

23 November 2016

## Education Report: Briefing - TIMSS 2015 and PISA 2015 results

### Executive Summary

1. This paper briefs you on the results of two major international studies of student knowledge and ability:
  - The Trends in International Mathematics and Science Study (TIMSS) 2015<sup>1</sup> assesses Year 5 and Year 9 students in science and maths as well as collecting background information about students and their schools.
  - The Programme of International Student Assessment (PISA) assesses 15-year-olds, regardless of what year level they are in. It assesses their abilities in science, maths and reading. Unlike TIMSS it is not designed to assess against participating countries curricula. The focus of PISA is to test students against an international standard.
2. The previous cycles of TIMSS and PISA showed decreases in achievement among New Zealand students across most subjects and year levels. The 2015 results show that this downward trend has stabilised and students' achievement has generally held steady.
3. New Zealand's Year 5 results sit slightly below the international average, but the average scores significantly improved for science in this cycle. In Year 9 and for 15-year-olds our scores are above the international averages and remained stable.
4. The 2015 cycle of PISA was the first time the assessment was administered through computers rather than pen and paper. The OECD advises they have looked in depth at this and it has not impacted on the validity of results (through a "mode effect" where a change in mode of administration can change the way questions are answered). However there may be some commentary internationally or from academics about this change to computers.

### Science

5. The most positive change for New Zealand students was in their science achievement. There has been a significant<sup>2</sup> increase in the Year 5 achievement score since 2010. Our PISA ranking for 15-year-olds also improved this cycle (from 18<sup>th</sup> to 12<sup>th</sup>) but this was mainly due to declines in achievement in countries that were once ranked higher than us.

Science achievement				
Assessment	New Zealand's standing		New Zealand's average score	
	This cycle	Last cycle	This cycle	Last cycle
Year 5 (TIMSS)	30/47	29/50	506	497
Year 9 (TIMSS)	14/39	10/45	513	512
15-year-olds (PISA)	12/70	18/65	513	516

6. New Zealand Year 5 and Year 9 students continued to perform their best in earth and life / biology sciences. Our 15-year-olds performed equally well across all assessed domains (physical systems, living systems and earth science).

<sup>1</sup> TIMSS 2015 is the name of the cycle as this is when it is administered in the Northern hemisphere – however the study was administered in NZ in 2014/2015 – therefore results are shown as indicative of the 2014/2015 year.

<sup>2</sup> Significant refers to "statistically significant" meaning that the result is unlikely to have occurred through chance.

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## Mathematics

7. There was little change in our maths scores across the three cohorts. There was a slight decrease for 15-year-olds and an increase for Year 5, but these changes were not significant. New Zealand's position relative to other countries has also stayed stable across all three groups.

Maths achievement				
Assessment	New Zealand's standing		New Zealand's average score	
	This cycle	Last cycle	This cycle	Last cycle
Year 5 (TIMSS)	33/49	29/50	491	486
Year 9 (TIMSS)	17/39	14/45	493	488
15-year-olds (PISA)	21/70	23/65	495	500

8. New Zealand Year 5 and Year 9 students continued to perform their best in statistics-related maths areas.

## Reading

9. PISA also assesses reading literacy and for New Zealand there has been no statistically significant change in score since the last cycle.

Reading achievement				
Assessment	New Zealand's standing		New Zealand's average score	
	This cycle	Last cycle	This cycle	Last cycle
15-year-olds (PISA)	10/70	13/65	509	512

10. New Zealand's ranking increased from 13<sup>th</sup> to 10<sup>th</sup> relative to other participating countries but this was again due to declining scores in other participating countries.

## Analysis

11. When compared with other countries, we continue to have a relatively wide spread between scores at the top and bottom achievement levels for all subjects and year groups. This widened between 2010 and 2015 for both Year 5 and Year 9 students. PISA data also shows more variance in scores among New Zealand students than the OECD average.
12. Over the longer term, the proportion of students in the lower levels of proficiency has increased and the proportion of students at the higher levels of PISA proficiency has declined. In 2006, 18% of our students were in the top two proficiency levels in science. By 2015, the proportion in the top two bands had decreased to 13%. There have been very similar declines in reading over this time period. The proportion of students in the top two bands for maths declined from 21% in 2002 to 12% in 2015.
13. While there has been a decline in students at the top end of the achievement distribution, our very top 15-year-old performers continue to do well internationally. New Zealand has one of the largest proportion of students achieving at the highest proficiency levels of all countries participating in PISA. Six percent of our students reached the highest performance benchmark across all three subjects compared to the OECD average of 4%.
14. Socio-economic circumstances continue to impact student achievement in New Zealand and internationally. In both PISA and TIMSS, students in higher socio-economic areas have higher average scores than students from lower SES communities.
15. This gap between average student achievement scores was larger in New Zealand than most other countries, particularly at the Year 5 level. These results are consistent with results from domestic studies such as the National Monitoring Study on Student Achievement.

