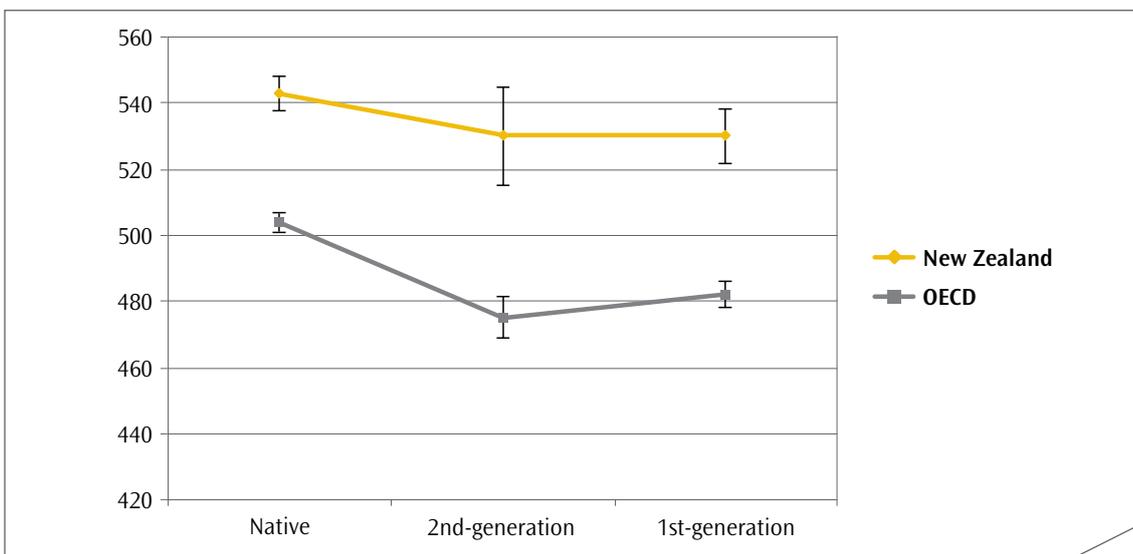


*Notes: The points represent means scores and the lines extending vertically from the points represent the 95% confidence intervals (ie, the range within which we are 95% confident that the true population value lies). Please note that the standard error and therefore the confidence interval will increase when there are fewer students in a particular group (eg, 2nd generation students in New Zealand).*

*Please note that the error lines for native New Zealand students and first-generation New Zealand students appear to be overlapping slightly, indicating a non-significant difference between the means. However, when a more sensitive t-test was done, the relationship was shown to be significant.*

*Source: Data from OECD (2011), Table VI.4.4, p.277.*

The relationship between students' immigrant status and digital reading achievement is often specific to the context of each country. A high proportion of native students in a country is not necessarily an indication of high achievement and/or equitable education systems. Korea and Japan, two of the highest scoring countries with the narrowest ranges of achievement, did have some of the highest percentages of native students (100% and 99.7% respectively). However, Poland and Chile, the two other countries with the highest proportions of native students (100% and 99.5% respectively), had relatively low mean digital reading achievement scores and medium to large ranges in their digital reading achievement data.

## Socio-economic status

Students participating in PISA were asked questions about their parents' occupational status and highest educational level. They were also asked whether they had a range of education-related and household items at home. Based on their responses, PISA developed an index that is known as "economic, social and cultural status" (ESCS).[8]  In this report the common term "socio-economic status", or SES, is used to refer to analyses using this index.

All PISA students were assigned to one of four equal-sized groups according to their family's estimated position on the socio-economic index in their country: low (the bottom 25%), low/medium, medium/high and high (the top 25%).

New Zealand students from high socio-economic backgrounds tended to have significantly higher mean achievement than those from low socio-economic backgrounds. This relationship between socio-economic background and performance for New Zealand's 15-year-olds was also observed across all other countries participating in the ERA.

**Table 2:     Mean digital reading achievement of New Zealand 15-year olds for different levels of SES in New Zealand**

| Socio-economic grouping | Mean score |
| --- | --- |
| Low (bottom 25%) | 495 (3.9) |
| Low-medium | 528 (3.5) |
| Medium-high | 551 (3.0) |
| High (top 25%) | 589 (3.4) |

*Note: Standard errors are shown in parentheses.*

*Source: Data from OECD (2011), Table VI.4.2, p.273.*

In New Zealand, socio-economic factors had a relationship with digital reading achievement similar to that with print reading. When compared to the other OECD countries that took part in the ERA, digital reading achievement in New Zealand was classified as showing an average relationship with socio-economic background.

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8     Details of the ESCS index can be found in Appendix 4.

# Background variables by ethnicity[9]

**Language spoken at home by ethnicity**

Overall, digital reading achievement was significantly higher, on average, among New Zealand students who regularly spoke English at home. This pattern varied across the ethnic groupings, as did the proportions of students who spoke English at home.

A large proportion of Pākehā/European (96%) and Māori (90%) students spoke English at home most or all of the time. Less than half of 15-year-old Asian students in New Zealand reported that they spoke English at home most of the time. Asian students with English as their home language achieved a significantly higher mean digital reading achievement score (by 37 points) than those Asian students who did not. For Pasifika students, a 66 score-point advantage was observed for the 68% of Pasifika students who spoke English at home most of the time, when compared with the 32% of Pasifika students who did not.

**Table 3:**     **Mean digital reading achievement for New Zealand 15-year-olds by language spoken at home and ethnicity**

| Student grouping | English (language of the test) | | Another language (or more than one language)[10] | |
| --- | --- | --- | --- | --- |
| | Percentage of students | Mean score | Percentage of students | Mean score |
| Pasifika | 68 (2.8) | 493 (6.7) | 32 (2.8) | 427 (7.8) |
| Asian | 42 (2.0) | 560 (6.4) | 58 (2.0) | 523 (6.8) |
| All students | 86 (0.7) | 547 (2.4) | 14 (0.7) | 497 (5.1) |

*Note: Standard errors are shown in parentheses.*

*Source: International data from OECD (2011), Table VI.4.5, p.279.*

# Immigrant status and ethnicity

The pattern of achievement by immigrant status is slightly different for each of the different ethnic groupings.[11] Asian and Pākehā/European students whose parents were immigrants (second-generation students) had the highest digital reading achievement scores overall, although the Asian grouping was a very small percentage of students (3%). Pasifika students who were native to New Zealand (neither they nor their parents were immigrants) had the highest digital reading achievement scores.

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9    Generally, the connection between background variables and achievement did not change much based on whether the student was a boy or girl, and so a breakdown by gender is not included here.

10   Students were asked to indicate only one language spoken at home, but some indicated more than one.

11   Māori students were not included in this analysis as almost all students who identified with this ethnic grouping also identified as being native to New Zealand.

**Table 4:**     **Mean digital reading achievement for New Zealand 15-year olds by immigrant status and ethnicity**

| | Native | | Second-generation | | First-generation | |
|---|---|---|---|---|---|---|
| Student grouping | Percentage of students | Mean score | Percentage of students | Mean score | Percentage of students | Mean score |
| Pākehā/European | 89 (0.7) | 555 (2.6) | 3 (0.3) | 589 (9.2) | 9 (0.6) | 564 (5.9) |
| Pasifika | 49 (3.2) | 490 (8.1) | 32 (3.4) | 462 (9.5) | 19 (2.0) | 449 (10.1) |
| Asian | 18 (1.7) | 549 (10.7) | 24 (1.7) | 566 (7.5) | 59 (2.0) | 525 (6.7) |

*Note: Standard errors are shown in parentheses.*

*Because results are rounded to the nearest whole number, some totals may appear inconsistent.*

**Figure 11:**     **Mean digital reading achievement for New Zealand 15-year-olds by immigrant status and ethnicity**
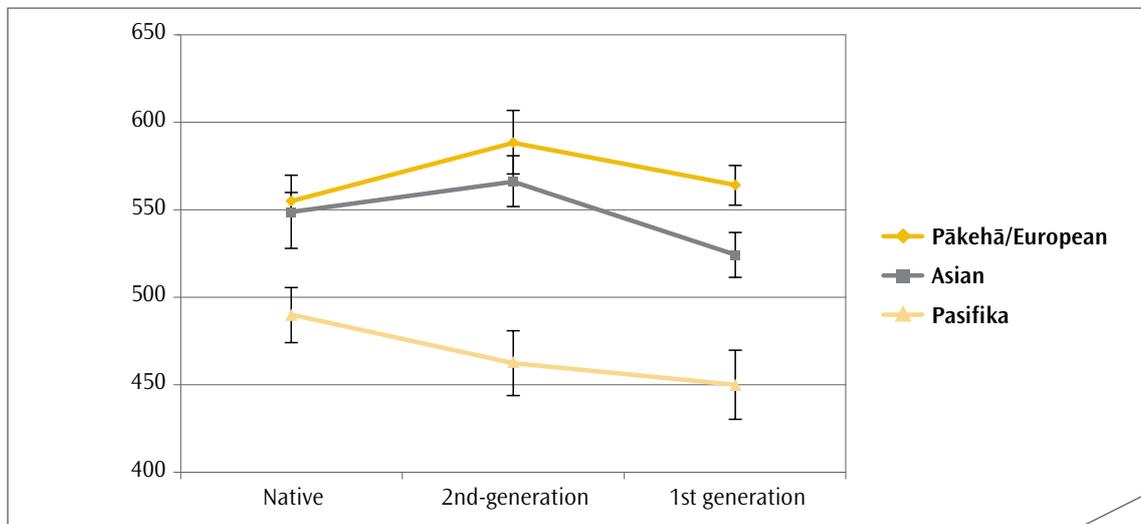


*Note: The points represent mean scores and the lines extending vertically from the points represent the 95% confidence intervals (ie, the range within which we are 95% confident that the true population value lies).*

## Socio-economic status by ethnicity

The same relationship between socio-economic status and digital reading achievement that was found among all students was also observed across the four main ethnic groupings, as can be seen in Figures 12a to d below. In all cases, students at the higher end of the socio-economic status index achieved significantly higher in digital reading than those at the lower end. The graphs also show the proportion of students from each of the four major ethnic groupings in the socio-economic status quarters. For Pākehā/European and Asian students, the proportions of students at each quarter of the index is fairly even; for Māori and Pasifika students, there is a higher proportion in the lower quarters.

