PISA 2006
School context of science achievement

How ready are our 15-year-olds for tomorrow's world?

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MINISTRY OF EDUCATION NEW ZEALAND
Te Tāhuhu o te Mātauranga Aotearoa

OECD PISA
Programme for International Student Achievement

An Overview of PISA

What is PISA?

The Programme for International Student Assessment (PISA) is an international standardised study that assesses and compares how well countries are preparing their 15-year-old[1] students to meet real-life opportunities and challenges.

What does PISA assess?

PISA assesses three key areas of knowledge and skills –reading literacy, mathematical literacy and scientific literacy – and has a focus on one of these literacy areas each time PISA is administered. The focus of PISA 2006 is science. The term 'literacy' is used to emphasise that the assessment is not restricted to assessing how well students have mastered the content of a specific school curriculum. Instead, PISA focuses on assessing students' ability to apply their knowledge and skills, and their ability to make decisions in real-life situations. PISA defines this approach as assessing "[t]he knowledge, skills, competencies and other attributes embodied in individuals that are relevant to personal, social and economic well-being" (OECD 2006, p. 11).

What additional information is gathered?

Background information is also gained in each PISA cycle from questionnaires completed by students and school principals. In addition, in PISA 2006 parents completed a questionnaire. These questionnaires allow for the relationship between contextual information and achievement to be examined.

How often is PISA administered?

PISA is administered every three years, beginning in 2000. Reading was the main focus in the first cycle. In 2003 the focus was mathematical literacy, and in 2009 it will be reading literacy again. Rotating the major focus for each administration of PISA provides in-depth and detailed information on the subject of major focus along with an ongoing source of achievement data on the two minor subjects.

Who participates in PISA?

Around 400,000 15-year-old students from 57[2] countries, including the 30 Organisation for Economic Co-operation and Development (OECD) member countries, participated in PISA 2006. In New Zealand 4,824 students from 170 schools took part. Students and schools were randomly selected. A two-tiered stratified sampling method was used to ensure the sample was representative. Students were sampled from schools of different sizes and decile groupings, and from urban and rural schools. As a result, every 15-year-old had roughly the same chance of selection.

Why participate in PISA?

PISA assesses students who have completed around 10 years of compulsory schooling, which means the PISA results are an important source of information in New Zealand. PISA measures progress towards the Government's goals of:

- building an education system that equips New Zealanders with 21st century skills, and
- reducing systemic underachievement in education.

PISA not only allows measurement of New Zealand's progress on these goals over time, but also allows measurement of New Zealand's performance relative to other countries in equipping students with skills and reducing disparities in achievement. The PISA data provide evidence to inform policy and practice in literacy, numeracy and curriculum development.

Who organises PISA?

PISA is an initiative of the OECD and a collaborative effort of the participating countries. A consortium is responsible for developing and overseeing PISA 2006 at the international level. This consortium is led by the Australian Council for Educational Research (ACER), and consists of the Netherlands National Institute for Educational Measurement (Citogroup), Westat (USA), the Educational Testing Service (ETS, USA), and the Japanese National Institute for Educational Policy Research (NIER, Japan). In New Zealand, the Comparative Education Research Unit within the Ministry of Education's Research Division is responsible for PISA.

How did countries ensure the PISA data were of high quality?

A number of quality assurance procedures were put in place, both nationally and internationally, to ensure the data were of as high a quality as possible. These included: rigorous training of staff; high-quality documentation; monitoring of sampling procedures; quality checks and monitoring at a number of stages, including during administration of the tests; multiple coding and data entry procedures; and data cleaning and checking procedures. Further details of international procedures can be found in the PISA 2006 technical report (OECD, in press), or in the technical notes (OECD, n.d.)

1 Students are aged between 15 years 3 months and 16 years 2 months. As most students are aged 15, they are referred to as 15-year-olds for brevity.

2 The countries participating in PISA 2006 are listed in Appendix 1.

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Key findings

School demographic characteristics

- Students from larger locations, larger schools, or in higher socio-economic schools (as measured by the decile indicator) generally had higher achievement than other students.

School management and decision-making

- Schools in New Zealand have a lot of autonomy with regard to decision-making, with considerable responsibility in relation to staffing, budgeting, instructional matters, and assessment practices relative to other OECD countries.
- Assessment data are used in New Zealand schools for decision-making and evaluation as well as for feedback to parents and students.
- Parents in New Zealand had a lot more choice than those in many other OECD countries when deciding where to send their child.
- Nearly half of all 15-year-old students were in schools where principals felt under pressure from parents to achieve higher academic standards.
- Ability grouping was used regularly within New Zealand schools to provide instruction based on the needs of pupils.
- The most popular admission criterion among New Zealand school is residency in a particular area.
- Students in schools where teacher shortages had higher perceived impact on instruction, as reported by their principal, generally had lower science achievement than those in schools with lower impact. Similarly, students in schools where the impact of resource shortages was perceived to be greater generally had lower science achievement than those in schools with a lower perceived impact.

Science teaching and learning

- Most New Zealand 15-year-olds were enrolled in some form of science education, most commonly in a course for four hours a week or more.
- *Interactive teaching* activities were most frequently used in science lessons in New Zealand compared with other types of activities.
- Most New Zealand 15-year-old students were enrolled in schools that held activities to promote science, most commonly science competitions as well as excursions and field trips.

Perceptions of school climate

- The vast majority of students in New Zealand felt they fitted in at school and had generally positive feelings about their teachers.
- The majority of parents were satisfied with the quality of the school attended by their children.
- Of the statements listed, principals in New Zealand perceived student absenteeism and teachers not meeting individual students' needs to be the two greatest potential hindrances to a good school climate.
- Most New Zealand students agreed that schools provide useful preparation for science-related careers.
- Higher-achieving students in the PISA 2006 science assessment were generally those who were studying science, and felt that school was preparing them well for a science-related career.

Introduction

Introduction

This report examines the school context in which the science learning of 15-year-old students takes place. The findings presented come from the administration of PISA 2006, where the main subject of interest was science. The international findings were published by the OECD in two volumes in 2007 (OECD, 2007a & 2007b). This report is part of a series on New Zealand's participation in PISA 2006. A summary of key New Zealand results from this study was published in December 2007 (Telford & Caygill, 2007). Other reports in the series include a report on 15-year-old students' science achievement, the attitudes to and engagement with science of 15-year-old students, and reports on the mathematics and reading achievement of students in PISA 2006.[3]

The priorities of the Ministry of Education in schooling (Ministry of Education, 2007a) include strong professional leadership, resourcing, effective teaching, parents and whānau, and healthy confident kids. This report begins by examining the overall structure and management systems in place in schools, with particular attention paid to the demographic characteristics of schools, approaches to school management, the way secondary schools use grouping to deal with diversity in the student population, and resources invested in education. Next, an analysis of the science teaching taking place in schools, including extra activities to promote science will be presented. Finally, the report examines principals', students' and parents' perceptions of school climate, along with students'

3 Caygill et al., 2008; Caygill, 2008; Marshall et al., 2008; others in press.

opinions on how well schools are preparing them for a science-related career. Comparisons are made with other OECD and selected partner countries, and the relationships between school context and achievement are examined.

A number of points need to be noted when interpreting data about the schools attended by 15-year-old students in PISA.

- Information was collected from principals, students and parents. No input was sought from other staff in the schools, so any information about teachers and teaching is based on indirect observations and does not come from the practitioners themselves.
- Many New Zealand 15-year-old students would have attended two or more schools since entering the schooling system, in which case the information collected on their current school will reflect only part of the individual's schooling experience.
- The intention of this report is to look at the learning environment of 15-year-old students. Therefore, the data are analysed and reported in order to make statements about the proportions of students attending schools with a particular characteristic, rather than the proportion of schools with that characteristic.
- In most schools, only a portion of the 15-year-olds enrolled participated in PISA. Information from school principals is analysed and reported so that it reflects the education received by all 15-year-olds enrolled in each school.

School demographic characteristics and decile

This chapter aims to examine the relationship between the demographic make-up of schools (that is, location, school size, and class size), their decile ranking, and student achievement. Previous international studies (for example, the Progress in International Reading Literacy Study, Caygill & Chamberlain 2004; Trends in International Mathematics and Science Study, Chamberlain & Caygill 2002; and PISA 2000, Sturrock & May 2002) have shown that school demographics influence student achievement in some respects. In these studies, students enrolled in larger schools and high decile schools (often large schools are high decile) performed higher on average than other students. One of the challenges New Zealand faces is how to reconcile these differences so that the learning needs of each student are met.

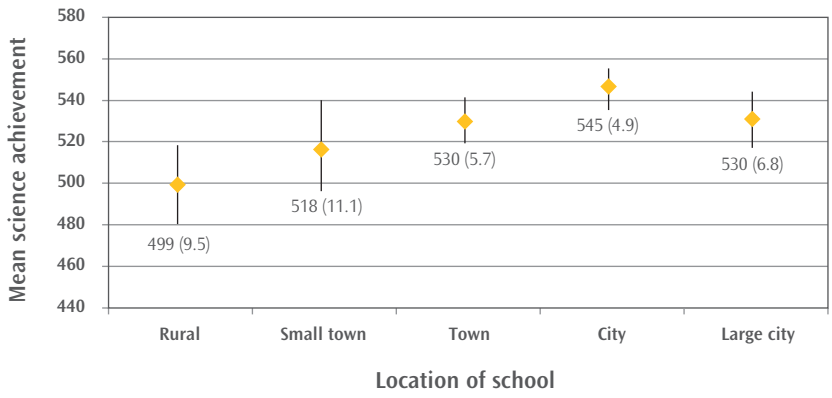
Demographic characteristics

The location and size of a school, as well as the size of classes and the economic composition of the student population within the school, may require variations to be made in the school's organisation or curriculum to meet the needs of the students adequately. The results of analyses of these variables are presented in this section.

Location of school

Students in schools in rural locations can potentially have quite different needs to students in schools in urban locations. PISA categorises the location of schools under five headings: *rural*, *small town*, *town*, *city*, and *large city*. There are some differences in achievement among New Zealand 15-year-old students between those in the smaller areas (rural and small town) and those in cities. Generally, students in schools in the larger locations had higher science achievement, on average, than those in smaller locations.

Figure 1: Mean science achievement of New Zealand students, by location of school



Notes: Standard errors are presented in parentheses. Points indicate best estimates of the achievement of 15-year-old students in the population, while lines extending from the points indicate the 95% confidence interval – the region in which the population mean is most likely to lie.

Size of school

The size of a school can potentially have an impact on the education of its students, with economies of scale possible with larger schools, but a sense of intimacy and knowledge of the needs of students potentially easier with smaller schools. The New Zealand schools involved in PISA were divided into four broad bands of school size, as illustrated in Table 1. Students in the larger schools (more than 1,200) had higher scientific literacy achievement than students in the smaller schools. Note that this analysis does not show a causal relationship – a bigger school does not necessarily guarantee higher achievement. Further analyses that include other factors are required to explain this result.