16. However, in PISA 2015, the strength of the relationship between SES and achievement was attenuated somewhat. In 2012, SES explained 18% of the variation in student achievement. In 2015, this had reduced to 13%. This means that SES was less of a predictor of students' achievement than it has been in the past and may signal improvements in the equitability of the New Zealand education system.

#### *Gender and ethnicity*

17. Year 5 and Year 9 boys and girls had similar achievement levels across all subjects, although boys generally had a wider range of scores. After a substantial decrease in science and maths between 2002 and 2010, Year 9 girls' results have increased back to 2002 achievement levels. More Year 9 girls also reached the 'high' achievement benchmark in maths and science than the previous cycle.
18. There has been little change in Māori and Pasifika scores across cohorts and subject areas. These students remain over-represented at lower achievement levels and under-represented at high achievement levels. For 15-year-olds there was a slight though not significant, increase in average science and maths scores.

#### *Teachers and teaching*

19. Teachers at Year 5 had a low level of science and maths specialisation relative to other countries. They also reported a lack of confidence around these subjects. Year 5 teachers also use whole-class teaching less frequently and same-ability grouping more frequently than other countries in maths lessons.
20. At the Year 9 level, most science teachers had specialised in science or science education and expressed high or very high confidence in their teaching abilities. Fewer maths teachers had a maths specialisation compared to their international counterparts, although they reported relatively high levels of confidence.
21. In Year 5 science 15% of students had teachers who specialised in science (internationally it is 38%). As would be expected, more Year 9 teachers specialised in maths and science. However, fewer New Zealand Year 9 students had mathematics teachers who specialised in mathematics (66%) than their international counterparts (85%). For science, nearly all Year 9 students in both New Zealand (93%) and internationally (91%) had science teachers who specialised in science.
22. The teachers in the TIMSS study reported higher levels of engagement in professional development programmes than most of the other participating countries. However, the association between PD and student achievement is weak across both TIMSS and PISA.
23. New Zealand Year 5 students self-reported one of the highest levels of exposure to bullying behaviours across all the participating countries. Our Year 9 students self-reported similar levels to our Year 5 students but the gap between New Zealand and other countries closes somewhat for the Year 9 context.

#### *Release*


24. We propose to:
- a. Brief key external stakeholders on the results and identify opinion leaders who may wish to provide context for subsequent media reporting.

- b. Publish a series of reports that cover the high-level achievement findings with a New Zealand focus at the same time as the international TIMSS and PISA results are released. We will provide you with advance copies of these reports shortly.
- c. Support you to adopt a proactive communications approach in regard to media, and provide an appropriate context for the results. The overall communications approach for TIMSS is outlined in Appendix 1. The communications approach for PISA will be sent to your office next week.

#### Recommendations

##### **We recommend that you:**

- a. **note** that the TIMSS 2015 results will be release on the 29<sup>th</sup> of November and the PISA 2015 results will be released on the 6<sup>th</sup> of December
- b. **note** that we have recently provided you with information about interventions related to mathematics and options to lift the quality of teaching and learning in mathematics, statistics and Pāngarau [METIS 1014654 refers]
- c. **agree** the Ministry releases New Zealand reports as outlined  
AGREE / DISAGREE
- d. **agree** to the communications approach attached to this report (Appendix 1)  
AGREE / DISAGREE
- e. **forward** this report to the Minister for Tertiary Education, Skills and Employment.

  
Dr. Craig Jones  
Deputy Secretary  
Evidence, Data and Knowledge

NOTED / APPROVED

Hon Hekia Parata  
Minister of Education

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## Education Report: Briefing - TIMSS 2015 and PISA 2015 results.

### Purpose of report

1. To brief you about upcoming releases from the Trends in International Mathematics and Science Study (TIMSS) 2015 cycle and the Programme for International Student Assessment 2015 (PISA) 2015. All results are under **strict embargo** until the release dates.
2. To seek your approval for the Ministry to release domestic reports focused on New Zealand results at the same time as the international reports.