**Figure 12a:** **Mean digital reading achievement scores and proportions by socio-economic status quarter for Pākehā/European students**
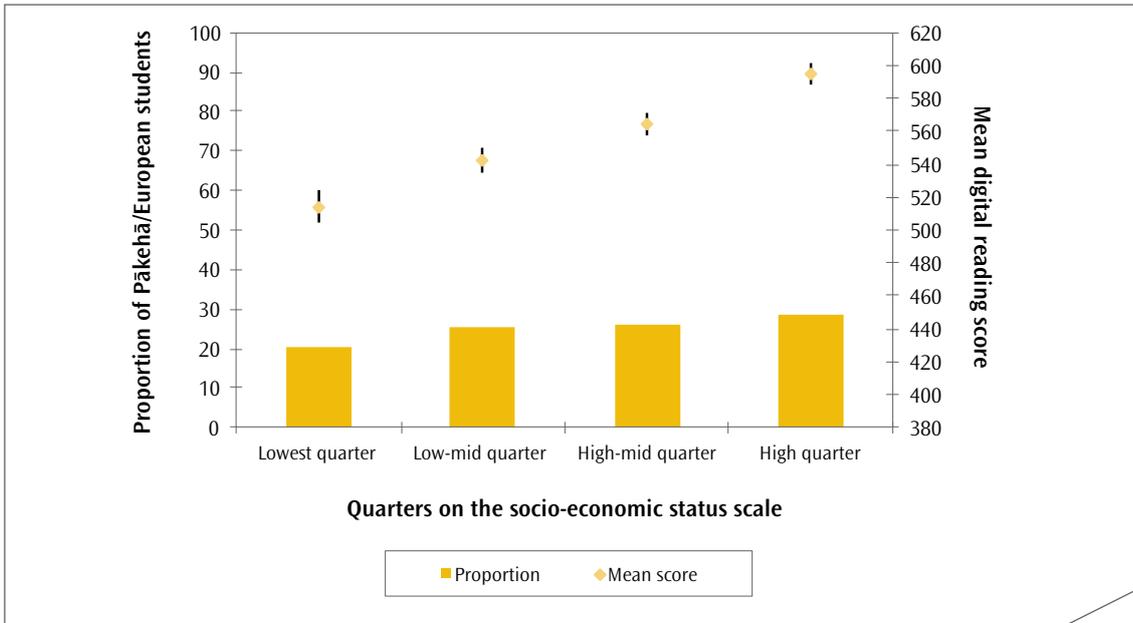


**Figure 12b:** **Mean digital reading achievement scores and proportions by socio-economic status quarter for Māori students**
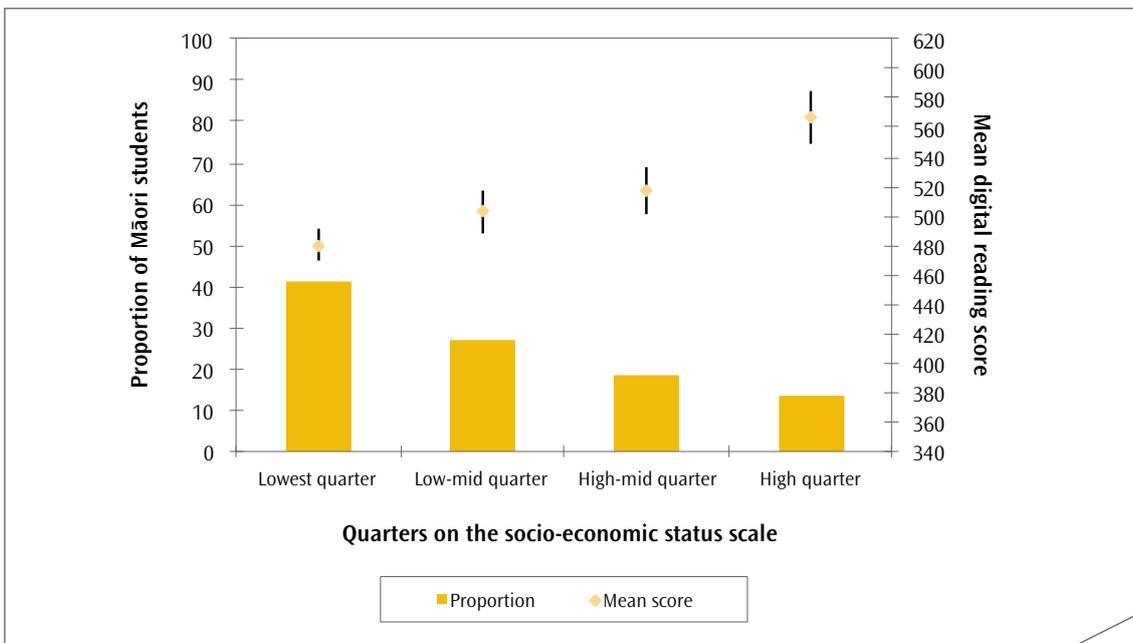
**Figure 12c:** **Mean digital reading achievement scores and proportions by socio-economic status quarter for Pasifika students**
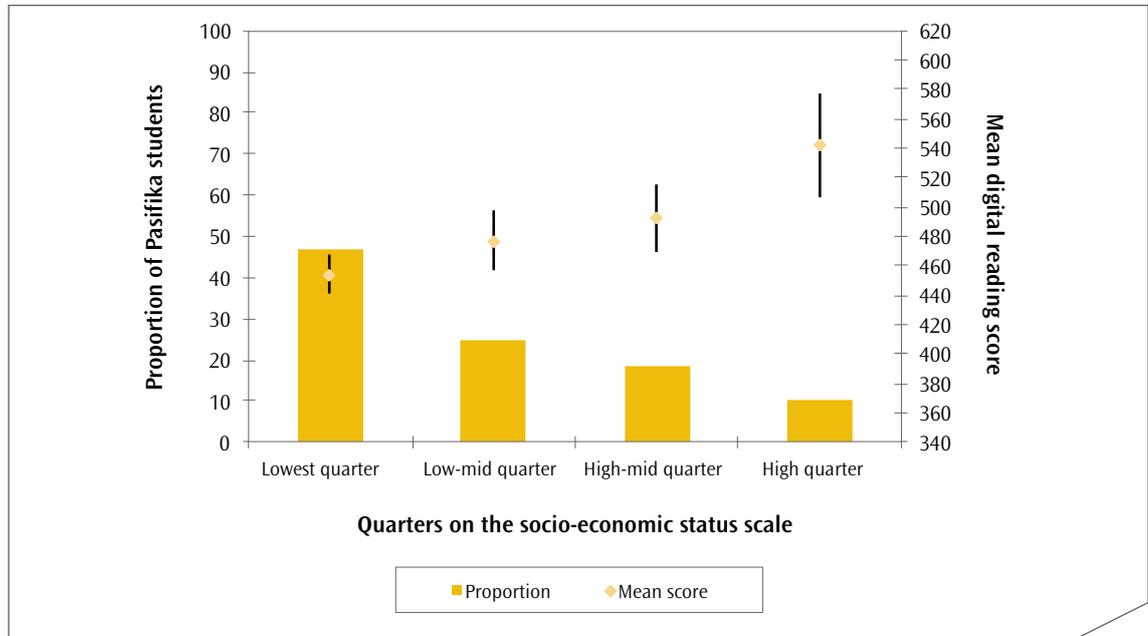


**Figure 12d:** **Mean digital reading achievement scores and proportions by socio-economic status quarter for Asian students**
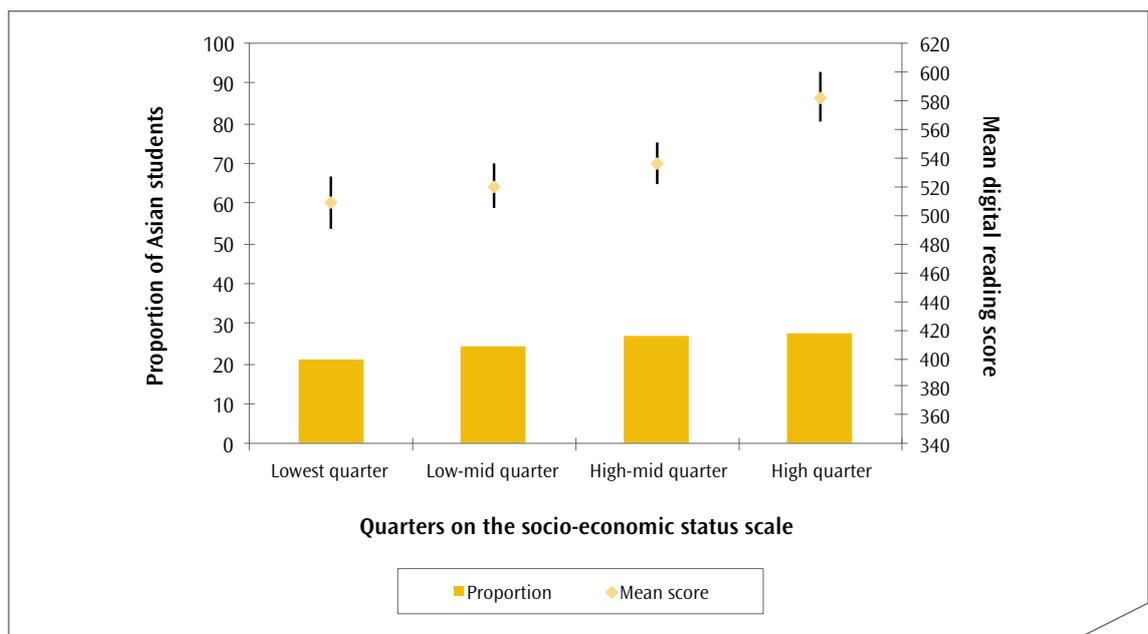


*Note: Lines extending from the score points represent the 95% confidence interval (ie, the range within which we are 95% confident that the true population value lies). Please note that the standard error and therefore the confidence interval will increase when there are fewer students in a particular group (eg, Pasifika students in the top quarter of the index).*

# Students' access to technology

Students taking part in PISA were asked about their access to and use of computers at home and at school. The percentage of New Zealand students with access to a computer at home rose by 17% between 2000 and 2009 (see Table 5), reflecting a similar rise across OECD countries. In 2009 almost all New Zealand students reported that they had used a computer.

The proportion of students with access to the internet at home saw an even bigger increase between 2000 and 2009. For all four ethnic groupings, access to both computers and the internet increased over that period. Māori and Pasifika students' access increased particularly, with 30% and 26% increases respectively in reported access to computers at home and 37% increases for both in access to the internet. Despite the large increases, the access for these two groupings still remained lower than for Pākehā/European and Asian students.

Although the overall proportion of students who reported not having access to the internet at home was relatively small (8%), 25% of Pasifika students and 18% of Māori students reported that they did not have access to the internet at home. The ERA results indicate that the digital reading achievement for those students without access to the internet at home was significantly lower than for those with access.