Table 1: Mean science achievement of New Zealand students, by school size band

School size band	Proportion of students	Mean science achievement (s.e.)	
600 or less	21	511	(7.2)
601 to 900	23	525	(5.9)
901 to 1,200	23	527	(7.2)
More than 1,200	32	549	(4.8)
All New Zealand	100	530	(2.7)

Note: (s.e.) standard errors are presented in parentheses.

Class sizes

Research has shown that smaller classes can have a positive effect on the learning of students, although there appear to be more benefits for younger children (Podmore, 1999). Principals were asked about the number of students in the average English class in Year 11 (other countries had similar appropriate categories of language-of-the-test and year level). This question was intended as a proxy for general student-teacher ratios.

In New Zealand, most of the students were in classes of size 26 to 30 (54%) or 21 to 25 (31%). In comparison, Australia and the United Kingdom had more students in the smaller class size of 21 to 25 (46% and 45% respectively) and fewer students in the larger class size of 26 to 30 (44% each). Interestingly, the majority of students in Finland were in classes of size 25 or lower (46% in classes of 16 to 20 and 48% in classes of 21 to 25), while the majority of students in Hong Kong-China were in classes of 36 or more (58% in classes of 36 to 40 and 26% in classes of 41 to 45).

Table 2: Proportion of students in each class size band

Country	Proportions of students in schools with an average English class size of:					
	15 or less	16 to 20	21 to 25	26 to 30	31 to 35	36 or more
New Zealand	2	7	31	54	2	0
OECD average	5	15	34	27	12	20

Notes: 5% of students had missing data for this question in New Zealand, compared with 2% on average across the OECD.

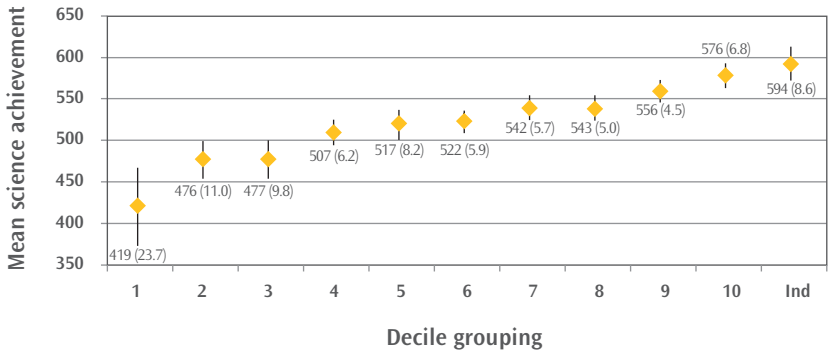
In large-scale snapshot studies such as PISA, examining the relationship between class size and achievement is often confounded by the fact that smaller class sizes are often used for students needing remedial help. In addition, the high-performing countries included both those with more students in smaller classes (Finland) and those with more students in larger classes (Hong Kong-China) than New Zealand.

Decile

The decile indicator of a school relates to the extent to which a school draws its students from low socio-economic communities. Five factors are used to calculate decile: household income, occupation, household crowding, educational qualifications, and the income support levels of houses in the areas a school draws its students from. Schools are ranked and then divided into 10 groups, called deciles.

As shown in Figure 2, the achievement of New Zealand 15-year-old students increased with the increasing socio-economic grouping of the school, although differences between adjacent deciles are not always significant (for example, deciles 2 and 3 are approximately the same). That is, in general, students in schools where the household income, occupation, and educational qualifications in the area were high and the household crowding and income support levels were low had higher achievement than those in lower socio-economic areas.

Figure 2: Mean science achievement of New Zealand students, by decile grouping



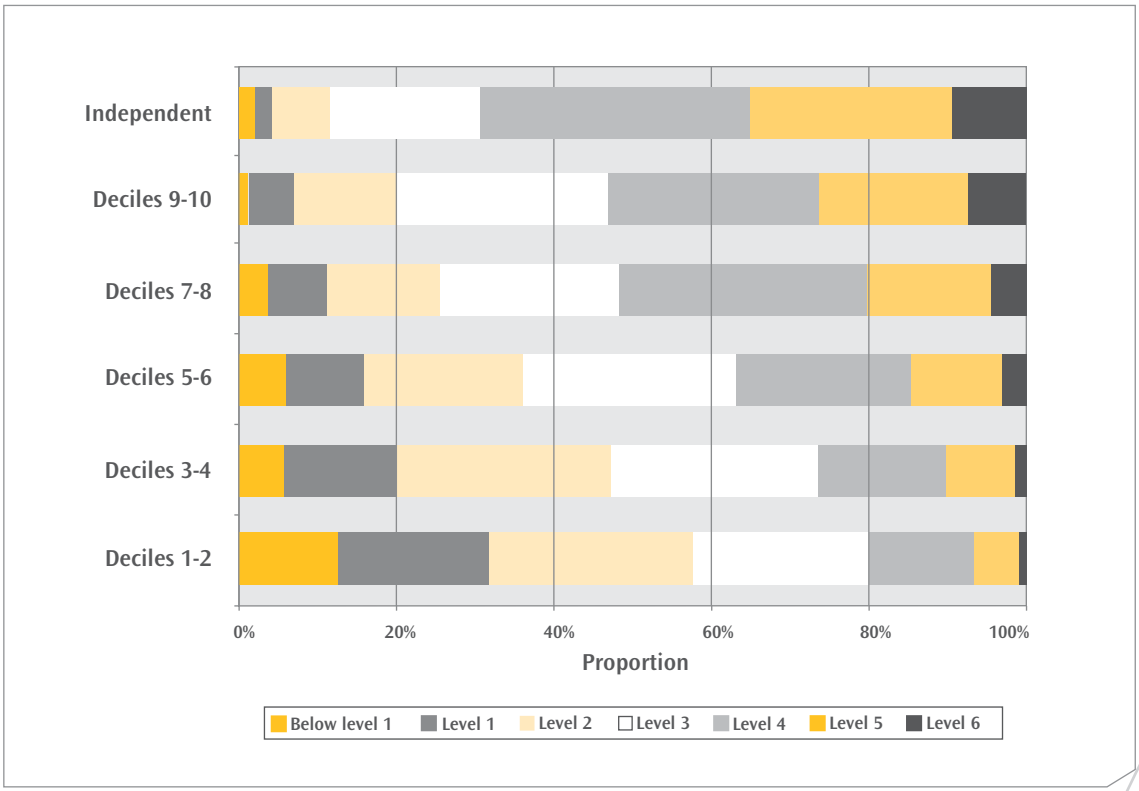
Notes: Standard errors are given in parentheses. Points indicate best estimates of the achievement of 15-year-old students in the population, while lines extending from the points indicate the 95% confidence interval – the region in which the population mean is most likely to lie. 'Ind' stands for 'independent schools'. Although some of these have decile ratings, this is not consistent across all independent schools.

Along with mean achievement, PISA also provides the opportunity to look at the higher and lower performers using proficiency levels. Six scientific proficiency levels link student achievement scores to the types of tasks that students at each level would typically be expected to perform. At the highest level, level 6, students can typically perform tasks involving complex thinking and analysis, as well as easier tasks at the lower levels. Students at level 1 demonstrate much more limited scientific knowledge and can only apply it in familiar situations.

The proportions of students at each of the proficiency levels can not be examined for individual deciles because the number of students at each level is too small. To overcome this problem, the deciles are grouped into quintiles; that is, decile 1 with 2, decile 3 with 4, etc. as shown in Figure 3. As might be expected from an examination of the means for individual groupings, larger proportions of students in independent, deciles 9 to 10, and deciles 7 to 8 schools performed at the higher proficiency levels. Similarly, fewer students in these decile groupings performed at the lower proficiency levels.

Figure 3 also shows that there are very high-performing students in all decile bands as well as students who performed at lower levels of proficiency.

Figure 3: Scientific literacy proficiency levels of New Zealand students, by decile grouping



School management

In PISA, approaches to school management and decision-making differed markedly across participating countries, from strongly centralised systems to those largely devolved to individual schools. This section examines different facets of school management and decision-making, including the responsibilities and influences of schools and stakeholders, school accountability and autonomy, school choice and parental expectations, grouping policies, teacher vacancies and school resources, with particular reference to New Zealand and other high-performing countries in PISA 2006.

Approaches to school management

In order to determine the levels of responsibility and influence in schools, principals were asked which of *principal or teachers*, *board of trustees or governors*, or *national education authority* they perceived had considerable responsibility for each of a list of tasks covering issues such as staffing, budget matters, disciplinary policies, assessment policies, instructional content, and admission practices. A subsequent question asked which of a series of groups – *national education authorities, the school's board of trustees/governors, parent groups, teacher groups, student groups,* or *qualification authorities* – they thought exerted direct influence on decision-making about staffing, budgeting, instructional content and assessment practices. For both questions, principals were able to choose more than one group if they felt it was appropriate. Answers to these questions are examined in the following sections.

Staffing matters

Under staffing matters, principals were asked who (out of *principal or teachers*, *board of trustees or governors* and the *national education authorities*) had considerable responsibility for the following: *selecting teachers for hire*, *firing teachers*, *establishing teachers' starting salaries* and *determining teachers' salary increases*. Across English-speaking and high-performing countries, the *principal or teachers* and the *board of trustees or governors* were frequently reported as having considerable responsibility in the area of appointing and dismissing teachers, but less so in decisions concerning teachers' salaries.

All 15-year-olds in New Zealand were enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for appointing teachers, and almost all (97%) for dismissing teachers. For both aspects, the Netherlands and the United States reported similar results (at least 98%). There were also a high percentage of students in the United Kingdom and partner countries Estonia, Hong Kong-China and Chinese Taipei enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for appointing and dismissing teachers (ranging from 72% to 97%); the OECD average was 59 percent

and 50 percent for these two aspects, respectively. In comparison to New Zealand, there was a lower proportion of students enrolled in such schools in Australia, Canada, Finland, Japan and Korea (ranging from 14% to 58%).

For the majority of countries who participated in PISA 2006, principals most frequently reported that *national education authorities* had considerable responsibility for establishing teachers' starting salaries and determining salary increases, leaving little discretion for school bodies. In New Zealand, 13 percent of 15-year-olds were enrolled in schools where the principal reported that the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for establishing teachers' starting salaries, similar to Australia (13%), Canada (11%), Korea (13%), and partner country Estonia (11%). A higher proportion of students were enrolled in such schools in the Netherlands (75%), the United Kingdom (55%), and the United States (80%), while Finland and Ireland reported a lower proportion (5% and 4% respectively) in comparison to New Zealand; the OECD average was 22 percent.