### Release overview

#### **Release of TIMSS 2015 results**

3. On November 29<sup>th</sup> (11pm NZST) the International Association for the Evaluation of Educational Achievement (IEA) will release the TIMSS 2015 results. They will release a separate report for each year level and subject, as well as one report focused on 20 years of trend data.
4. New Zealand administered TIMSS for Years 5 and 9 in November 2014. Data were collected from:
  - a. Year 5: 167 schools, 6,321 students, 460 teachers, 3,424 parents
  - b. Year 9: 137 schools, 8,101 students, 865 teachers.
5. The Ministry intends to publish:
  - a. Subject/Year level reports which will include:
    - i. Strengths and weaknesses for New Zealand students
    - ii. TIMSS and the New Zealand Curriculum
    - iii. Achievement by gender, ethnicity, socio-economic status
    - iv. Home learning climate
    - v. Teachers, teaching and learning activities
    - vi. School climate.
  - b. Flyer/factsheet summaries of various headline findings.
6. These reports are currently being designed and formatted to be highly accessible to the public. We will be providing your office with an advance copy of these reports, flyers and fact sheets on Thursday 24 November.
7. A communications approach for TIMSS and draft media release are appended to this report (Appendix 1).

#### **Release of PISA 2015 results**

8. On December 6<sup>th</sup> (11pm NZST) the Organisation for Economic Cooperation and Development (OECD) will release the PISA 2015 results. This study assesses 15-year-olds' achievement in reading, maths and science. In New Zealand the assessment covered 4,520 students.

9. The OECD will publish:

- Volume one: "PISA 2015 Results: Students' performance in Science, Reading and Mathematics"
- Volume two: "PISA 2015 Results: Schools, School systems characteristics"
- An "executive summary" of the top headlines, which is likely to form the basis of a "PISA in Focus" between the release and Christmas.

10. The Ministry intends to publish:

- a. A New Zealand summary report which will include:
  - i. New Zealand students' achievement for 2015 across science, maths and reading
  - ii. Achievement by gender, ethnicity and socio-economic status
  - iii. Information about New Zealand's achievement trend since 2000.
- b. A New Zealand science report which will include:
  - i. More detailed information about different aspects of science achievement
  - ii. Information about science teachers' qualifications and professional knowledge
  - iii. Science teaching practices
  - iv. Factors impacting on science-related outcomes: motivation, attitudes, and beliefs
  - v. Students' thoughts on science careers.
- c. Flyer/factsheets with various headline findings of the above.

11. These reports are currently being designed and formatted to be highly accessible to the public. We will be providing your office with an advance copy of these reports, flyers and fact sheets on Thursday 1 December.

12. A communications approach for PISA and draft media release will also be provided on 1 December.

### **TIMSS Key findings**

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#### ***Overall achievement***

13. New Zealand achievement results had trended downward between 2002 and 2010. The latest results show that this trend has stabilised and students' achievement generally held steady, with some indications of significant improvement<sup>3</sup>.

<sup>3</sup> The term "significant" is used as short hand for "statistically significant" meaning the result is not likely to have occurred randomly or by chance.

14. The following table summarises New Zealand's results over the last two cycles of the TIMSS study:

New Zealand TIMSS results					
Year/subject	Average score		NZ's simple rank		Comments
	2010	2015	2010	2015	
Year 5 maths	486	491	29/50	33/49	The increase between 2010 and 2015 is not statistically significant.
Year 5 science	497	506	29/50	30/47	The increase between 2010 and 2015 is statistically significant.
Year 9 maths	488	493	14/45	17/39	The increase between 2010 and 2015 is not statistically significant.
Year 9 science	512	513	10/45	14/39	The increase between 2010 and 2015 is not statistically significant.

15. The range of achievement between the highest and lowest performers in New Zealand has increased in this cycle of the study, and this gap is larger than in many other countries.
16. Individual student results are stratified into one of five achievement groups<sup>4</sup>. In both year levels for maths and in Year 5 science, 6% of New Zealand students scored above the highest benchmark ('advanced'). Ten per cent of Year 9 science students achieved above this benchmark. These results put New Zealand sits around the middle of participating countries in terms of our highest achievers.
17. In contrast, across both year levels in science, 12% of students did not reach the lowest achievement level. This means they did not achieve the basics required for those year levels. In maths this was 16% for Year 5 and 15% for Year 9.
18. Appendix 2 shows how New Zealand ranks compared to other countries.