For those students identified in the bottom quarter of the socio-economic status scale, access to a computer at home rose from 54% to 88% between 2000 and 2009, while access for those in the top quarter rose from 97% to 100%. Access to both a computer at home and the internet was still lower for those at the bottom of the socio-economic status scale than for those at the top.

**Table 5:**  **Proportions of New Zealand 15-year old students with access to a computer and internet at home**

|  | Computer at home (%) | | Internet at home (%) | |
| --- | --- | --- | --- | --- |
|  | 2000 | 2009 | 2000 | 2009 |
| New Zealand | 79 (0.8) | 96 (0.3) | 61 (1.0) | 92 (0.5) |
| OECD average* | 72 (0.2) | 94 (0.1) | 45 (0.2) | 89 (0.1) |
|  |  |  |  |  |
| Pākehā/European | 83 (0.8) | 98 (0.2) | 64 (1.1) | 95 (0.4) |
| Māori | 62 (1.9) | 92 (0.9) | 45 (1.8) | 82 (1.6) |
| Pasifika | 61 (3.0) | 87 (1.8) | 38 (3.3) | 75 (1.8) |
| Asian | 85 (2.2) | 99 (0.4) | 79 (2.3) | 95 (0.8) |
|  |  |  |  |  |
| Bottom quarter of NZ socio-economic status scale | 53 (1.7) | 88 (1.1) | 31 (1.5) | 76 (1.5) |
| Top quarter of NZ socio-economic status scale | 97 (0.7) | 100 (0.0) | 89 (1.3) | 99 (0.3) |

*\* Based on 27 OECD countries that administered this question in both 2000 and 2009.*

*Note: Standard errors are shown in parentheses.*

*Source: International data from OECD (2011), Table VI.5.4, p.302; Table VI.5.7, p.305.*

New Zealand was one of the OECD countries with the highest level of computers in schools per student in 2009 (0.9 computers per student, or almost one-to-one for 15-year-olds in each school, on average), along with Australia, the United Kingdom, Austria and Denmark, all of which had ratios over 0.8.[12] Despite this, 43% of New Zealand students were in schools where the principals reported a shortage or inadequacy of computers for instruction, one of the highest rates across the OECD countries.[13] Because this is self-reported, however, it may be related to expectations of what is "adequate", and this expectation is likely to differ from country to country. Almost all New Zealand students reported in 2009 that they have access to computers and the internet at school (less than 2% reported no access to either at school).

**Figure 13:    New Zealand 15-year-old students' computer usage at home and school**
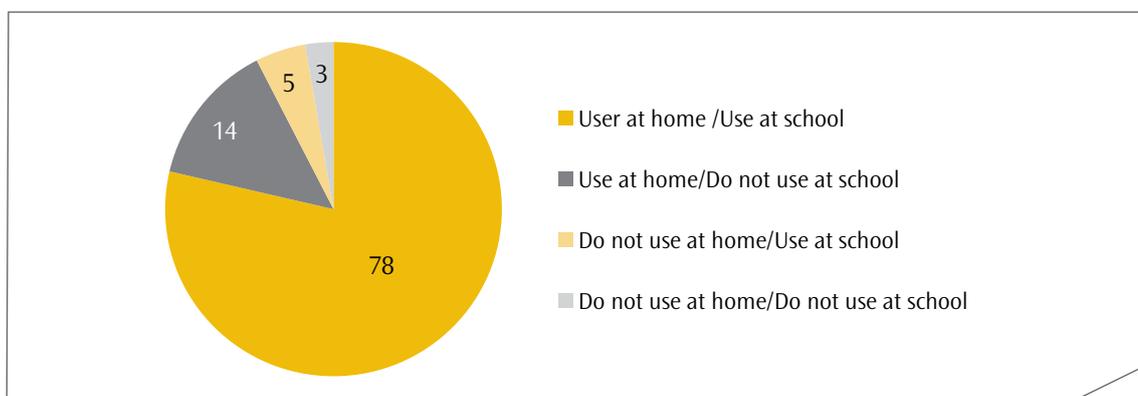


*Source: Data from OECD (2011), Table VI.5.10b, p.309.*

Seventy-nine percent of New Zealand students reported that they used the computer both at home and at school, while 14% used the computer at home but not at school and 5% used the computer at school but not at home. Three percent reported not using the computer at either location. Ninety percent of students who reported that they use the internet, use it at home, while 85% reported using it at school.

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12    Based on 33 OECD countries that administered this question in 2009.

13    This information is gathered in the PISA school questionnaire.
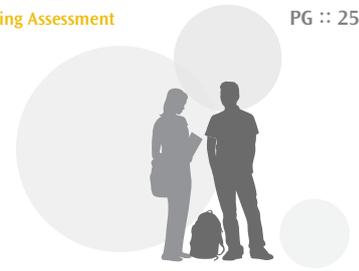
# Students' use of technology

## Electronic reading activities

As well as looking at background characteristics and access to technology, it is interesting to see whether there was a relationship between the kinds of electronic reading activities that students took part in and their digital reading achievement.

As part of the student questionnaire, PISA students were asked about their electronic reading activities. The most popular activity by quite a substantial margin was reading text messages; 87% of 15-year-olds in New Zealand reported that they did this frequently (several times a week or several times a day). As this was a national option only, there are no international comparisons available. The next most popular activity was reading emails, then chatting online, and searching online information to learn about a practical topic, echoing the top three across the OECD countries (albeit in a different order).[14] These three activities (plus the national option reading text messages) were the most popular for both New Zealand girls and New Zealand boys, but girls reported doing them more frequently than boys. The most popular activities were also the same for the four ethnic groupings, although in a different order for Māori and Pasifika students, and the proportions were different in each group (see Table 6 below).

**Table 6:**    **Four most popular electronic reading activities by percentage of students who said they did this activity frequently ("several times a week" or "several times a day")**

|  | Reading text messages/SMS (%) – national option only | Reading emails (%) | Chatting online (eg, MSN®) (%) | Searching online information to learn about a practical topic (%) |
|---|---|---|---|---|
| OECD average* | N/A | 64 (0.1) | 73 (0.1) | 51 (0.1) |
| NZ students | 87 (0.5) | 61 (0.7) | 57 (0.9) | 50 (0.8) |
| | | | | |
| NZ girls | 91 (0.7) | 67 (0.9) | 61 (1.0) | 51 (1.0) |
| NZ boys | 83 (0.8) | 55 (1.1) | 53 (1.3) | 49 (1.1) |
| | | | | |
| Pākehā/European | 89 (0.6) | 62 (0.8) | 57 (0.9) | 48 (1.0) |
| Māori | 87 (1.3) | 53 (2.0) | 55 (2.1) | 45 (1.4) |
| Pasifika | 78 (1.9) | 47 (2.0) | 43 (2.4) | 53 (2.2) |
| Asian | 79 (1.7) | 69 (1.8) | 66 (1.7) | 65 (2.1) |

*\* Based on 34 OECD countries that administered this question in 2009.*

*Note: Standard errors are shown in parentheses.*

*Source: International data from OECD (2010b), Table 111.2.9, p.198; Table 111.2.10, pp.199-201.*

14  The proportions of students who said they frequently carried out other electronic reading activities asked about in the question were: reading online news, New Zealand 27% (0.7 s.e.), OECD 46% (0.1 s.e.); using an online dictionary or encyclopaedia (e.g., Wikipedia®), New Zealand 30% (0.8 s.e.), OECD 39% (0.1 s.e.); taking part in online group discussions or forums, New Zealand 17% (0.6 s.e.), OECD 20% (0.1 s.e.); and the other New Zealand national option, reading blogs, New Zealand 31% (0.7 s.e.), OECD NA.

The list of electronic reading activities (see Appendix 4 for details of the online reading activities index the international questions contribute to) can be further subdivided into two main types of activities: searching for information and social activities.[15] In all of the ERA countries, more frequent online searching for information was related to better performance in digital reading in a linear way; the more often students carried out online information searching, the higher their score in digital reading. The relationship between online social activities and digital reading achievement, however, was weaker and less straightforward; those who frequently carried out this activity performed much better than those who carried out the activity least frequently, but not better than those who did it moderately.

New Zealand students registered below the OECD average for both searching for information and social activities online, meaning they carried out these activities less frequently than average across the 16 OECD ERA countries. There was no significant difference between the frequency of searching online activities for New Zealand girls and boys, but girls carried out online social activities more frequently than boys.[16]

PISA 2009 students were asked how often they used a computer at home for eight leisure activities and six schoolwork activities. Students were considered frequent users for a task if their response was at least once a week ("once or twice a week" or "everyday or almost every day").

The most popular of these home-based activities for New Zealand students were browsing the internet for fun (79% reported doing this at least once a week), using email (71%), chatting online (63%), and downloading music, films, games or software from the internet (60%).[17] The most frequently carried out schoolwork activities at home were doing homework on the computer (68%) and browsing the internet for schoolwork (52%).[18]

More New Zealand boys than girls reported that they used computers at home for leisure, and this was the pattern across the rest of the OECD countries also. For schoolwork-based home computer activities, however, more girls reported frequent use than boys.

Asian students reported the most frequent use of computers at home for leisure, followed by Māori students and Pākehā/European students; Pasifika students reported the least frequent use. Asian students also reported the most frequent use of computers at home for schoolwork-based activities, followed by Pākehā/European students and Pasifika students; Māori students reported doing this least frequently.[19]

The most frequently carried out use for school computers by both New Zealand students and the OECD average was searching the internet for schoolwork; 50% of New Zealand students reported doing this at least once a week and 39% on average across the OECD.[20] New Zealand was one of only two countries (along with Iceland) that took part in the ERA where girls reported using computers at school more often than boys. Pasifika students reported using computers at school the most of the ethnic groupings, followed by Māori students, then Asian and Pākehā/European students.

Moderate users of computers at home, both on the index of computer use at home for leisure and on the index of computer use at home for schoolwork, tended to have higher digital reading achievement than those who used them rarely or frequently. This can be seen in the New Zealand results and the OECD average. However, the relationship between students' computer use at school and digital reading achievement for both New Zealand and the OECD average tended to be negative. The OECD report hypothesised that this may mean that students who used computers at school were doing so because they needed more time or work to catch up to their peers.[21]

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15  Note these sub-indices do not include the New Zealand national options "reading text messages/SMS" and "reading blogs".

16  Student-level data for these indices are not publicly available for national level analysis therefore a breakdown by ethnicity has not been included here.