New Zealand had 23 percent of students enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for determining salary increases for teachers – similar to the OECD average (21%). In comparison to New Zealand, the Netherlands, the United Kingdom and the United States had a higher percentage of students enrolled in such schools (ranging from 61% to 78%). Among the English-speaking or high-performing countries, Finland, Ireland and Korea reported the lowest proportion of students (ranging from 3% to 6%) enrolled in such schools.

Table 3: Proportion of students in schools where principal, teachers and school board reportedly had considerable responsibility for staffing matters

Area of staffing	Percentage of students	
	New Zealand	OECD average
Selecting teachers for hire	100	59
Dismissing teachers	97	50
Establishing teachers' starting salaries	13	22
Determining teachers' salary increases	23	21

Of the six categories of bodies listed in Table 4, in general *regional or national education authorities* and the *school's governing board* were most frequently reported as exerting a direct influence on decisions related to staffing in English-speaking and high-performing countries. Approximately three-quarters of 15-year-olds in New Zealand were enrolled in schools where *national education authorities* or the *school's governing board* exerted a direct influence on decision-making about staffing. The OECD averages were 54 percent and 34 percent respectively for these two stakeholders, as shown in Table 4.

The influence teacher groups had in this area was also quite prominent: 46 percent of 15-years-olds in New Zealand were enrolled in schools where teacher groups exerted a direct influence on decisions about staffing, which is similar to Australia (43%), Canada (37%), Finland (37%) and the United States (37%). Of the countries that New Zealand is compared with, Australia, Finland, Korea, the Netherlands and partner country Estonia reported teacher groups as the second most frequently reported stakeholder to exert a direct influence on staffing decisions. The other three stakeholders – parent groups, student groups and external examination boards – had minor input in comparison across English-speaking or high-performing countries.

Table 4: Proportion of students in schools where stakeholders reportedly exerted a direct influence on decisions related to staffing

Stakeholders influencing staffing	Percentage of students	
	New Zealand	OECD average
Regional or national education authorities	73	54
The school's governing board	75	34
Parent groups	1	4
Teacher groups	46	29
Student groups	3	7
External examination board	3	7

Budget matters

Principals were asked who has considerable responsibility for decisions about budget allocations within the school. The majority of students in English-speaking and high-performing countries were enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for decisions in this area of school policy and management (ranging from 79% to 99%). New Zealand had the highest proportion of 15-year-olds enrolled at such schools (99%), and was similar to Ireland (95%), the Netherlands (99%), the United Kingdom (97%) and the United States (95%); the OECD average was also high (84%).

Of the six categories of bodies listed in Table 5, the *school's governing board* was most frequently reported as exerting a direct influence on budgeting decisions in New Zealand and across the OCED countries in general. In New Zealand, 95 percent of 15-year-olds were enrolled in such schools; this was similar to the United Kingdom (91%), the United States (94%) and partner country Hong Kong-China (92%), but significantly higher than the OECD average (62%).

The *regional or national education authorities* were the second most frequently reported stakeholder to exert a direct influence on budgeting decisions among the English-speaking and high-performing countries. Fifty-nine percent of 15-year-olds in New Zealand were enrolled in such schools, which is similar to most other English-speaking and high-performing countries with the exception of Ireland (73%), the United States (77%) and Chinese Taipei (75%).

Table 5: Proportion of students in schools where stakeholders reportedly exerted a direct influence on decisions related to budgeting

Stakeholders in budget	Percentage of students	
	New Zealand	OECD average
Regional or national education authorities	59	50
The school's governing board	95	62
Parent groups	3	14
Teacher groups	24	24
Student groups	4	6
External examination board	5	10

Instructional matters

Principals were asked who has considerable responsibility for the following: *choosing which textbooks are used*, *determining course content,* and *deciding which courses are offered*. In general, schools in the English-speaking and high-performing countries had a lot more discretion in choosing textbooks and what courses to offer, but less so in the area of course content.

All 15-year-olds in New Zealand were enrolled in schools where the principal reported that the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for deciding which textbooks to use. With the exception of Canada, which reported only 39 percent of students enrolled in such schools, all other English-speaking and high-performing countries reported a high proportion of students (ranging from 72% to 100%) enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for this aspect of school policy and management; the OECD average was 80 percent.

The majority of 15-year-olds in New Zealand (90%) were also in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for deciding what courses to offer. This was similar to Japan (93%), the United Kingdom (87%) and partner countries Hong Kong-China (93%) and Estonia (85%), but significantly higher than that for Canada (44%) and the OECD average (51%). All remaining English-speaking and high-performing countries reported a majority of students in such schools (ranging from 64% to 82%).

Compared with the two instructional aspects discussed above, a lower proportion of 15-year-olds in New Zealand (69%) were enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for determining course content. This is similar to the United Kingdom (74%), Estonia (65%) and partner country Chinese Taipei (76%); significantly higher than that for Australia (31%), Canada (12%), Finland (38%), Ireland (35%), and the OECD average (43%); and lower than that for Japan (93%), Korea (93%) and partner country Hong Kong-China (87%). Canada reported the lowest proportion of students under each aspect (out of the English-speaking and high-performing countries); it appears such decisions are made in tandem with the Canadian government.

Table 6: Proportion of students in schools where principal, teachers and school board reportedly had considerable responsibility for instructional matters

Area of instructional content	Percentage of students	
	New Zealand	OECD average
Choosing which textbooks are used	100	80
Deciding which courses are offered	90	51
Determining course content	69	43

Principals were asked who (out of the six stakeholders listed in Table 7) exerts a direct influence on decisions related to instructional content. Among the English-speaking or high-performing countries, three stakeholders – the *regional or national education authorities*, the *school's governing board*, and the *external examination board* – were most frequently reported as exerting a direct influence on decision-making about instructional content. New Zealand, along with Australia, Canada, Finland, Ireland, the United States and partner country Chinese Taipei, most frequently reported that *regional or national authorities* exerted a direct influence on decisions related to instructional content, while Japan, Korea, the Netherlands and partner country Estonia most frequently reported *teacher groups* as exerting a direct influence. In contrast, the United Kingdom and partner country Hong Kong-China most frequently reported *external examination boards* as exerting a direct influence in this area. The other three stakeholders – the *school's governing board*, *parent groups* and *students groups* – generally had less input in comparison.

Table 7: Proportion of students in schools where stakeholders reportedly exerted direct influence on decisions related to instructional content

Stakeholders in instructional content	Percentage of students	
	New Zealand	OECD average
Regional or national education authorities	77	66
The school's governing board	11	22
Parent groups	12	14
Teacher groups	59	56
Student groups	12	19
External examination board	45	22

Assessment practices

Principals were asked who has considerable responsibility for establishing student assessment policies. This could have been interpreted as either internal to the school or overall assessment policies. With the exception of Canada (25%), all other English-speaking or high-performing countries reported a majority of 15-year-olds (ranging from 50% to 99%) enrolled in schools where the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for setting student assessment policies. Eighty-two percent of students in New Zealand were enrolled in such schools, similar to Finland (79%) and th United Kingdom (86%), but higher than the OECD average (63%).

Of the six stakeholders (listed below in Table 8), *regional or national education authorities*, *teacher groups* and the *external examinations board* were most frequently cited as exerting a direct influence on decisions related to assesment practices in English-speaking or high-performing countries. Ninety-six percent of 15-year-olds in New Zealand were enrolled in schools where the *external examinations board* exerted a direct influence on decisions related to assessment practices, the highest proportion reported among countries for the above criteria, similar to Hong Kong-China (93%) but significantly higher than the OECD average (40%). Finland, Japan and Chinese Taipei reported much lower proportions of students in such schools (23%, 7%, and 27% respectively).

Table 8: Proportion of students in schools where stakeholders reportedly exerted a direct influence on decision-making about assessment practices

Stakeholders in assessment practices	Percentage of students	
	New Zealand	OECD average
Regional or national education authorities	79	59
The school's governing board	11	29
Parent groups	5	16
Teacher groups	59	59
Student groups	5	21
External examination board	96	40

Admission policies

Eighty-seven percent of 15-year-olds in New Zealand were enrolled in schools where the *principal(s) or teachers* had considerable responsibility for approving student admission to the school. This is similar to Korea (83%), the United States (88%) and partner country Hong Kong-China (91%), and higher than the OECD average (74%). Compared with New Zealand, there were proportionally more students enrolled in such schools in Japan (99%) and the Netherlands (97%), while Chinese Taipei had proportionally fewer (33%).

Disciplinary policies

With the exception of Canada, a majority of students in the English-speaking or high-performing countries were enrolled in schools where the principal reported that the *principal or teachers* and the *board of trustees or governors* had considerable responsibility for establishing student disciplinary policies. Ninety-six percent of 15-year-olds in New Zealand were enrolled in such schools. This is similar to Japan, the Netherlands, the United Kingdom, the United States, and partner countries Estonia and Hong Kong-China (ranging from 90% to 100%).

School accountability

Principals were asked a number of questions relating to their use of achievement data, feedback provided to the parents and the public, and their perceptions of pressure from parents to achieve high academic standards. These questions were designed to explore aspects of the school's accountability to parents and the wider public. For New Zealand schools, the Education Review Office has the main responsibility for evaluating the quality of education provided within each school, and reports are freely available to the public.

Uses made of achievement data

Principals were asked how frequently achievement data were used for accountability purposes in each of the following five areas: posted publicly, used in evaluation of the principals' performance, used in evaluation of teachers' performance, used to decide instructional allocation to the school, and tracked over time by an administrative authority. Achievement data were defined in the question as including "aggregated school or Year/Form-level assessment results or school-leaver qualifications". Thus, this question covers a number of different types of achievement data, but with a focus on their use for accountability purposes.

Not surprisingly, tracking by an administrative authority was most commonly identified among New Zealand principals as a way for achievement data to be used for accountability purposes (nearly all students were in such schools). The majority of students (two-thirds) were in schools where principals indicated achievement data were posted publicly for accountability purposes. It was less common for principals to indicate that achievement data were used in the evaluation of principals' or teachers' performance among New Zealand schools (38% and 47% respectively).

Although achievement data were more commonly perceived to be used for accountability purposes in New Zealand than in many of our OECD counterparts (with averages ranging from 30% to 65% – see Appendix 2 for details), the United Kingdom put much greater emphasis on this and Finland much less emphasis than New Zealand. Nearly all students in the United Kingdom were in schools where the principal reported achievement data were used to evaluate the principals' and teachers' performance, as well as posted publicly and tracked by an administrative authority (ranging from 92% to 94%). In contrast, few students in Finland were in schools where principals indicated achievement data were posted publicly or used in the evaluation of principals' and teachers' performance (ranging from 3% to 14%).

Principals were also asked about the type of information that was given to parents about their child's performance. Fifty percent of students in New Zealand were enrolled in schools where parents were provided with information on student performance relative to other students in the same school. This is similar to the United Kingdom (55%) and the OECD average (54%). There were a lot more students enrolled in schools who employed this method in Canada (79%), Korea (84%), and Hong Kong-China (86%) compared to New Zealand. Schools in Finland were less likely to provide information to parents in this way, with only 15 percent of students enrolled in such schools.