#### **Strengths and weaknesses within subjects**

19. In 2015, Year 5 students were stronger in statistical-based maths problems than they were in number-based problems, geometry or measurement. Teachers reported feeling most prepared for statistics and that they covered it most regularly. Similarly, Year 9 students scored higher in statistics (509) than number (500), geometry (488) and algebra (475).
20. Year 5 science students continued to achieve better results in earth and life sciences than in physical sciences. The life science score increased significantly between 2010 and 2015. Year 9 science students showed strength in biology and earth science, while chemistry remained a relative weakness.
21. In both maths and science, New Zealand students achieved better results in the cognitive processes of 'applying' and 'reasoning', compared to their results in 'knowing'.

<sup>4</sup> "Advanced" means a score of 625 or above, "High" is a score of 550 to 625, "Intermediate" is a score of 475 to 550, "Low" is a score of 400 to 475 and "Below low" is a score below 475 and indicates the students were unable to complete basic tasks.



### ***Ethnicity, gender and achievement***

22. Māori and Pasifika students continued to have lower achievement than non-Māori and non-Pasifika students, which is consistent with previous cycles and with other studies. These gaps are attenuated somewhat when socio-economic factors are accounted for but they are not eliminated entirely.

23. The mean scores for Māori students saw no significant change between last cycle and 2015:

Māori students average TIMSS scores		
Subject	2010	2015
Year 5 maths	459	451
Year 9 maths	451	451
Year 5 science	472	470
Year 9 science	473	469

24. For both maths year levels, 12% of Māori students scored at or above the 'high' performance level. Seventeen percent of Māori students were at or above the 'high' performance level for science.
25. Maori students were much more likely than non-Māori to fall below the 'low' benchmark, as shown in the following table:

Percentages of Māori and non-Māori students who did not reach the 'low' TIMSS benchmark in 2015		
Subject	Māori	Non-Māori
Year 5 maths	26%	13%
Year 9 maths	26%	11%
Year 5 science	20%	9%
Year 9 science	22%	8%

26. The results for Pasifika students are similar to Māori and overall scores showed no significant change since 2010:

Pasifika students average TIMSS scores		
Subject	2010	2015
Year 5 maths	445	439
Year 9 maths	442	438
Year 5 science	443	446
Year 9 science	453	449

27. The proportion of Pasifika students who scored at or above the 'high' standard in Year 5 maths and science was 9%. For Year 9 maths it was 8% and in science it was 11%.
28. Pasifika students were also much more likely to fall below the 'low' benchmark, as shown in the following table:

Percentages of Pasifika and non-Pasifika students who did not reach the 'low' TIMSS benchmark in 2015		
Subject	Pasifika	Non-Pasifika
Year 5 maths	31%	13%
Year 9 maths	32%	12%
Year 5 science	28%	9%
Year 9 science	27%	9%

29. Boys and girls had similar average achievement across both year levels and subjects, although boys generally had a wider range of scores.
30. Girls made some notable gains in some areas compared with earlier years. For example, after having a substantial decrease in science and maths between 2002 and 2010, Year 9 girls have increased back to 2002 levels of achievement. In 2015, more Year 9 girls reached the high achievement benchmark in maths and science than the previous cycle.
31. In 2015, Year 9 girls did better than boys in biology, while boys achieved higher than girls in physics and earth science. There was no significant gender difference in chemistry or in the cognitive domain areas of 'knowing', 'applying' and 'reasoning'.
32. Both boys and girls tended to perform slightly better in science than maths (though the difference was not always statistically significantly). Students were less likely to achieve at the 'below low level in science than they were in maths.

#### ***Socio-economic status and home learning environment***

33. Consistent with previous cycles, students who had more resources in the home and whose parents reported often doing literacy and numeracy activities with them tended to have higher achievement levels. However, there was no apparent association between parents' attitudes towards maths and science, and student achievement.
34. Students attending schools with more economically affluent<sup>5</sup> students had higher average achievement scores across all subjects and year levels than students attending schools with more economically disadvantaged students. The gap between the students with the highest and lowest socioeconomic indicators was larger in New Zealand than most other countries, particularly at the Year 5 level. This finding is consistent with earlier cycles and with other studies.
35. Parents reported how often they did early literacy and numeracy activities with their children. Students whose parents reported they 'often' did early literacy activities, such as reading books and identifying words, with their children had higher science and maths achievement. Average Year 5 mathematics achievement scores increased as the amount of time spent on reading increased.

#### ***Early Childhood Education (ECE) engagement and Year 5 achievement***

36. The TIMSS parental questionnaire gathers information about children's participation in ECE. Only 56% of students had a parent who returned this information and there may be differences between parents who returned this information and those who chose not to complete this part of the survey. These results should therefore be interpreted cautiously.
37. The results suggest that children who attended ECE for more than one year had higher levels of achievement by Year 5. Students who had attended ECE for more than three years had significantly higher average scores than the 5% of students who had not attended at all (518 cf. 478 for maths, and 534 cf. 469 for science).