17  The figures in this paragraph for "using email" and "chatting online" differ from those in Table 6 because they were based on different questions in the student questionnaire. The questions were phrased differently to each other and the options students could choose from were also different, and so students may very well have chosen to answer them in slightly different ways. The student questionnaire for PISA 2009 is available at www.educationcounts.govt.nz/topics/research/pisa_research/pisa_2009

18  See Appendix 4 for the full list of home-based activities.

19  See Appendix 4 for ethnic groupings' placement on these two indices.

20  The other activities asked about were: chat online at school; use email at school; download, upload or browse material from the school's website; post your work on the school's website; play simulations at school; practice and drilling, such as for foreign language learning or mathematics; do individual homework on a school computer; use school computers for group work and communication with other students. Less than 30% of New Zealand students reported doing these frequently, as was the case across the OECD average. The OECD figures are based on 29 OECD countries that administered this question in 2009.

21  OECD (2011), pp.20–21.

# Student attitudes towards, and self-confidence in using, computers

The extent to which students agreed with statements about their experiences with computers were combined into an index of attitudes towards computers.[22] Despite regular use of computers by a relatively high proportion of students, New Zealand students expressed significantly less positive attitudes towards using computers than the OECD average. This does not mean they expressed negative attitudes, but rather, were less positive than the OECD average.

This is shown in Table 7, where we can also see that the score on the index is strongly affected by the lower percentage of New Zealand students who agreed that they use a computer because they are very interested. For the other three questions that made up the index, the results for New Zealand and the OECD average were similar.

**Table 7:**     **Proportion of students who responded positively to statements about computer experiences**

| Statements about computer experience | Agreeing (%) New Zealand | Agreeing (%) OECD average* |
|---|---|---|
| It is very important to me to work with a computer | 79 (0.7) | 83 (0.1) |
| I think playing or working with a computer is really fun | 89 (0.4) | 87 (0.1) |
| I use a computer because I am very interested | 52 (0.9) | 76 (0.1) |
| I lose track of time when I am working with the computer | 67 (0.8) | 69 (0.1) |

*\* Based on 28 OECD countries that administered this question in 2009.*

*Note: Standard errors are shown in parentheses.*

*Source: Data from OECD (2011), Table VI.5.22, p.324.*

There was no significant difference in digital reading achievement between the upper and lower quarters of the index of attitudes towards computers; in other words, the students' attitudes towards computer did not seem to make a difference to how well they did in the ERA.

New Zealand boys reported more positive attitudes towards computers than New Zealand girls. This pattern also occurred in 16 other OECD countries. There was no significant difference in digital reading achievement based on how positive the attitude of the student was across the genders.

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22   Agreeing with the statement meant answering with either "Strongly agree" or "Agree". Students were also able to respond with "Strongly disagree" and "Disagree".

Across ethnic groupings, Asian students indicated the most positive attitudes of the four main groupings, followed by Pasifika then Māori students. Pākehā/European students were the least positive. All groupings were less positive than the OECD average.

As well as overall attitudes towards computers, students were asked about how confident they were in carrying out high-level ICT tasks (see Figure 14 for the tasks asked about). New Zealand students felt most confident about creating a presentation by themselves or with some help from someone, and were least confident about creating a database by themselves or with help (see Figure 14). This pattern was the same across the other ERA countries.

**Figure 14:     Percentage of New Zealand 15-year-old students who reported being able to do each of the following tasks very well by themselves or with help from someone**
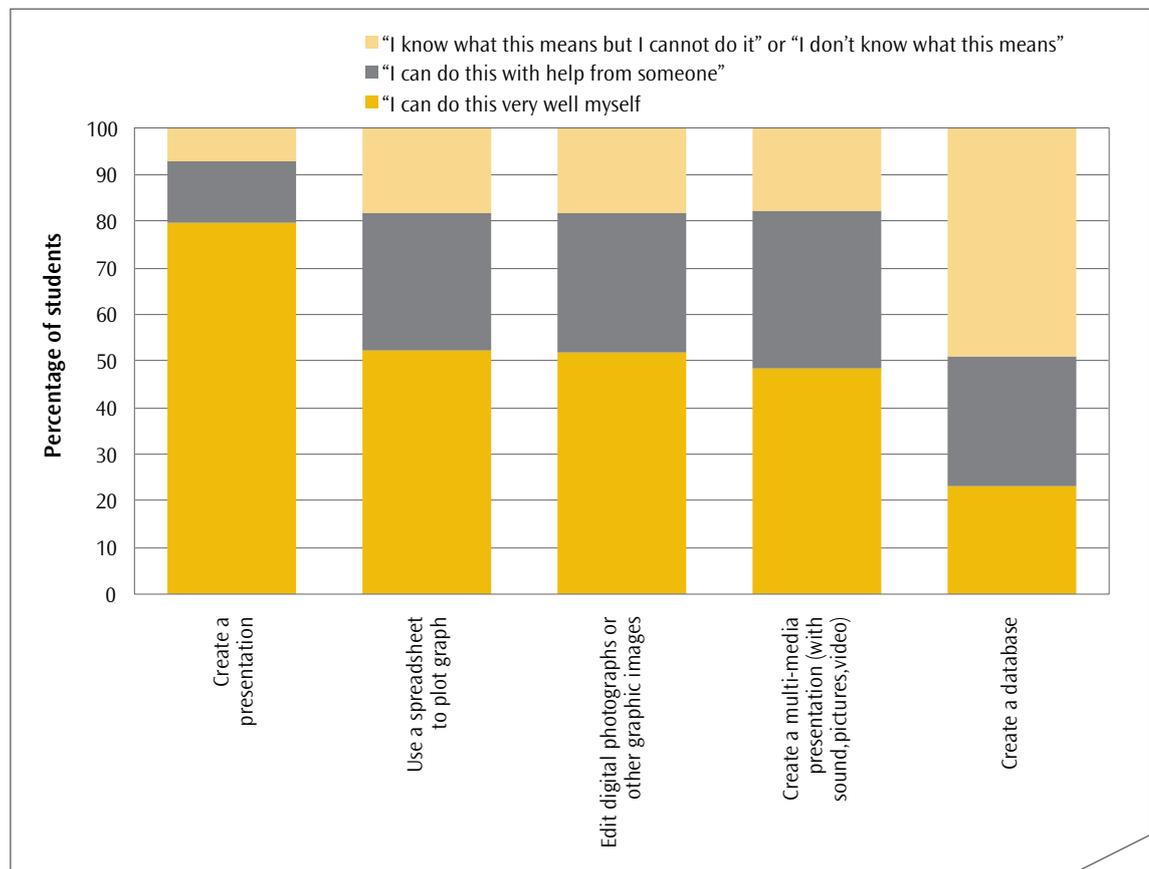


*Source: Adapted from OECD (2011), Figure VI.5.26, p.170 using New Zealand data from Table VI .5.24, p.327.*

Student responses about carrying out the high-level ICT tasks were used to create an index of self-confidence.[23] Students who featured in the top quarter of this index achieved significantly higher in digital reading (551) than those who featured in the bottom quarter (512). This index shows that New Zealand students were slightly less confident than the OECD average, and that there is no significant difference between boys' and girls' confidence levels when it comes to computer use. New Zealand was one of the few OECD countries where this was the case; in most countries, boys were more self-confident.

Among the ethnic groupings, Asian students were the most confident, followed by Pākehā/European students then Māori students. Pasifika students were the least confident.

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23    Based on 29 OECD countries that administered this question in 2009.

# Special focus: the relationship between digital and print reading

PISA 2009 allows us look at the close connection between performance in digital reading, as measured through the ERA, and print reading. Print reading was the main focus of assessment for PISA 2009. As the information in the section *About Pisa 2009 ERA* at the beginning of this report explains, a subset of the students who had taken the print (paper)-based assessment went on to take the Electronic Reading Assessment. This means we have results for the same students for both print reading and digital reading. We can then examine how the two types of assessment are connected with each other and with background characteristics of students.

The OECD carried out an analysis, using multi-level regression modelling, to look at the links between the two types of reading achievement, as well as the relationships with the other background factors described in Figure 15. There are two broad types of characteristics. Characteristics such as "student is a boy" and "computer at home" are taken from questions that can just be answered with a yes or no. Others are indices – "index of enjoyment of reading" and "index of diversity of reading materials" – where a student gets a score from high to low.[24] The characteristics chosen for this analysis are the ones we are using to describe the background of students for the purposes of comparing groups of students on print and digital reading. The advantage of using multi-level regression modelling is that it demonstrates that there is more than one attribute or characteristic that is related to achievement. It also demonstrates the relative strength of the relationship between achievement and particular characteristics.

**Figure 15:**   **Score point differences in digital reading associated with variables in the multi-level regression models for New Zealand data**
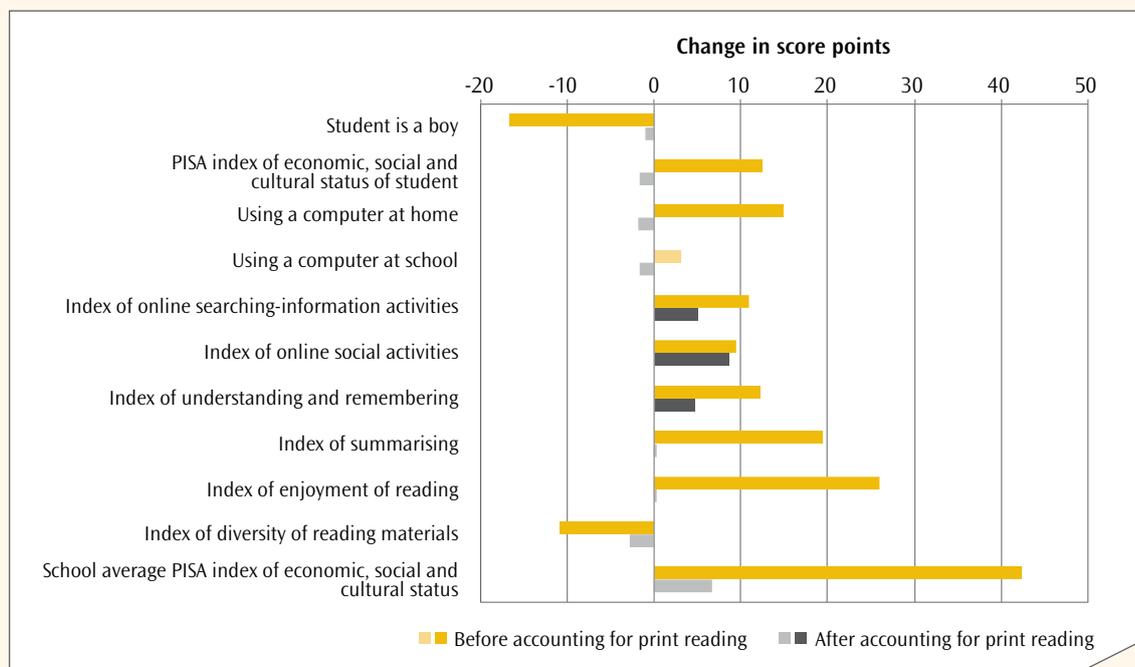


*Note: Bars are ranked in descending order of the change in digital reading achievement score after accounting for print reading. Changes in score that are statistically significant are marked in a darker tone.*

*Source: Adapted from OECD (2011), Figure VI.7.2, p.204 with New Zealand data from Table VI.7.1b, p.382; Table VI.7.2b, p.384.*

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24   For a country's rating on an index, the higher the value, the more students agree with the statements that make up that particular index.