It was less likely for New Zealand schools to provide information on student performance relative to other students in other schools to parents, with only 37 percent of students enrolled in such schools; the OECD average was 27 percent. New Zealand in this respect was similar to Canada (34%), Korea (42%) and the United Kingdom (36%), while the United States had significantly more students (64%). On the other end of the scale, Finland, the Netherlands and partner country Hong Kong-China had much fewer, with 6 to 16 percent of students enrolled at such schools.

School choice

In order to gauge the options available to parents when choosing a school for their child, school principals were asked *how many other schools were available to students in your location*. The majority of parents in New Zealand had a choice in deciding what school to send their child to, with 82 percent of students enrolled in schools located in areas where there were two or more schools available. In this respect, New Zealand was similar to Australia (88%), Japan (82%), the United Kingdom (84%), and partner countries Hong Kong-China (90%) and Chinese Taipei (81%). Only 7 percent of New Zealand students were enrolled in schools where there was only one other school in the area. This is lower than the OECD average (14%), but similar to Australia (5%), Japan (8%), Korea (9%), the United Kingdom (9%), the United States (11%) and partner country Hong Kong-China (9%). Only 11 percent of New Zealand students were enrolled in schools where principals reported that there was no other available school in their area. This was less than half that for the OECD average (26%), but similar to Australia (6%), Japan (10%), the Netherlands (11%) and partner country Chinese Taipei (6%). In comparison to New Zealand, Finland had substantially more students enrolled in such schools (44%).

Table 9: Proportion of students in schools with two, one or no other schools in the same area

Number of schools competing for students in the same area	Proportion of students (%)	
	New Zealand	OECD average
Two or more other schools	82	60
One other school	7	14
No other schools	11	26

Parental expectations for high academic standards

In order to gauge parental expectations of the school for academic standards, principals were asked to indicate whether they perceived there to be *constant pressure from many parents, who expect our schools to set very high academic standards and to have our students achieve them*; whether this pressure *to achieve higher academic standards among students comes from only a minority of parents*; or whether *pressure from parents on the school to achieve higher academic standards among students is largely absent*.

Forty-four percent of students in New Zealand were enrolled in schools where principals perceived there was a constant pressure from many parents to set very high academic standards and have their students achieve them; 49 percent of students were enrolled in schools where pressure for higher academic standards only came from a minority of parents; and 7 percent of students were enrolled in schools where the pressure to achieve higher academic standards was largely absent. Relative to students in other OECD countries in general, more New Zealand students were in schools where principals perceived they received constant pressure from many parents to achieve high academic standards (see Table 10). The New Zealand proportion of students was similar to Australia (37%), Ireland (43%), Japan (39%), the United Kingdom (38%), and the United States (36%), but markedly higher than Finland (1%), Luxemburg (2%) and Hong Kong-China (3%).

Seven percent of students in New Zealand were enrolled in schools where pressure to achieve higher academic standards was largely absent. This was significantly lower than the OECD average of 32 percent, but similar to Australia (10%), and partner country Chinese Taipei (6%).

Table 10: Proportion of students in schools, by parental expectations for high academic standards

Parental expectations to achieve high academic standards among students	Proportion of students (%)	
	New Zealand	OECD average
Constant pressure from many parents	44	21
Pressure from a minority of parents	49	47
Pressure from parents largely absent	7	32

Grouping policies

In order to examine the ways in which countries address diversity among their students, PISA examined two policies on pre-selection to school (entitled admittance policies) and ability grouping within schools. These are discussed in the following sections.

School admittance policies

School principals were asked to indicate to what extent the following are considered when admitting students to their school: *residence in a particular area*; *student's academic record*; *recommendations of feeder schools*; *parents' endorsement of the school's instructional or religious philosophy*; *student's need or desire for a special programme*; and *attendance of other family members at the school.*

New Zealand, along with Canada (78%), Finland (75%), the United Kingdom (61%) and the United States (81%), most frequently reported that residence in a particular area was at least a high priority. Japan (86%), Korea (59%) and partner countries Estonia (44%), Hong Kong-China (83%) and Chinese Taipei (53%) most frequently reported that a student's academic record was at least a high priority. In contrast, both residence in a particular area and attendance of other family members were the highest considerations in Australia (42% for both). The Netherlands rated recommendations of feeder schools as most important, with over 90 percent of 15-year-olds enrolled in schools where this was at least a high priority.

As shown in Table 11, 49 percent of 15-year-olds in New Zealand were enrolled in schools where the principal reported that residence in a particular area was a prerequisite or high priority. This was similar to Australia (42%) and the OECD average (47%). The proportion for the United Kingdom (61%), Canada (78%), Finland (75%) and the United States (81%) was significantly higher than New Zealand in comparison.

Table 11: Proportion of students in schools, by school admittance policies

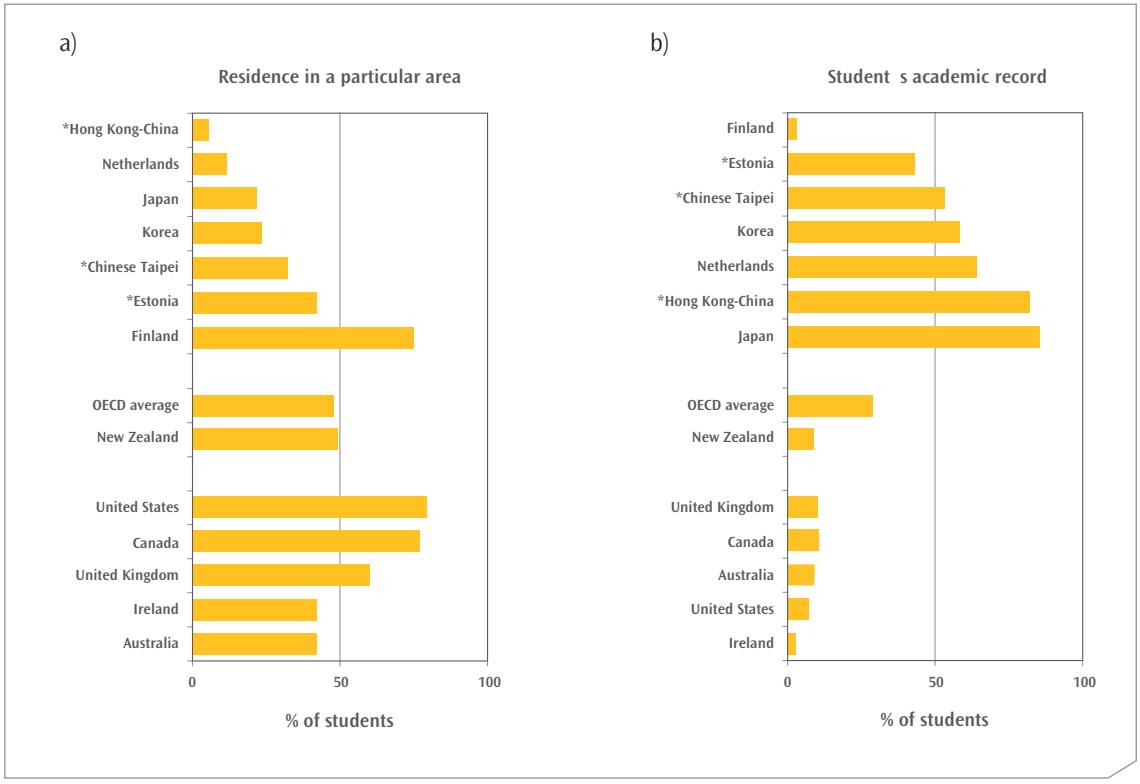
Statements reported by the principal as a 'prerequisite' or a 'high priority' for admittance at their school	Proportion of students (%)	
	New Zealand	OECD average
Residence in a particular area	49	47
Student's academic records	9	27
Recommendation of feeder schools	16	13
Parents' endorsement of the instructional or religious philosophy of the school	19	12
Student's need or desire for a special programme	19	19
Attendance of other family members	31	17

A student's academic record was the least prominent factor in New Zealand: only 9 percent of students were enrolled in schools where the principal reported this as a prerequisite or high priority. This is similar to Australia (9%), Canada (10%), Finland (4%), the United Kingdom (10%) and the United States (8%). In contrast, the relevance of a student's academic record was more prominent in Japan (86%), Korea (59%), the Netherlands (65%), Estonia (44%), Hong Kong-China (83%) and Chinese Taipei (53%). The OECD average was 27 percent. With the exception of Estonia, countries that reported a higher proportion of their students enrolled in schools where the academic record was a prerequisite or high priority generally registered residency less of a priority, and vice versa.

Attendance of other family members at the school was the second-highest admission policy for New Zealand schools, with 31 percent of 15-years-olds enrolled in schools where principals reported this as a prerequisite or high priority. Both Canada (26%) and the United Kingdom (33%) were similar to New Zealand. Australia was significantly higher in this respect at 42 percent. In comparison to New Zealand, all other countries (presented in Figure 4) considered this less of a priority. The OECD average for this aspect was also substantially less at 17 percent. Fewer than 1 percent of students were enrolled in such schools in Korea.

While the recommendation of feeder schools was the leading admission criterion for the Netherlands, in New Zealand it was less common with only 16 percent of students enrolled in schools where principals reported this as a prerequisite or high priority. This is similar to most other countries (presented in Figure 4), including Australia (18%), Canada (22%) and the United States (9%). Only Finland (2%) and the United Kingdom (7%) were significantly lower. Nineteen percent of students in New Zealand were enrolled in schools where the parents' support of the instructional or religious philosophy of the school. Similarly 19 percent were enrolled in schools where the student's need or desire for a special programme was a prerequisite or high priority. The OECD average for these two aspects was 12 percent and 19 percent respectively.

Figure 4: Proportion of students in schools, by factors reported by principals as being a 'prerequisite' or a 'high priority' for admittance at their school



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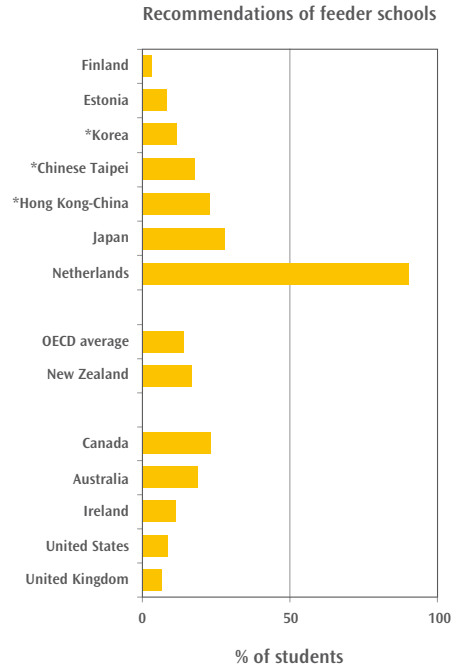

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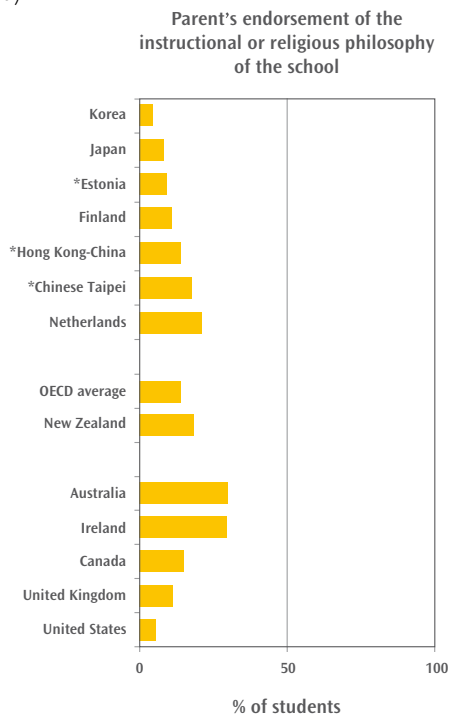

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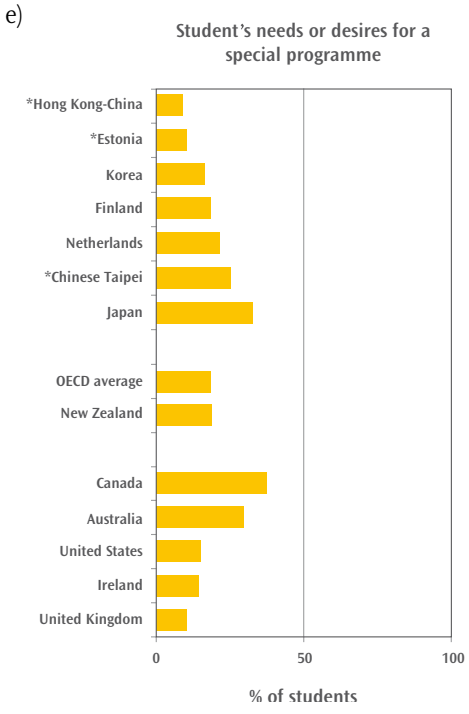

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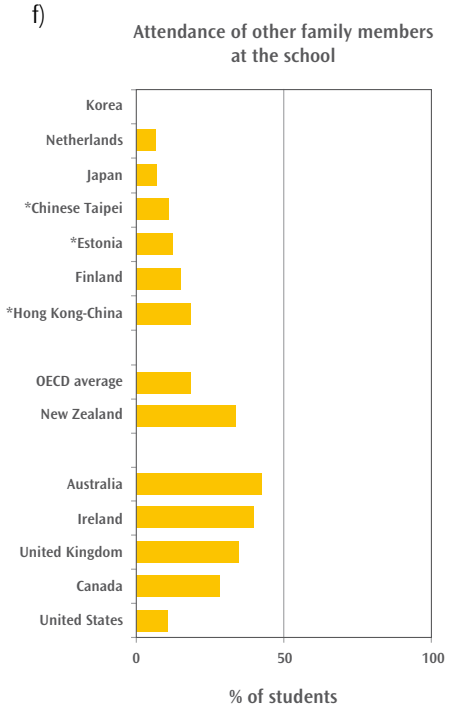


*Notes: Graphs present information for English-speaking and high-performing countries. An asterisk (*) denotes non-OECD countries. The OECD average includes all OECD countries, not just those presented in these graphs.*

Ability groupings

Principals were asked to indicate the extent to which ability groupings were used within their school, either grouping by ability into different classes (streaming, broad-banding, or setting) or grouping by ability within classes. Note that where ability grouping is used, any grouping is still likely to include a range of abilities and differences will still be evident. The majority of schools in English-speaking or high-performing countries grouped their students according to ability in one form or another.

Most commonly across countries, ability grouping was used only for some subjects. Ninety-one percent of students in New Zealand were enrolled in schools where grouping took place for some subjects. New Zealand had one of the highest proportions among the English-speaking and high-performing countries, and was similar to Australia (90%), Korea (82%) and the United Kingdom (92%), but significantly higher than the OECD average (54%).

With the exception of the Netherlands, which had 48 percent of students enrolled in schools where there was ability grouping in *all* subjects, this frequency of grouping was less common among the English-speaking and high-performing countries. In New Zealand, only 6 percent of students were enrolled in schools where ability grouping was applied across all subjects. This is similar to Australia (5%), Korea (7%), the United Kingdom (8%) and the United States (7%); the OECD average was higher at 14 percent.

It was relatively uncommon for New Zealand schools to use no form of grouping, with only 3 percent of students in New Zealand enrolled in such schools. This was similar to Australia (6%) and the United Kingdom (less than 1%). Over 40 percent of students in Finland, Japan, and partner countries Chinese Taipei and Estonia were enrolled in schools where there was no ability grouping in place. Similarly, across the OECD countries, one-third of students were in schools where there was no ability grouping in place.

Principals were not asked specifically whether grouping was used to form science classes or used within science classes in their schools. However, comparisons were made between scientific literacy achievement in PISA and general grouping policies in schools. There was no significant difference in scientific literacy achievement between students in schools where different grouping policies were in place.

Table 12: Proportion of students in schools, by ability grouping policy in schools (between and/or within classes)

Grouping policy	Proportion of students (%)	
	New Zealand	OECD average
No ability grouping	3	33
Ability grouping for some subjects	91	54
Ability grouping for all subjects	6	14

Note: Proportions should add up to 100%; inconsistencies are due to rounding.

Resources invested in education

Teacher shortages

Principals were asked to report whether all vacant science teaching positions were filled in the previous year in their school. Nearly all schools either had no vacant science teaching positions (19% of students in such schools) or managed to fill all vacancies for science teachers (79% of students were in such schools). Only two percent of students were in schools that failed to fill all vacant science teaching positions.

New Zealand students were more likely to be in schools where vacancies in science teaching occurred than students in other OECD countries (81% in New Zealand compared with 62% across OECD countries), but in New Zealand these vacancies were more likely to be filled. The net result was a similarly low level of students in schools with vacant science teaching positions: 2 percent in New Zealand and 3 percent on average across the OECD.

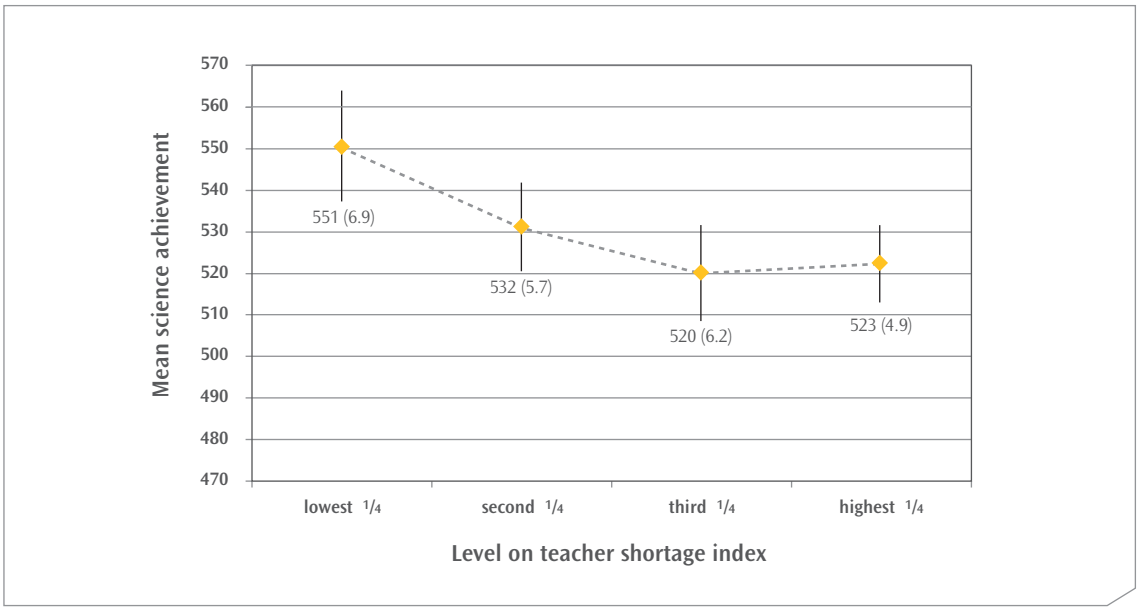
In schools where all science teaching positions were filled, New Zealand principals were less likely to report that a lack of qualified science teachers hindered instruction at least to some extent than in schools where there were science teaching vacancies. However, 15 percent of students were in schools where, despite no vacancies, lack of qualified science teachers was seen to hinder instruction. This finding implies that vacancies were filled by teachers whose qualifications were not to the level desired for the position.

In order to examine the perceived impact of teacher shortages on instruction, an index of teacher shortage was created by combining responses to questions about the extent to which the shortage or inadequacy of teachers in science, languages, mathematics and other subjects hindered the school's capacity to provide instruction. Higher values on the index indicate a greater perceived impact of teacher shortages on the capacity of schools to provide instruction.

New Zealand students were in schools with relatively high levels of perceived impact on instruction by teacher shortages as measured by the index of teacher shortage compared to the average across the OECD, but were similar to Australia.

In those New Zealand schools where the impact of teacher shortages was perceived to be greater, students' achievement reflected this perception and was significantly lower than in schools where teacher shortages were not perceived to be a problem (see Figure 5). This pattern was observed both in New Zealand and generally across OECD countries.

Figure 5: Mean science achievement of New Zealand students at each quarter of the index of teacher shortage



Notes: Standard errors are presented in parentheses. Points indicate best estimates of the achievement of 15-year-old students in the population, while lines extending from the points indicate the 95% confidence interval – the region in which the population mean is most likely to lie.

Higher values on the index indicate greater perceived impact of teacher shortages on the capacity of schools to provide instruction.

Educational resources

Along with the questions on the impact of the lack of qualified teachers on the school's capacity to provide instruction, principals were also asked about the impact of shortages or inadequacies of a list of seven resources (shown in Table 13). On average, compared to other OECD countries, New Zealand students were less likely to be in schools where principals were concerned that an inadequacy or shortage of resources hindered science instruction (differences in proportions between New Zealand and the OECD average ranged from 5% to 24%). The exception was *shortage or inadequacy of computers for instruction*, where a higher proportion of New Zealand students (42%) were in schools where principals perceived this lack to adversely affect the school's capacity to provide instruction compared with their OECD counterparts (average 37%).

The overall pattern of generally less perceived impact on instruction in New Zealand compared with other countries is consistent with results from other international studies, namely PIRLS (Caygill & Chamberlain, 2004) and TIMSS (Chamberlain & Caygill, 2002). For the laboratory equipment, instructional materials, computer software, and library resources, similar proportions of students in Australia were in schools where principals perceived the lack of these resources hindered instruction (see Table 13). Internet connectivity was far less of a perceived problem in New Zealand than in Australia, while audio-visual resources and lack of computers were much more of a problem in New Zealand compared with Australia.