Earlier we have established that in New Zealand girls outperform boys in digital reading (see Figure 2). The mean score for girls is 558 and for boys it is 518; a difference of 40 score points. If we start to compare boys and girls from similar backgrounds and take their print reading ability into account however, another picture emerges.

If we compare a group of boys with a group of girls from very similar backgrounds, we can expect girls to score 17 points higher than boys in digital reading. Taking this one step further, if we take those same groups of boys and girls with similar backgrounds and now make sure we are comparing students with the same print reading score, we would expect girls and boys to score roughly the same in digital reading. The result is no difference.

The OECD has made the same comparison across students from all OECD countries that participated in PISA 2009. Although, as in New Zealand, girls outperformed boys in digital reading on average across the OECD countries, when they compared boys and girls from very similar backgrounds and with the same print reading scores, boys, on average, outperformed girls. That is, the relationship between gender and digital reading achievement is reversed.

We can also look at the difference between students who use computers at home and those who do not. If we compare students from very similar backgrounds on their digital reading we would expect those who use computers at home to score 15 points higher than those who did not. If we then take their print reading achievement into account we find this difference reduces further and there is virtually no difference in their digital reading scores.

It is also the same for the PISA index of economic, social and cultural status (ESCS). When students with similar print reading ability are compared, and all their other background characteristics are the same, socio-economic, social and cultural status is not strongly related to digital achievement.

In addition to the relationships between digital reading and the background characteristics mentioned in this report, the OECD analysis found strong relationships between digital reading and how much students enjoy reading, diversity of print material for reading, and reading strategies. Once the students' print based reading scores were taken into account, however, the strength of these relationships was considerably reduced.

# Summary and conclusion

## Overall achievement

The New Zealand students who took part in the PISA 2009 ERA performed better than the majority of their international peers in digital reading literacy, as they continue to do in the paper-based reading literacy areas. New Zealand students' average digital reading achievement score was well above the OECD mean; indeed, only one OECD country (Korea) had a significantly higher average. New Zealand's digital reading result was significantly better than 16 other PISA countries and the same as one other (Australia).

At the top of the proficiency level scale, New Zealand students were as successful as their Korean counterparts. However, New Zealand had a larger proportion at the low end of the scale, which helps explain why their overall average was lower than Korea's. New Zealand had one of the widest ranges of scores of any of the OECD countries who participated in the ERA.

It is worth noting that a number of OECD and partner countries and economies who participated in the PISA 2009 print assessment did not participate in the ERA option. This includes Shanghai-China and Finland, who scored significantly higher than New Zealand in the print assessment, and Singapore and Canada, who scored statistically similar to New Zealand. Relative position on the PISA print assessment scale is not necessarily an indicator of how a country would score in the ERA, however; for example, Hong-Kong China scored significantly higher than New Zealand in the print assessment but lower in the ERA.

## Gender and ethnicity

Both high and low performers were found among boys and girls, and in all ethnic groupings. On average, girls had higher achievement than boys and were more likely to be at the top of the digital reading proficiency scale, while boys were more likely to be at the bottom. Pākehā/European and Asian students, on average, had higher digital reading achievement than Māori and Pasifika students.

## Family background

Digital reading achievement in New Zealand is strongly related to students' family background. Digital reading achievement was higher, on average, among students who regularly spoke English at home. Similarly, students who were born in New Zealand had higher digital reading achievement, on average, than those who were not. Students from higher socio-economic backgrounds tended to have higher digital reading achievement than those from lower socio-economic backgrounds. The relationship between digital reading achievement and socio-economic status was observed across all ERA countries and was also evident in the print assessment.

The pattern of higher achievement in higher socio-economic groups was also observed across the four ethnic groupings.

## Access to and use of technology

Almost all New Zealand students reported that they had used a computer, and the proportion of students with access to computers and the internet at home rose dramatically between PISA 2000 and PISA 2009. Fewer students reported using computers at school than at home, although this rate was still reasonably high, and New Zealand had one of the highest rates of principals reporting a shortage or inadequacy of computers for instruction across the OECD countries.

New Zealand students reported that their most common form of electronic reading was reading text messages, followed by reading emails, chatting online, and searching online information to learn about a practical topic. Girls reported doing these more frequently than boys, and the proportions of students who did these activities frequently varied across the ethnic groupings. Frequency of digital activities did vary, however, depending on whether they were carried out at home or at school, and also whether it was for leisure or for school work.

New Zealand students expressed less positive attitudes towards computers than the OECD average, although this was largely due to fewer students agreeing that they "use a computer because they are very interested". Their attitudes towards computers did not seem to affect achievement in the ERA. Boys had more positive attitudes than girls and Asian students had the most positive attitudes of the ethnic groupings, while Pākehā/European students were the least positive.

On the whole, our students reported being less confident in their computer use than the OECD average. Overall, those who were most confident when it came to computers scored significantly higher than those who were the least confident. There was no difference between girls and boys when it came to confidence in using computers. For the ethnic groupings, Asian students were the most confident and Pasifika students the least.

## Conclusion

The 2009 cycle of PISA was the first year that digital reading literacy has been examined alongside the print-based assessment, recognising the ever-increasing presence of digital information and interactions in our everyday lives. It is also an acknowledgement of the need for students to be able to effectively operate in such an environment.

As is also evident in the print PISA results for New Zealand, despite our high overall achievement levels, the spread of digital reading proficiency in this country is still considerably wider than for most of the other OECD countries and partner economies. In an ever-changing digital world, it is important to identify ways to support all students as they increasingly interact and work online.
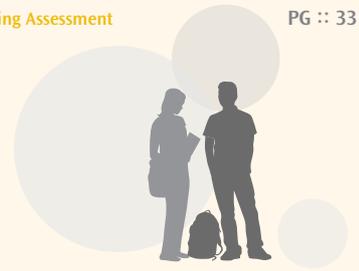
# Appendix 1:
# The PISA reading framework

As can be seen in the chart below, digital texts make up part of the overall PISA reading framework. Although digital reading is considered as a subset of reading literacy as a whole, it has some distinct and unique features, such as non-linear navigation through pages of text. However, the basic processes of reading, such as word identification and ability to recognise and understand grammatical structures, are applicable to both online and print reading.

**Figure A1.1:  Main features of the PISA 2009 reading framework**

### Main features of PISA 2009 reading framework

| | | |
|---|---|---|
| **TEXTS** What kind of text must students read? | **Medium** In what form does the text appear? | ▪ On paper ▪ Digitally |
| | **Environment** Can the reader change digital texts? | ▪ *Authored* (reader is receptive) ▪ *Message-based* (reader can change) |
| | **Text format** How is the text presented? | ▪ *Continuous texts* (in sentences) ▪ *Non-continuous texts* (in lists, like this one) ▪ *Mixed texts* (combining these) ▪ *Multiple texts* (brought together from more than one source |
| | **Text type** What is the rhetorical structure of the text? | ▪ Descriptive (typically answering "what" questions) ▪ Narration (typically "when") ▪ Exposition (typically "how") ▪ Argumentation (typically "why") ▪ Direction (providing instructions) ▪ Transaction (exchanging information) |
| **ASPECTS** What is the reader's purpose and approach to the text? | ▪ *Access and retrieve* information in the text ▪ *Integrate and interpret* what they read ▪ *Reflect and evaluate,* standing back from a text and relating it to their own experience | |
| **SITUATIONS** What is the intended use of the text, from the author's point of view? | ▪ *Personal:* To satisfy one's own interests ▪ *Public:* Relating to wider society ▪ *Educational:* Used in instruction ▪ *Occupational:* Related to the world of work | |

*Source: OECD (2010a), Figure I.2.7, p.38.*

The items in the ERA were intended to represent the digital medium as fully as possible. The chart below shows the distribution of the ERA items across the different digital reading characteristics (many of which are the same as those for the print assessment) by percentage of tasks they make up, number of score points allocated and the percentage of total score points they represent.

## Figure A1.2: Characteristics of digital texts

| | Characteristics | | Percentage of tasks | Number of score points[25] | Percentage of total score points |
|---|---|---|---|---|---|
| **Texts** | **Environment** | Authored | 66 | | |
| | | Message-based | 28 | | |
| | | Mixed | 6 | | |
| | **Text format** | Continuous | 7 | 2 | 5 |
| | | Non-continuous | 10 | 4 | 11 |
| | | Mixed | 7 | 2 | 5 |
| | | Multiple | 76 | 30 | 79 |
| | **Text type** | Argumentation | 21 | 8 | 21 |
| | | Description | 31 | 11 | 29 |
| | | Exposition | 31 | 11 | 29 |
| | | Transaction | 14 | 6 | 16 |
| | | Mixed / Not specified | 3 | 2 | 5 |
| **Cognitive processes** | **Aspect** | Access and retrieve | 24 | 7 | 18 |
| | | Integrate and interpret | 35 | 11 | 29 |
| | | Reflect and evaluate | 21 | 8 | 21 |
| | | Complex | 21 | 12 | 32 |

*Note: Because percentages are rounded to the nearest whole number, some totals may appear inconsistent.*

*Source: Adapted from OECD (2011), Figure VI.2.1, p.40, Figure VI.2.2; Figure VI.2.3, p.41; Figure VI.2.4, p.42; Figure VI.2.15, p.71; Figure VI.2.16, p.72; and Figure VI.2.17, p.73.*

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25   Greyed-out sections are not available.