Table 13: Proportions of students in schools, by extent to which a lack of resources was perceived to hinder a school's capacity to provide instruction

Is your school's capacity to provide instruction hindered by any of the following?	Percentage of students where principals responded a lot or to some extent		
	New Zealand	Australia	OECD average
Shortage or inadequacy of science laboratory equipment	18	23	42
Shortage or inadequacy of instructional materials (e.g. textbooks)	16	14	25
Shortage or inadequacy of computers for instruction	42	34	37
Lack or inadequacy of Internet connectivity	0	17	20
Shortage or inadequacy of computer software for instruction	25	26	38
Shortage or inadequacy of library materials	12	16	34
Shortage or inadequacy of audio-visual resources	26	17	37

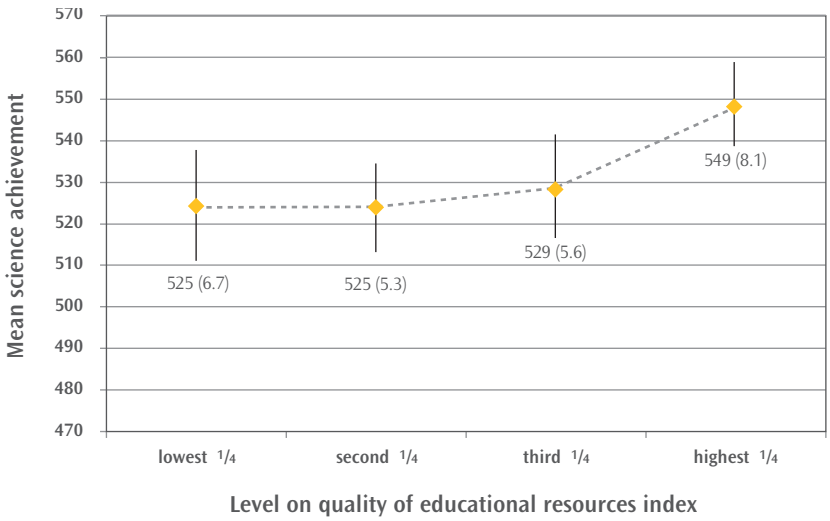
Notes: Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 5 to 6%; these students are not included in this table.

In order to examine the perceived impact of resource shortages or inadequacies on instruction, an index of school principals' perceptions of the quality of the schools' educational resources was created by combining responses to questions about the extent to which shortage or inadequacy of resources hindered the school's capacity to provide instruction. Higher values on the index indicate less perceived impact of resource shortages on the capacity of schools to provide instruction.

New Zealand students were in schools with relatively low perceived impact on instruction by resource shortages, summarised by the index, compared to the average across the OECD, but similar to Australia, the United Kingdom, and the United States.

In New Zealand schools where the impact of resource shortages or inadequacies was perceived to be greater, students' achievement reflected this perception and was significantly lower than in schools where resource shortages or inadequacies were not perceived to be a problem (see Figure 6). This pattern was also observed across OECD countries.

Figure 6: Mean science achievement of New Zealand students at each quarter of the index of quality of schools' educational resources



Notes: Standard errors are given in parentheses. Points indicate best estimates of the achievement of 15-year-old students in the population, while lines extending from the points indicate the 95% confidence interval – the region in which the population mean is most likely to lie.

Higher values on the index indicate less perceived impact of educational resource shortages or inadequacies on the capacity of schools to provide instruction.

Science teaching and learning

It might be expected that science performance is lifted when more time is invested in learning science and connections are made between what is taught and the wider world. In this section we examine what type of science education 15-year-olds are engaged in, the time spent learning science in and out of school, what teaching methods are employed in the classroom, and what activities are endorsed to promote science.

Science enrolment

Students were asked whether they were enrolled in any type of science course, and if so, what type of course. Over 90 percent of 15-year-olds in New Zealand were enrolled in some type of science course, whether compulsory or optional, similar to the OECD average (87%). Of the 90 percent of students, 74 percent were enrolled in a compulsory science course and 43 percent in an optional science course (some students were enrolled in both). The OECD average was higher for the percentage of students enrolled in a compulsory science course (84%) but lower for students enrolled in optional courses (29%). A further breakdown by science subject is provided in Table 14.

Finland had significantly more students enrolled in compulsory science courses, across both general and science-specific topics (ranging from 73% to 95%) compared to New Zealand. Across the OECD countries it was more common for students to be enrolled in a general science than a biology, physics or chemistry course at age 15.

Table 14: Proportion of students taking various science courses

Science course	Proportion of students taking science subjects (%)	
	New Zealand	OECD average
Compulsory general science	70	64
Optional general science	*32*	*21*
Compulsory biology	30	57
Optional biology	*18*	*15*
Compulsory physics	31	61
Optional physics	*17*	*15*
Compulsory chemistry	32	60
Optional chemistry	*17*	*15*

Time spent learning science

Sixty-five percent of students in New Zealand indicated that they spent four hours a week or more on regular lessons learning science at school (similar to the United Kingdom at 62%), while 17 percent of students spent less than two hours a week learning science at school. Interestingly, the average percentage of students across the OECD countries who spent four hours a week or more on regular lessons at school was almost half that for New Zealand (36%), while twice as many as in New Zealand spent less than two hours a week on regular lessons at school (33%).

Only a very small percentage of students in New Zealand (1%) spent more than four hours on science lessons outside of school, similar to the OECD average (3%). Significantly more students in New Zealand (94%) spent less than two hours a week on lessons out of school. This is similar to most of the English-speaking and high-performing countries, with the OECD average being 89 percent.

Seventy-nine percent of New Zealand students spent less than two hours a week on self-study or homework. This proportion was slightly higher than the OECD average (75%) but similar to Australia (81%), the United Kingdom (75%) and partner country Chinese Taipei (78%). There were significantly fewer students in New Zealand who spent four hours a week or more doing self-study or homework (4%). This is half the OECD average (8%), but similar to Australia (4%), Korea (5%), the United Kingdom (4%) and partner country Chinese Taipei (5%).

Table 15: Proportion of students studying science in different contexts, by time spent on learning

Context of studying science	Proportion of students studying science (%)			
	New Zealand		OECD average	
	Less than 2 hours a week	4 hours a week or more	Less than 2 hours a week	4 hours a week or more
Regular lessons at school	17	65	33	29
Out of school-time lessons	94	1	89	3
Individual study or homework	79	4	75	7

Methods of teaching science

To teach science effectively it would seem obvious that schools need to provide a learning environment that fosters development in scientific literacy. PISA 2006 collected information on teaching from individual learners to examine four different teaching methods: *interactive teaching*, *hands-on learning*, *student investigations*, and *models and application*. A series of activities were listed which can be categorised under each method and are displayed in Tables 16 to 19 below. A larger proportion of 15-year-olds in New Zealand reported the use of *interactive teaching* activities (40% to 71%) compared with *models and applications* (37% to 66%), *hands-on* learning (23% to 58%), and *student investigations* (12% to 26%). These findings are similar to those found on average across the OECD countries.

The *interactive teaching* activities are those that are designed to foster discussion about science. The opportunity for students to explain their ideas was the most frequently reported activity by 15-year-olds in New Zealand (71%), as shown in Table 16; this is similar to Australia (71%), Canada (73%), Finland (64%), United Kingdom (72%), and the United States (74%). Fifty-one percent of students in New Zealand were able to have discussions about the topics in all or most lessons (similar to Australia, Canada, the United Kingdom and the United States, ranging from 44% to 59%). Fifty percent of students in New Zealand reported that all or most science lessons involved students' opinions about the topic and 40 percent reported that a class debate or discussion took place.

Table 16: Proportion of students reporting that interactive teaching activities occur in all or most science lessons

Interactive teaching activities	Percentage of students who responded *in all* or *most lessons*	
	New Zealand	OECD average
Students are given opportunities to explain their ideas	71	62
Students have discussions about the topics	51	43
The lessons involve students' opinions about the topics	50	49
There is a class debate or discussion	40	36

Notes: Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 10%; these students are not included in this table.

The *models and application* teaching activities help students understand science in relation to the outside world. Sixty-six percent of 15-year-olds in New Zealand reported that teachers explained how a science idea can be applied to a number of different phenomena in all or most lessons. This is similar to Australia, Canada, Finland, the Netherlands, the United Kingdom, and the United States (ranging from 51% to 72%). The majority of students in New Zealand (51%) reported that teachers clearly explained the relevance of science concepts to their lives, and a similar proportion (48%) reported teachers using science to help students understand the world outside school (similar to Australia, with 55% and 49% respectively, and Canada, with 58% and 53% respectively). Just under 40 percent of students in New Zealand were asked either to apply a science concept to everyday problems or the teacher used technological applications to show how science is relevant to society.

Table 17: Proportion of students reporting models and application teaching activities occur in all or most science lessons

Models and applications activities	Percentage of students who responded *in all* or *most lessons*	
	New Zealand	OECD average
The teacher explains how a science idea can be applied to a number of different phenomena (e.g. the movement of objects, substances with similar properties)	66	60
The teacher clearly explains the relevance of science concepts to our lives	51	46
The teacher uses science to help students understand the world outside school	48	38
The students are asked to apply a science concept to everyday problems	38	30
The teacher uses examples of technological application to show how science is relevant to society	37	35

Notes: Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 10% these students are not included in this table.

The *hands-on* learning approach enables students to learn from experiments conducted either by the individual student or by the teacher. In New Zealand, 15-year-old students most frequently reported either being asked to draw conclusions from experiments they had conducted (58%), or to do an experiment following instructions relayed by the teacher (57%). The New Zealand proportions of students for these two activities were similar to

Finland (55% and 51% respectively). Activities less frequent, both in New Zealand schools and across OECD countries on average, included experiments done by teachers as demonstrations (38% and 34% respectively) and students spending time in a lab doing practical experiments (23% and 22% respectively).

Table 18: Proportion of students reporting hands-on learning activities occur in all or most science lessons

Hands-on learning activities	Percentage of students who responded *in all* or *most lessons*	
	New Zealand	OECD average
Students are asked to draw conclusions from an experiment they have conducted	58	51
Students do experiments by following the instructions of the teacher	57	45
Experiments are done by the teacher as demonstrations	38	34
Students spend time in the laboratory doing practical experiments	23	22

Notes: Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 10%; these students are not included in this table.