# Appendix 2:
# PISA ERA proficiency levels

**Figure A2.1:** **Summary descriptions for four levels of proficiency in digital reading**

| Level | Lower score limit | Percentage of students able to perform tasks at this level or above | Characteristics of tasks |
|---|---|---|---|
| Level 5 and above | 626 | 7.8% | Tasks at this level typically require the reader to locate, analyse and critically evaluate information related to an unfamiliar context, in the presence of ambiguity. They require the generation of criteria to evaluate the text. Tasks may require navigation across multiple sites without explicit direction, and detailed interrogation of texts in a variety of formats. |
| Level 4 | 553 | 30.3% | Tasks at this level may require the reader to evaluate information from several sources, navigating across several sites comprising texts in a variety of formats, and generating criteria for evaluation in relation to a familiar, personal or practical context. Other tasks at this level demand that the reader construe complex information according to well-defined criteria in a scientific or technical context. |
| Level 3 | 480 | 60.7% | Tasks at this level require that the reader integrate information, either by navigating across several sites to find well-defined target information, or by generating simple categories when the task is not explicitly stated. Where evaluation is called for, only the information that is most directly accessible or only part of the available information is required. |
| Level 2 | 407 | 83.1% | Tasks at this level typically require the reader to locate and interpret information that is well defined, usually relating to familiar contexts. They may require navigation across a limited number of sites and the application of web-based tools such as dropdown menus, where explicit directions are provided or only low-level inference is called for. Tasks may require integrating information presented in different formats, recognising examples that fit clearly defined categories. |

*Note: A description of the tasks that students below Level 2 are able to complete is not available here because the pool of items applicable to this section of the scale is too small. This group is comprised of the lowest achievers and it can be assumed that they are unable to complete the range of tasks described for Level 2.*

*Source: OECD (2011), Figure V1.2.8, p.46.*

# Appendix 3: Example of stimulus material and marking schedule

Following each iteration of the PISA study, some of the test items that will not be used again are released and published to show examples of the types of stimuli and questions used. The items available from the main study of PISA 2009 are IWantToHelp, Smell, and Job Search. These items are available for viewing at:

*http://erasq.acer.edu.au/index.php?cmd=home*
(with username: Public and password: Access)

The other items on the website (Philosophers' Café, Ice Cream, Phishing, and Let's Speak) were discarded following the PISA 2009 field trial.

Because of the nature of online reading and its methods of non-linear navigation, it is difficult to adequately portray items in a print report. However, for your information, a summary of one of the questions and marking schedule are included here. Also included is the percentage of New Zealand students and the OECD average percentage of students who answered these questions correctly. For multiple choice questions, this is one score; for open-ended questions, there is a percentage for those students who scored partial credit and those who scored full credit. Standard errors of these percentages are included in parentheses.
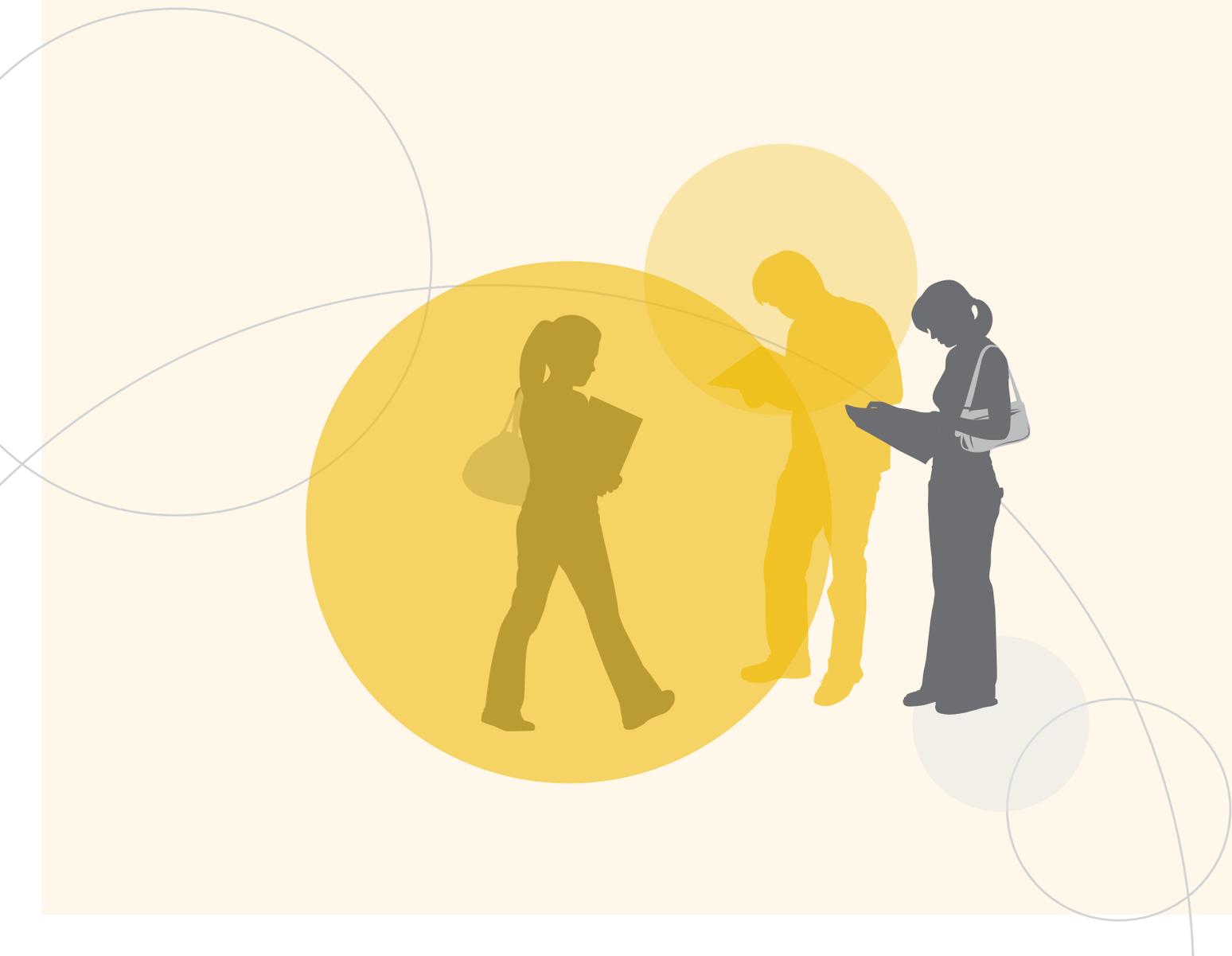
## Figure A3.1: **IWantToHelp released item**
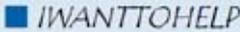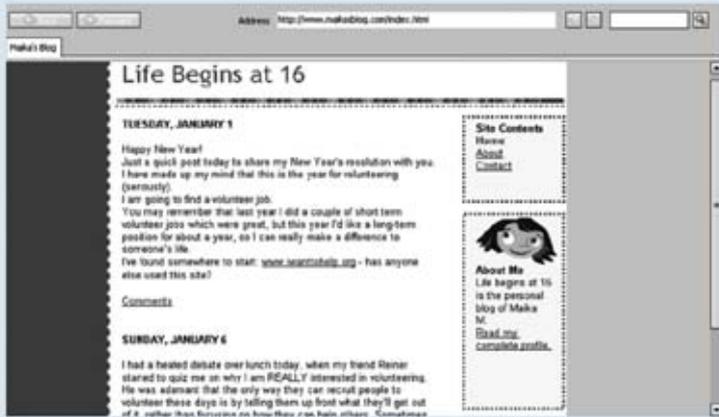


**IWANTTOHELP**

**IWANTTOHELP** – QUESTION 1

Situation: *Occupational*
Environment: *Message-based*
Text format: *Continuous*
Text type: *Description*
Aspect: *Access and retrieve – Retrieve information*
Question format: *Multiple choice*
Difficulty: *362 (below Level 2)* •

**Percentage correct**
New Zealand: 91% (0.96 s.e.)
OECD average: 85% (0.33 s.e.)

Read Maika's blog entry for January 1. What does the entry say about Maika's experience of volunteering?

A. She has been a volunteer for many years.

B. She only volunteers in order to be with her friends.

C. She has done a little volunteering but would like to do more.

D. She has tried volunteering but does not think it is worthwhile.

**Scoring**

**Full Credit:** C. She has done a little volunteering but would like to do more.

**Comment**

The first page that students see in this unit is the home page of the blog (*Life Begins at 16*) of a young person named Maika. This page contains two entries from the blog, for January 1 and January 6. Although this kind of text often appears on a social networking site, the specific content describes Maika's interest in and plans for doing voluntary work, so this question (and later questions in this unit) are classified as falling within the occupational context.

Fifteen-year-old students may not have much experience of volunteering, but the concept is quite concrete, and the text is made accessible by the use of language that is relatively simple and colloquial ("Just a quick post", "(seriously)"), and addressed directly to the audience who may be reading it ("share my New Year's resolution with you", "You may remember", "has anyone else used this site?"). The page contains features typical of social networking sites, with four links available within the site ("About", "Contact", "Read my complete profile", "Comments") and one link to an external site (www.iwanttohelp.org).

This task requires the reader to identify information about Maika's experience of volunteering. Students need to read the short text entry for January 1 in order to locate the answer. It is not necessary to scroll down to see the remainder of the entry for January 6, nor for any other kind of navigation. The second and third sentences of the text give an indication of Maika's desire to work as a volunteer, which discounts option D and guides the reader towards the second part of the key ("would like to do more"). The key is a simple paraphrase of two pieces of information in the following sentence: "... last year I did a couple of short term voluntary jobs ..., but this year I'd like a long-term position ...". Given the relative prominence of the information in this short text, the direct and relatively simple language, the lack of need to navigate, and the straightforward way in which terms in the question and key to expressions they locate in the text are related, this has all the features of an easy question.

## IWANTTOHELP – QUESTION 2

**Situation:** *Educational*
**Environment:** *Message-based*
**Text format:** *Multiple*
**Text type:** *Description*
**Aspect:** *Access and retrieve – Retrieve information*
**Question format:** *Multiple choice*
**Difficulty:** *417 (Level 2)*

**Percentage correct**
New Zealand: 84% (1.03 s.e.)
OECD average: 78% (0.35 s.e.)

| | |
|---|---|
| 626 | Level 5 or above |
| 553 | Level 4 |
| 480 | Level 3 |
| 407 | Level 2 |
| | Below Level 2 |

Go to Maika's "About" page.

What kind of work does Maika want to do when she leaves school?

A. Photography.

B. Web design.

C. Banking.

D. Social work.

### Scoring

**Full Credit:** B. Web design.

### Comment

This question also starts on the home page of the blog, but the question directs students to navigate to a second page. Therefore, in contrast to all print reading tasks, the information needed to answer the question cannot be obtained from the material initially presented: the student needs to locate an additional text by clicking on the link. In this instance, selecting the correct link from the five available is easy because there is a literal match between the term in the task and the name of the link ("About"), and because the link is prominent.

**Life Begins at 16**

**About**

Life begins at 16 is the personal blog of Maika M.
I love art and am working towards a future in web design.
I do almost all of my illustration in PhotoSet.
Please feel free to comment on my artwork (or on anything else that takes your fancy).

**Site Contents**
Home
About
Contact
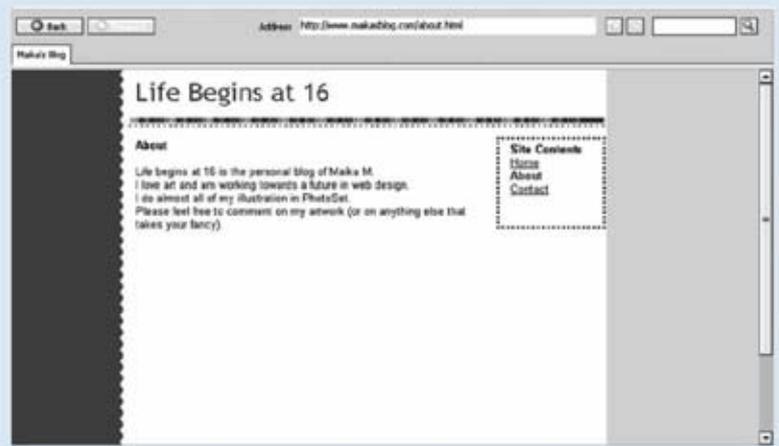
Once students click on this link, a second text appears, hiding the first text – this is one of the strongest distinctions between print and digital texts. This new text is very brief, containing a small amount of background information about the personal life of the writer of the blog. It can be considered as dealing with information of a kind likely to be fairly familiar to most 15-year-olds. There is minor distracting information in option A, with reference to "PhotoSet" in the text, while option D is also plausible, given the information on the first text (the home page) about Maika's expressed desire to do voluntary work and to make a difference to someone's life. Answering this question relies on making a literal match between the key and one of the terms in the text, "web design". The brevity of the text, its simple language, and the literal matches make this question relatively comprehensible; it appears that the need for one navigation step adds an element of difficulty, making it slightly more difficult than the previous question.

## IWANTTOHELP – QUESTION 3

**Situation:** Educational
**Environment:** Authored
**Text format:** Multiple
**Text type:** Argumentation
**Aspect:** Integrate and interpret – Form a broad understanding
**Question format:** Multiple choice
**Difficulty:** 462 (Level 2)

**Percentage correct**
New Zealand: 79% (1.31 s.e.)
OECD average: 69% (0.38 s.e.)

Level 5 or above
62%  Level 4
353  Level 3
480  Level 2
407  Below Level 2
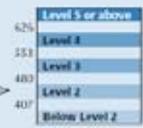
Open the link that Maika refers to in her January 1 post. What is the main function of this website?

A. To encourage people to buy **iwanttohelp** products.

B. To encourage people to give money to people in need.

C. To explain how you can make money by volunteering.

D. To provide people with information about ways to volunteer.

E. To tell people in need where they can find help.

### Scoring

**Full Credit:** D. To provide people with information about ways to volunteer.

### Comment

In this task students are required to recognise the main idea of a text, but in order to do this, they first need to find the text. In order to view the necessary text, they have to click on a link, as indicated in the task. Only one of the hyperlinks on this page occurs within the blog entry for January 1, so the direction in the task is explicit, but four other links available on the page act as distractors. Clicking on the correct link takes the reader not only to a new page, but also to an entirely new website, the home page for an organisation called iwanttohelp. This page opens in a new tab, so that it is possible for students to click on the tab "Maika's Blog" if they wish to return to the first text, although that is not necessary for this task. The content of the new website is more abstract, employing terms that may be relatively unfamiliar to students, such as "non-profit organisation", "opportunity" and ".org", and is addressed to a large anonymous audience rather than operating at the personal level of a blog.

This text is classified as argumentation because it encourages readers to take action, either by contacting other organisations ("Find an Opportunity Now") or by making donations ("We rely on public donations"). Four links to other part of the website are available on this page if students wish to explore the site in order to obtain a broader picture of the organisation. This, however, would be time consuming and inefficient. Such opportunities always exist for anyone reading material on the Internet, so one feature of reading in this environment is being able to judge when it is necessary to open new links, thus expanding the number of available texts.

In this case, in order to answer this broad understanding question, students need to read the short description of the organisation provided in the box on the left of the home page, supported by the prominent question and link above the photograph. It is not possible to make any literal matches between the task and the key: some (relatively low) level of inference is needed to recognise that this site provides information explaining how people could volunteer. The distractors all have some degree of plausibility, because of their references to the iwanttohelp site, to money and people in need, to volunteering, and to giving information about help.

This task is somewhat harder than the previous task, although it is still relatively easy. The comparative difficulty is explained by the need to navigate to the text with the required information using the correct link; the amount of potentially distracting information available through irrelevant links on the web pages; the somewhat abstract and unfamiliar information and language used; and the need for a level of inference to answer the question.

## IWANTTOHELP – QUESTION 4

**Situation:** *Educational*
**Environment:** *Mixed*
**Text format:** *Multiple*
**Text type:** *Mixed*
**Aspect:** *Complex*
**Question format:** *Constructed response*
**Difficulty:** *Full credit 567 (Level 4); Partial credit 525 (Level 3)* •

**Percentage correct**
New Zealand:
Partial: 10% (0.98 s.e.); full:65% (1.60 s.e.)
OECD average:
Partial: 14% (0.27 s.e.); full: 44% (0.44 s.e.)

Read Maika's blog for January 1. Go to the iwanttohelp site and find an opportunity for Maika. Use the e-mail button on the "Opportunity Details" page for this opportunity to tell Maika about it. Explain in the e-mail why the opportunity is suitable for her. Then send your e-mail by clicking on the "Send" button.

### Scoring

**Full Credit:** Selects Graphic Artist or Upway Primary School and writes a message in the e-mail text box with a relevant explanation that matches Maika's criteria.

#### E-mail message for Graphic Artist

Refers to ongoing position or future or web design or art.
- You're a great artist and it is ongoing – you said you wanted a longer type of work right?
- It's ongoing and it would help you get experience for your future.
- You are obviously interested in graphic design, and want to pursue this when you finish school, and you would also love to volunteer. This would be a great opportunity to do both these things, and will look great on your CV too!

OR

#### E-mail message for Upway Primary School

Refers to ongoing position or making a difference.
- This would be a good job – ongoing and you get to help some kids.
- Here's a job where you'll really make a difference.

**Partial Credit:** Selects Graphic Artist or Upway Primary School and writes a message in the e-mail text box with no explanation or an irrelevant explanation.

#### E-mail message for Graphic Artist

Gives insufficient or vague answer.
- You'd like it.

Shows inaccurate comprehension of the opportunity or gives an implausible or irrelevant answer.

- You'd be working with kids a lot. [Irrelevant, not one of Maika's criteria.]
- It gives you a chance to get out and about.

OR

**E-mail message for Upway Primary School**

Gives insufficient or vague answer.

- You need an hour a week but it sounds like this could be what you're looking for. *[Lacks reference to job criteria, repeats part of stem.]*
- You'd like it.

Shows <u>inaccurate comprehension of the opportunity</u> or gives an <u>implausible or irrelevant</u> answer.

- It gives you a chance to get out and about.

## Comment

This is an example of a complex task, which involves all three aspects of reading. It also has a substantial navigation requirement. This complexity highlights a number of differences between print and digital reading tasks. The overall task requires students to construct a short e-mail message after integrating and reflecting upon information located in several texts. The text type has not been specified because the task requires the reader to integrate information from several types of text: argumentation (the iwanttohelp website), description (Maika's blog) and transaction (the e-mail).

Beginning with an interpretation of information given on Maika's blog, students are then required to locate a number of pages on the iwanttohelp website, evaluate information on these pages in relation to what they have read on the blog, and use the evaluation to send Maika a simple message. There is no single pathway for navigation, and two different texts can be used to formulate responses that receive credit. This variability is typical of navigation in the digital environment.

The task requires students to navigate from the starting page, Maika's blog, to the Latest Opportunities page shown below. To see the whole page, scrolling is required.



This page offers four opportunities for students to evaluate on Maika's behalf, each with links providing additional information. Students may open as many of the links as they consider necessary. The page for the Upway Primary School opportunity is shown below.

This text is fairly short, but relatively dense, with quite complex vocabulary ("an innovative approach", "a more diverse population", "foster the academic development", "academic support"). Having located the opportunities, students need to compare descriptions of the opportunities with the criteria given on Maika's blog. They may click on the tab to re-read her entry for January 1, where she refers to wanting "a long-term position" in which she can "make a difference". A broad understanding of the Upway Primary School text would support the evaluation that working here would fit Maika's criteria. This interpretation is supported by expressions such as "The volunteer meets with the student ... for a minimum of one year" and "through academic support, positive role-modelling, and a one-to-one friendship, students will succeed".

Some students may also use the link "Read my complete profile" or "About", which refers to her interest in "a future in web design" and to her "artwork". The information here supports the selection of the Graphic Artist opportunity.

Students may use the "Back" and "Forward" buttons, the links on each page and the scroll bar to navigate back and forth between descriptions of various opportunities until they have selected the one that they judge to be most suitable. In each case it is necessary to scroll down to see a full description of the opportunity.

Once students have chosen an opportunity, they need to construct an e-mail message to send to Maika. They do this by opening yet another link, "E-mail opportunity details to a friend", in accordance with the task instructions.



The page where they do this has the e-mail address and subject lines already completed, together with the beginning of a message: "Thought you'd be interested in this volunteer opportunity because...". To receive credit, students must select either the Graphic Artist or the Upway Primary School opportunity. Students who recommend the Graphic Artist opportunity receive full credit if they refer to the fact that this opportunity is an ongoing position; or comment that it is relevant to her future or to her interest in web design or art. Students who recommend Upway Primary School receive full credit if they refer either to the fact that this is an ongoing position or to the idea of making a difference.

Students who select one of these two opportunities but do not write a message that refers to the criteria Maika is seeking nevertheless receive partial credit for having successfully completed much of this complex task: accessing relevant information, comparing information from different texts and making a judgment about which opportunity is suitable.

In summary, in order to obtain full credit for this task, students need to go through a series of processes, involving multiple navigation steps to access a series of texts. Some of the navigation steps are made explicit in the task instructions, but readers need to make multiple evaluations of the available links to decide which ones would allow the most efficient way of completing the task. Students need to make multiple interpretations of texts, from Maika's blog as well as various pages on the iwanttohelp website, and to compare ideas and information across these texts, in support of the reflection and evaluation that the task requires.