Of the four teaching approaches, *student investigation* was the least frequently reported by students in New Zealand and across the OECD countries. Twenty-six percent of 15-year-olds in New Zealand indicated they were required to design how a science question could be investigated in the laboratory. This is similar to Australia (28%) and the Netherlands (26%), significantly higher than Finland (10%), Japan (9%) and Korea (13%), but almost half that for the United States (45%). Twenty-two percent of students in New Zealand reported that they were asked to do an investigation to test out their own ideas. This is similar to Australia, Japan and the United Kingdom (26%, 22%, and 23% respectively). Fourteen percent of students in New Zealand were allowed to design their own experiments, and 12 percent were given the chance to choose their own investigations. This is similar to the average across the OCED countries for these two activities – 17 percent and 16 percent respectively.

Table 19: Proportion of students reporting student investigations occur in all or most science lessons

Student investigation activities	Percentage of students who responded *in all* or *most lessons*	
	New Zealand	OECD average
Students are required to design how a science question could be investigated in the laboratory	26	22
Students are asked to do an investigation to test out their own ideas	22	23
Students are allowed to design their own experiments	14	17
Students are given the chance to choose their own investigations	12	16

Notes: Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 10%; these students are not included in this table.

Activities to promote science

School principals were asked what activities, from a list of five (see Table 20), their school participated in to promote science learning among students in Year 11 (other countries included the grade name appropriate for them). The most common type of activity designed to promote science learning conducted externally to the classroom, both in New Zealand schools and across OECD countries, was excursions and field trips (94% of New Zealand students and 89% on average across the OECD). Science competitions were also popular in New Zealand (91%), along with Australia (98%), Poland (100%), and Hong Kong-China (91%), but less so across OECD countries (on average 54%). Although science fairs and projects were less common in New Zealand (72%), the proportion of students participating in them was significantly higher than the OECD average (39%). Having a greater variety of activities promoting science within a school was not associated with higher achievement for students in New Zealand schools, but it was associated with higher achievement among many of the OECD countries.

Table 20: Proportion of students in schools that hold activities to promote science

Activities to promote science	Proportion of students (%)	
	New Zealand	OECD average
Science clubs	32	38
Science fairs	72	39
Science competitions	91	54
Extra-curricular science projects	57	45
Excursions and field trips	94	89

Notes: Proportions presented are proportions of students whose principal indicated that these activities happened in their schools.

Perception of school climate

Students, parents and principals were asked a variety of questions about the learning atmosphere in their schools. It seems likely that a place where students feel they belong, and where they perceive their participation is worthwhile, would be a better place for learning than one where they feel out of place and no one is interested in what they have to say. This section looks at student, principal, and parent responses to various aspects of school climate. Note that no international comparisons are presented for the sections on students' and principals' perceptions because these questions were only asked in New Zealand as national options.

Students' perception of school climate

In New Zealand, students were asked two sets of questions on school climate. The first set of questions examined students' sense of belonging, and these statements are shown in Table 21 in the order in which they were presented to the students. Note that positive and negative statements are interwoven. Students were given four response options: *strongly agree*, *agree*, *disagree*, and *strongly disagree*.

The majority of students gave responses consistent with them feeling they belonged at school. On average 9 out of every 10 students felt that school was a place where they fitted in, with the lowest agreement at the 87 percent level for *My school is a place where I feel like I belong*. More than half of all students (59%) *strongly disagreed* with the statement that *My school is a place where I feel lonely*, while a further 34 percent *disagreed* with this statement.

Table 21: New Zealand students' sense of belonging at school

Statements from the question on "My school is a place where:"	Proportion of students	
	Agreeing	Disagreeing
I feel like an outsider (or left out of things)	8	92
I make friends easily	91	9
I feel like I belong	87	13
I feel awkward and out of place	12	88
Other students seem to like me	94	6
I feel lonely	7	93

Notes: Values presented for 'agreeing' included student responses to 'strongly agree' and 'agree'; similarly, 'disagreeing' includes both 'disagree' and 'strongly disagree'. See Appendix 3 for proportions of students in each of the four orginal categories..

The percentage of students with missing responses for each of these items ranged between 3% and 4%; these students are not included in this table.

The positive sense of belonging, as represented by the statements in the table above, was evident among both boys and girls, and among students from each of the ethnic groupings.

The second set of questions on school climate in the student questionnaire examined students' perceptions of their teachers, as shown in Table 22. Around three-quarters of students, or more, agreed with the positively worded statements about their teachers. The highest agreement (*strongly agree* and *agree* combined 86%) was for the statement *Most of my teachers treat me fairly*, while the lowest agreement (74%) was for the statement *Most of my teachers really listen to what I have to say*.

Table 22: New Zealand students' attitudes to their teachers

Statements about teachers	Proportion of students	
	Agreeing	Disagreeing
Students get along well with most teachers	78	22
Most teachers are interested in students' well-being	83	17
Most of my teachers really listen to what I have to say	74	26
If I need extra help, I will receive it from my teachers	85	15
Most of my teachers treat me fairly	86	14

Notes: Values presented for 'agreeing' include student responses to 'strongly agree' and 'agree'; similarly 'disagreeing' includes both 'disagree' and 'strongly disagree'. See Appendix 4 for the proportions of students in each of the four original categories.

Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 2%; these students are not included in this table.

The students' positive perceptions of teachers, as represented by the statements in the table above, were held by both boys and girls, and generally among students from each of the ethnic groupings. However, Māori students were less likely to agree that *most of my teachers really listen to what I have to say*, with only 67 percent of students agreeing compared to 74 percent of their Pākehā/European, 76 percent of their Pasifika, and 85 percent of their Asian counterparts.

Principals' perception of school climate

Principals were given 13 statements on potential hindrances to a good school climate, as shown in Table 23, and were given the response options *not at all*, *very little*, *to some extent*, and *a lot*. Note that the proportions given represent proportions of students rather than proportions of schools.

Of the statements listed, principals in New Zealand perceived student absenteeism to be the greatest potential hindrance to a good school climate, as shown in Table 23. About half (53%) of students were in schools whose principals thought student absenteeism hindered instruction to some extent or a lot. The second greatest issue reported by principals was teachers not meeting individual students' needs (38% to some extent or a lot). Few students were in schools where teacher absenteeism (3%), teachers being too strict (4%) or poor student-teacher relations (9%) were considered a problem.

Table 23: New Zealand principals' perceptions of potential hindrances to a good school climate

Statements about potential hindrances to a good school climate	Proportion of students in schools where principals perceived the school's capacity to provide instruction was hindered	
	Not at all or very little	To some extent or a lot
Teachers' low expectation of students	69 (3.2)	31 (3.2)
Student absenteeism	47 (3.1)	53 (3.1)
Poor student-teacher relations	91 (1.8)	9 (1.8)
Disruption of classes by students	69 (2.8)	31 (2.8)
Teachers not meeting individual students' needs	62 (3.3)	38 (3.3)
Teacher absenteeism	97 (1.3)	3 (1.3)
Students skipping classes	66 (2.8)	34 (2.8)
Students lacking respect for teachers	81 (2.5)	19 (2.5)
Staff resisting change	72 (3.0)	28 (3.0)
Student use of alcohol or illegal drugs	84 (2.8)	16 (2.8)
Teachers being too strict with students	96 (0.2)	4 (0.2)
Students intimidating or bullying other students	84 (2.4)	16 (2.4)
Students not being encouraged to achieve their full potential	82 (2.8)	18 (2.8)

Notes: Adjusted percentages are shown. The percentage of students with missing responses for each of these items was about 2%; these students are not included in this table.

The statements are ordered as they were asked in the questionnaire.

Parents' perception of school climate

In order to complement the perspectives of students and school principals, participating countries in PISA 2006 were given the opportunity to collect data from parents. Sixteen countries, including New Zealand, administered questionnaires to parents. The other countries were:

- OECD member countries: Denmark, Germany, Iceland, Italy, Korea, Luxembourg, Poland, Portugal and Turkey;
- partner countries: Bulgaria, Colombia, Croatia, Hong Kong-China, Macao-China, and Qatar.

Nearly 70 percent of the parents of participating New Zealand 15-year-old students returned a completed questionnaire.

To gauge the parents' perception of school quality, parents were asked about their agreement on seven positive statements about their child's school (listed in Table 24). The possible response options were: *strongly agree*, *agree*, *disagree*, and *strongly disagree*. The majority of parents of New Zealand 15-year-olds were satisfied with the quality of the school as measured by these statements. The statement with the most agreement (93%) among New Zealand parents was *most of my child's school teachers seem competent and dedicated*. Agreement from parents in the other countries was of a similar level (89% on average), with the highest agreement in Bulgaria (95%) and the lowest in Germany (80%).

The statement with the lowest level of agreement (82%) among New Zealand parents was *my child's school provides regular and useful information on my child's progress.* Another way of looking at this is that only 18 percent disagreed or strongly disagreed with this statement. This statement had much greater variation across countries (the average was 74%), with the highest agreement in Poland (93%) and the lowest in Germany (46%).

Table 24: Parents' perceptions of school quality, New Zealand and selected countries

Statements about the school	Percentage of students whose parents agree or strongly agree	
	New Zealand	Country average
Most of my child's school teachers seem competent and dedicated	93	89
Standards of achievement are high in my child's school	87	76
I am happy with the content taught and the teaching methods used in my child's school	87	82
I am satisfied with the disciplinary atmosphere in my child's school	83	81
My child's progress is carefully monitored by the school	85	78
My child's school provides regular and useful information on my child's progress	82	74
My child's school does a good job in educating students	91	86

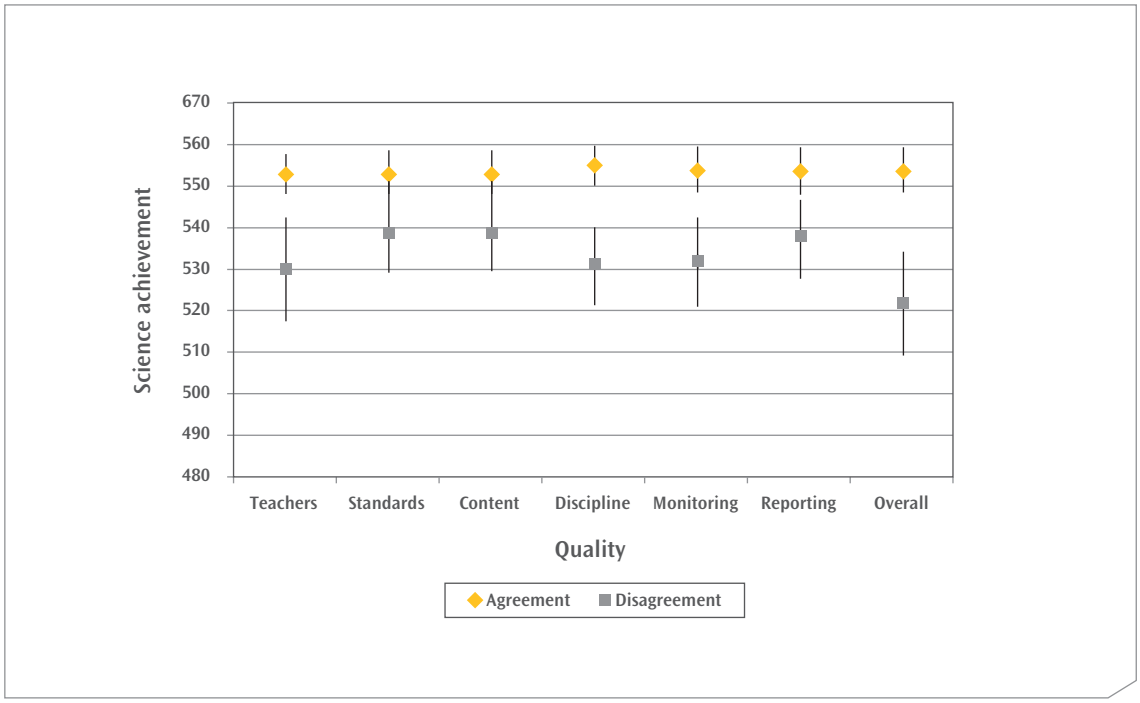
Notes: Only 16 countries collected data from parents, so the country average includes only these 16 countries.

Only 70% of New Zealand parents returned the questionnaire completed.

Source: Figure 5.8, OECD, 2007a.

The relationship between each of these statements on school quality and achievement was positive. That is, those parents who were satisfied with the school generally had children with higher achievement than those whose parents were not satisfied (see Figure 7).

Figure 7: Mean scientific literacy of students, by parental agreement with statements of school quality



Notes: Lines represent the confidence interval around the mean; i.e. we are 95% confident that if all 15-year-old students were tested the mean science achievement would be on the line.

See Appendix 5 for values.

School preparation for science-related careers

Students were asked how much they agreed with four statements on the way their school prepared them for a science-related career (the questions are presented in Table 25). Prior to the questions, the following definition of what was meant by a science-related career was presented:

> *When thinking about what a science-related career might be, think of the many jobs that involve science – not just the traditional 'scientist'. Careers like engineer (involving physics), weather forecaster (involving earth science), optician (involving biology and physics), and medical doctors (involving medical sciences) are all examples of science-related careers.*

Most New Zealand students agreed that schools were preparing them for a science-related career (between 74% and 93% agreeing or strongly agreeing with statements on this). The proportions were similar to Australia (71% to 93%), the United Kingdom (77% to 92%) and Ireland (74% to 92%). Students with higher levels of agreement to these statements (implying higher positive feelings of preparation) generally had higher achievement than those with lower levels of agreement.

Table 25: Student attitudes to whether school is preparing them for science-related careers

Careers and science	Percentage of students agreeing	
	New Zealand	OECD average
The subjects available at my school provide students with the basic skills and knowledge for a science-related career	93	83
The science subjects at my school provide students with the basic skills and knowledge for many different careers	89	80
The subjects I study provide me with the basic skills and knowledge for a science-related career	74	71
My teachers equip me with the basic skills and knowledge for a science-related career	81	73

Notes: Response options for 'strongly agreed' and 'agreed' are combined to give the values for agreement presented in this table.

Conclusion

This report has examined the overall structure and management systems in place in schools, the science teaching taking place in schools, and principals', students' and parents' perceptions of school climate.

School demographic characteristics and management

Schools in New Zealand had a lot of autonomy with regard to decision-making relative to other OECD countries. Assessment data were used in New Zealand schools for decision-making and evaluation, as well as for feedback to parents and students. Ability grouping was used regularly within New Zealand schools to provide instruction based on the needs of pupils. Students from larger locations, larger schools, or in higher socio-economic schools (as measured by the decile indicator) generally had higher scientific literacy achievement than other students. Students in schools with a higher perceived impact on instruction resulting from teacher or resource shortages, as reported by their principal, generally had lower science achievement than those in schools with lower perceived impact.

Science teaching and learning

Schools in New Zealand offered a wide range of science courses, and most New Zealand 15-year-olds were enrolled in some form of science education. Students reported their teachers used a range of teaching methods and most schools held activities to promote science. Higher achieving students in the PISA 2006 scientific literacy assessment were generally those that were studying science.

Perceptions of school climate

The vast majority of students in New Zealand held positive views about their schools and teachers and agreed that schools provide useful preparation for science-related careers. The majority of parents were satisfied with the quality of the school attended by their children. Many principals felt under pressure from parents to achieve higher academic standards. Of the statements listed, principals in New Zealand perceived student absenteeism and teachers not meeting individual students' needs to be the two greatest potential hindrances to a good school climate.

Final note

Science teaching and learning, specifically scientific literacy, was the focus area of PISA 2006. According to Telford and Caygill (2007), of the 57 countries participating in PISA 2006, only two countries performed better than New Zealand when the average scientific literacy of 15-year-old students was compared. However, there were significant differences in the achievement of students from different ethnic groupings. In addition, according to Caygill (2008), while most students were interested in science, there were significant differences in attitudes to science between boys and girls, and across ethnic groupings.

This report provides further evidence on aspects of the Ministry of Education's priorities for schooling (Ministry of Education, 2007a), including strong professional leadership, resourcing, effective teaching, parents and whānau, and healthy confident kids. It is encouraging that so many students and parents are happy with the schooling provided in New Zealand, but there is still a challenge to achieve the goal of education for all individuals appropriate to their needs, interests and aspirations. It is hoped that the implementation of education initiatives (e.g. Ministry of Education 2006; Ministry of Education 2008), including the new curriculum (Ministry of Education, 2007b), under strong professional leadership from schools and in cooperation with their communities, will ensure an increasing proportion of school leavers are ready for tomorrow's world.

Appendices

Appendix 1: Countries in PISA

Argentina*	Australia	Austria
Azerbaijan*	Belgium	Brazil*
Bulgaria*	Canada	Chile*
Colombia*	Croatia*	Czech Republic
Denmark	Estonia*	Finland
France	Germany	Greece
Hong Kong-China*	Hungary	Iceland
Indonesia*	Ireland	Israel*
Italy	Japan	Jordan*
Korea	Kyrgyzstan*	Latvia*
Liechtenstein*	Lithuania*	Luxembourg
Macao-China*	Mexico	Montenegro*
The Netherlands	New Zealand	Norway
Poland	Portugal	Qatar*
Romania*	Russian Federation*	Serbia*
Slovak Republic	Slovenia*	Spain
Sweden	Switzerland	Chinese Taipei*
Thailand*	Tunisia*	Turkey
United Kingdom	United States	Uruguay*

*Note: * denotes non-OECD countries.*

Appendix 2: Proportion of students in schools where achievement data were used for the purposes of accountability

Area where achievement data were used	Proportion of students (%)	
	New Zealand	OECD average
Posted publicly	67	38
Evaluation of the principals' performance	38	32
Evaluation of teachers' performance	47	43
In decisions about instructional resource allocation to the	69	30
Tracked over time by an administrative authority	92	65

Appendix 3: New Zealand students' agreement with statements on belonging at school

Statements from the question on "My school is a place where:"	Proportion of students							
	Strongly agree (s.e.)		Agree (s.e.)		Disagree (s.e.)		Strongly disagree (s.e.)	
I feel like an outsider (or left out of things)	2	(0.2)	6	(0.4)	41	(0.7)	50	(0.9)
I make friends easily	32	(0.7)	59	(0.7)	8	(0.4)	1	(0.1)
I feel like I belong	28	(0.8)	60	(0.8)	11	(0.5)	2	(0.2)
I feel awkward and out of place	3	(0.3)	10	(0.5)	46	(0.8)	42	(0.8)
Other students seem to like me	22	(0.7)	72	(0.8)	5	(0.4)	1	(0.1)
I feel lonely	2	(0.2)	5	(0.4)	34	(0.9)	59	(0.8)

Appendix 4: New Zealand students' agreement with statements about their teachers

Statements about teachers	Proportion of students							
	Strongly agree	(s.e.)	Agree	(s.e.)	Disagree	(s.e.)	Strongly disagree	(s.e.)
Students get along well with most teachers	11	(0.6)	67	(0.7)	19	(0.8)	3	(0.3)
Most teachers are interested in students' well-being	15	(0.7)	68	(0.7)	14	(0.7)	3	(0.3)
Most of my teachers really listen to what I have to say	15	(0.7)	59	(0.7)	22	(0.8)	4	(0.3)
If I need extra help, I will receive it from my teachers	23	(0.8)	63	(0.7)	12	(0.5)	2	(0.2)
Most of my teachers treat me fairly	21	(0.7)	65	(0.7)	10	(0.5)	3	(0.3)

Appendix 5: Relationship between mean scientific literacy performance of students and parents' attitudes to school quality

Statements on school quality	Mean science achievement					
	Agree or strongly agree	(s.e.)	Disagree or strongly disagree	(s.e.)	Difference	(s.e.)
Most of my child's school teachers seem competent and dedicated	553	(2.6)	530	(7.0)	23	(7.3)
Standards of achievement are high in my child's school	553	(2.8)	539	(4.9)	14	(5.5)
I am happy with the content taught and the teaching methods used in my child's school	553	(2.7)	539	(5.1)	14	(5.6)
I am satisfied with the disciplinary atmosphere in my child's school	555	(2.7)	531	(4.2)	25	(4.3)
My child's progress is carefully monitored by the school	554	(2.7)	532	(5.4)	23	(5.6)
My child's school provides regular and useful information on my child's progress	554	(2.7)	537	(5.1)	17	(5.3)
My child's school does a good job in educating students	554	(2.7)	522	(6.3)	32	(6.8)

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Further information

New Zealand's PISA web page is at www.educationcounts.govt.nz/goto/pisa. The OECD's PISA 2006 international report can be accessed from the OECD PISA website: www.pisa.oecd.org. An interactive data selection facility, which allows selected analyses of international contextual information for student performance, is also available from this site, along with the international versions of the student, school and parent questionnaires. Further reporting of New Zealand PISA 2006 results will be available later in 2008.

PISA will be administered in New Zealand again during July and August 2009. The PISA 2009 results will be published by the OECD in December 2010.

List of countries participating in PISA 2006


Argentina*


Azerbaijan*


Bulgaria*


Colombia*


Denmark


France


Hong Kong-China*


Indonesia*


Italy


Korea


Liechtenstein*


Macao-China*


New Zealand


Portugal


Russian Federation*


Slovenia*


Switzerland


Tunisia*


United States


Australia


Belgium


Canada


Croatia*


Estonia*


Germany


Hungary


Ireland


Japan


Kyrgyzstan*


Lithuania*


Mexico


Norway


Qatar*


Serbia & Montenegro*


Spain


Chinese Taipei*


Turkey


Uruguay*


Austria


Brazil*


Chile*


Czech Republic


Finland


Greece


Iceland


Israel*


Jordan*


Latvia*


Luxembourg


The Netherlands


Poland


Romania*


Slovak Republic


Sweden


Thailand*


United Kingdom

* Non-OECD countries

Note: Serbia and Montenegro equal two countries.

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