*Source: OECD 2011, pp.54–59.*

# Appendix 4: OECD PISA indices

## Index of economic, social and cultural status (ESCS)

### Items the index is based on

This index is derived from the following indices: the index of the highest socio-economic occupational status of a student's parents, the highest educational level of a student's parents, and home possessions. The last of these was obtained by asking students whether they had in their home: a desk to study at, a room of their own, a quiet place to study, a computer they could use for schoolwork, educational software, a link to the internet, their own calculator, classic literature, books of poetry, works of art (eg, paintings), books to help with their schoolwork, a dictionary, a dishwasher, a DVD player or VCR; the number of cell phones, televisions, computers, cars and books at home; and three country-specific items (for New Zealand, these were a broadband connection, pay television (eg, Sky, Saturn), and response to 'do you and your family have a holiday away from home for at least one week each year?').

### A4.1: Scores on the index of economic, social and cultural status

| | All students | Sub-groups | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | Girls | Boys | Pākehā/ European | Māori | Pasifika | Asian |
| New Zealand | 0.09 (0.02) | NA | NA | 0.19 (0.02) | -0.24 (0.03) | -0.38 (0.04) | 0.14 (0.03) |
| OECD average* | 0.06 (0.01) | NA | NA | NA | NA | NA | NA |

*Based on the 16 OECD countries that participated in the ERA in 2009.

Source: International data from OECD (2011), Table VI.4.3, p.276.

## Index of online reading activities

### Items the index is based on

The items were reading emails, chatting online, reading online news, using an online dictionary or encyclopaedia (eg, Wikipedia®), searching online information to learn about a particular topic, taking part in online group discussions or forums,and searching for practical information online. Two national options, reading text messages and reading blogs, were also included in the student questionnaire for New Zealand students. The questions used for this index were also divided into two sub-indices: online searching for information and online social activities. Note that the New Zealand national options were not included in the construction of the main index nor in the sub-indices.

### A4.2a: Scores on the index of online reading activities

| | All students | Sub-groups | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | Girls | Boys | Pākehā/ European | Māori | Pasifika | Asian |
| New Zealand | -0.29 (0.02) | -0.24 (0.02) | -0.33 (0.02) | -0.30 (0.02) | -0.47 (0.03) | -0.47 (0.04) | 0.12 (0.04) |
| OECD average* | 0.00 (0.00) | -0.03 (0.00) | 0.03 (0.00) | NA | NA | NA | NA |

*Based on the 34 OECD countries that administered the relevant questions in 2009.

Source: International data from OECD (2010b), Table 111.1.12, p.153.

### A4.2b: Scores on the sub-index of online searching for information activities[26]

| | All students | Sub-groups | | | | | |
|---|---|---|---|---|---|---|---|
| | | Girls | Boys | Pākehā/European | Māori | Pasifika | Asian |
| **New Zealand** | -0.13 (0.02) | -0.13 (0.02) | -0.14 (0.02) | NA | NA | NA | NA |
| **OECD average*** | 0.00 (0.00) | -0.03 (0.01) | 0.03 (0.01) | NA | NA | NA | NA |

*Based on the 16 OECD countries that participated in the ERA in 2009.*

*Source: OECD (2011), Table VI.4.11, p.286.*

### A4.2c: Scores on the sub-index of online social activities[27]

| | All students | Sub-groups | | | | | |
|---|---|---|---|---|---|---|---|
| | | Girls | Boys | Pākehā/European | Māori | Pasifika | Asian |
| **New Zealand** | -0.30 (0.02) | -0.18 (0.02) | -0.41 (0.03) | NA | NA | NA | NA |
| **OECD average*** | 0.00 (0.00) | 0.04 (0.01) | -0.04 (0.01) | NA | NA | NA | NA |

*Based on the 16 OECD countries that participated in the ERA in 2009.*

*Source: OECD (2011), Table VI.4.12, p.287.*

## Index of computer use at home for leisure

**Items the index is based on**

The eight leisure activities were: play one-player games; play collaborative online games; use email; chat online; browse the internet for fun; download music, films, games or software from the internet; publish and maintain a personal website, weblog or blog; and participate in online forums, virtual communities or spaces. Higher values on this index indicate more frequent computer use at home for leisure.

### A4.3: Scores on the index of computer use at home for leisure

| | All students | Sub-groups | | | | | |
|---|---|---|---|---|---|---|---|
| | | Girls | Boys | Pākehā/European | Māori | Pasifika | Asian |
| **New Zealand** | -0.13 (0.02) | -0.21 (0.02) | -0.06 (0.03) | -0.15 (0.02) | -0.07 (0.05) | -0.25 (0.04) | 0.06 (0.04) |
| **OECD average*** | 0.00 (0.00) | -0.16 (0.00) | 0.16 (0.00) | NA | NA | NA | NA |

*Based on 28 OECD countries that administered the relevant questions in 2009.*

*Source: International data from OECD (2011), Table VI.5.14, p.313.*

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26    Student-level data for this index is not publicly available for national-level analysis, and so a breakdown by ethnicity has not been included here.

27    Student-level data for this index is not publicly available for national-level analysis, and so a breakdown by ethnicity has not been included here.

# Index of computer use at home for schoolwork

**Items the index is based on**

The six schoolwork-related activities were: do homework on the computer; browse the internet for schoolwork; use email for communication with other students about schoolwork; use email for communication with teachers and submission of homework or other schoolwork; download, upload or browse material from your school's website; and check the school's website for announcements. Higher values on this index indicate more frequent computer use at home for schoolwork.

## A4.4: Scores on the index of computer use at home for schoolwork

| | All students | | | Sub-groups | | | |
|---|---|---|---|---|---|---|---|
| | | Girls | Boys | Pākehā/European | Māori | Pasifika | Asian |
| **New Zealand** | -0.16 (0.02) | -0.10 (0.02) | -0.22 (0.02) | -0.22 (0.02) | -0.34 (0.04) | -0.26 (0.06) | 0.27 (0.05) |
| **OECD average\*** | 0.00 (0.00) | 0.01 (0.00) | -0.02 (0.01) | NA | NA | NA | NA |

*\*Based on 29 OECD countries that administered the relevant questions in 2009.*

*Source: OECD (2011), Table VI.5.16, p.317.*

# Index of computer use at school

**Items the index is based on**

The computer activities at school the students were asked about were: chat online at school; use email at school; browse the internet for schoolwork; download, upload or browse material from the school's website; post their work on the school's website; play simulations at school; practice and drilling, such as for foreign language learning or mathematics; do individual homework on a school computer; and use school computers for group work and to communicate with other students. Higher values on this index indicate more frequent computer use at school.

## A4.5: Scores on the index of computer use at school

| | All students | | | Sub-groups | | | |
|---|---|---|---|---|---|---|---|
| | | Girls | Boys | Pākehā/European | Māori | Pasifika | Asian |
| **New Zealand** | 0.15 (0.02) | 0.20 (0.02) | 0.10 (0.02) | 0.10 (0.02) | 0.26 (0.04) | 0.45 (0.05) | 0.18 (0.04) |
| **OECD average\*** | 0.00 (0.00) | -0.05 (0.01) | 0.04 (0.01) | NA | NA | NA | NA |

*\*Based on 29 OECD countries that administered the relevant questions in 2009.*

*Source: OECD (2011), Table VI.5.18, p.319.*

# Definitions and technical notes

## Mean

Student performances in PISA are reported using means, which is a type of average, for groupings of students. In general, the mean of a set of scores is the sum of the scores divided by the number of scores, and is often referred to as "the average". Note that for PISA, as with other large-scale studies, the means for a country are adjusted slightly (in technical terms "weighted") to reflect the total population of 15-year olds rather than just the sample.

## OECD mean or average

The OECD mean, sometimes referred to as the OECD average, includes only the OECD countries that took part; no non-OECD (partner) countries or economies are included in this average. An OECD mean of 499 points was constructed for the ERA achievement scores.

Please note that in most places in this report, the OECD average is across the 16 OECD countries that took part in the ERA. However, analyses that include information from the ICT portion of the student questionnaire may be across other OECD countries as well; the number of countries included in the OECD mean calculations is included in footnotes for the analysis where this differs from the ERA countries.

## Proficiency levels

PISA developed proficiency levels to describe the range in literacy across 15-year-old students. The proficiency levels describe the competencies of students achieving at that level and are anchored to certain score points on the achievement scale. Note that students were considered to be proficient at a particular level if, on the basis of their overall performance, they could be expected to answer at least half the items in that level correctly. Typically, students who were proficient at higher levels had also demonstrated their abilities and knowledge at lower levels. Proficiency levels in digital reading are described in greater detail in Appendix 2.

## Sampling

Schools are sampled in PISA with a probability proportional to the number of 15-year-old students. To improve the precision of sampling, the schools were ordered by decile, level of urbanisation, and size, so that the schools selected better represented the population of schools in New Zealand. Within each school, 15-year-old students were sampled with equal probability.

The sample of students who participated in the ERA was a subsample of all those who participated in the print (paper)-based assessment.

## Standard error

Because of the technical nature of PISA, the calculation of statistics such as means and proportions has some uncertainty due to (i) generalising from the sample to the total 15-year-old school population, and (ii) inferring each student's proficiency from their performance on a subset of items. The standard errors (usually given in brackets) provide a measure of this uncertainty. In general, we can be 95% confident that the true population value lies within an interval 1.96 standard errors either side of the given statistic.

## Statistically significant

To determine whether a difference between two means is actual, it is usual to undertake tests of significance such as the t-test. These tests take into account the means and the error associated with them. If a result is reported as not being statistically significant, then, although the means might be slightly different, we do not have sufficient evidence to infer that they are different. All tests of statistical significant referred to in this report are at the 95% confidence level.

# References

OECD (2010a). *PISA 2009 results: What students know and can do – Student performance in reading, mathematics and science (Volume I).* Paris: OECD.

OECD (2010b). *PISA 2009 results: Learning to learn – Student engagement, strategies and practices (Volume III).* Paris: OECD.

OECD (2011). *PISA 2009 results: Students on line digital technologies and performance (Volume VI).* Paris: OECD.

Website: http://erasq.acer.edu.au/index.php?cmd=home (accessed July 2011).

## List of countries and economies participating in PISA 2009 Electronic Reading Assessment

Australia

Austria

Belgium

Chile

Colombia*

Denmark

France

Hong Kong-China*

Hungary

Iceland

Ireland

Japan

Korea

Macao-China*

New Zealand

Norway

Poland

Spain

Sweden

*non-OECD countries and economies.
In total, 63 countries or economies participated in PISA 2009.

## Information

The OECD PISA 2009 report Students On Line: Digital Technologies and Performance, Volume 6 can be accessed from www.educationcounts.govt.nz/goto/pisa. A summary brochure of New Zealand's PISA ERA results *PISA 2009: Digital Readers at age 15* and a summary report of New Zealand's print PISA results *PISA 2009: Our 21st century learners at age 15,* are also available from this site, as are national and international reports from previous cycles of PISA.

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