<sup>5</sup> "Affluent" is the term used by TIMSS when describing the index of socio-economics. This closely aligns with New Zealand's decile rating but is not the same measure.

38. Approximately two-thirds of parents reported that Year 5 students had spent more than 20 hours per week in ECE in the year prior to starting school. Children who attended for more than 20 hours had slightly higher achievement scores at Year 5 than those who attended for fewer than 20 hours, although these differences were not statistically significant.
39. In New Zealand, centre-based and Kindergarten were the most commonly accessed ECE services (22% and 35%, respectively), although 36% of students had attended more than one kind of ECE service. Only 4% of students had attended only home-based ECE. This was a New Zealand-specific question in TIMSS so we do not have similar information about type of services across other countries.
40. It is important to note that there are large differences in what constitutes ECE in different countries. For example, in Denmark the school starting age is seven, so they report much higher proportions of children attending ECE for three years or more as it covers the age range of children that in countries like New Zealand would already be in the schooling system.
41. These trends do not prove that ECE attendance is causally related to higher achievement. There may be systematic differences between families who enrol in ECE and who enrol for different lengths of time that contribute to the observed achievement patterns<sup>6</sup>.

***Teachers background, preparedness to teach and teaching practices***

42. Year 5 students in 2015 were more likely to have teachers with post-graduate and higher degrees than their 2010 counterparts (27% cf. 19% for maths, and 26% cf. 19% for science).
43. Only 19% of New Zealand Year 5 maths students had teachers who specialised in maths (internationally it was 41%). In Year 5 science 15% of students had teachers who specialised in science (internationally it is 38%).
44. As would be expected, more Year 9 teachers had specialised in maths and science but our levels of specialisation were still lower than in other countries. Two-thirds (66%) of New Zealand Year 9 students had mathematics teachers who specialised in mathematics compared with 85% their international counterparts.
45. For science, nearly all Year 9 students in both New Zealand (93%) and internationally (91%) had science teachers who specialised in science.
46. Student achievement was positively correlated teachers preparedness to teach maths. Teachers at Year 5 reported they were most prepared to teach adding, subtracting, multiplying and dividing, and less prepared to teach topics such as comparing and drawing angles and concepts of decimals. These topics were also less likely to be covered in class. Students' performance in the domains of number and geometric shapes and measurement was weaker relative to other maths topics.

<sup>6</sup> Neither PISA nor TIMSS can identify direct causal links between variables or factors. All reported findings are presented with the caveat they are correlations or relationships between factors only. Most of the variables that are correlated with achievement are collected via self-report. These can be subject to biases such as recollection errors or social desirability bias.

47. Teachers of Year 5 students reported feeling more prepared to teach science topics in 2015 than they did in 2010. However, about half still did not feel 'very well prepared', with physical science being the area they reported being most unprepared to teach. This is also the area with the lowest level of achievement. Teachers also reported less confidence to teach science than maths.
48. Year 5 teachers undertook less professional development for science than maths, despite science being the area they felt least prepared to teach. About 60% of Year 5 students were taught by teachers who had not had any science professional development in the prior two years. Despite these findings, our teachers were more engaged in professional development programmes than teachers in most other participating countries. Compared to the international average, a similar proportion of New Zealand Year 9 teachers participated in mathematics-related professional development activities. New Zealand teachers were slightly more likely to participate in science-related professional development activities, although fewer had more than 35 hours of professional development.
49. Relative to other countries, New Zealand teachers had high use of same-ability grouping, and relatively high use of having students work on problems (individually or with peers) while the teacher was occupied by other tasks. Activities where teachers explained new mathematics content, explained how to solve problems, or asked students to memorise rules, facts and procedures were less likely to be used in almost every lesson in New Zealand classrooms, compared with other countries.
50. Year 5 students in the study reported spending just over an hour a week on science topics, which is almost half as much as the international average. New Zealand teachers of Year 5 science used specific science learning techniques less often and relied more on students looking up ideas and information than the TIMSS average. Since 2010, there appears to have been an increase in the use of experimentation or investigation for Year 5 science students. In contrast to Year 5 maths, science students were more likely to work in mixed-ability groups.

#### ***Student attitudes and beliefs***

51. Confidence in a subject is more strongly correlated with achievement than is enjoyment of a subject. Year 5 students were less confident in their maths abilities than their international peers. While most (90%) Year 9 New Zealand students valued maths, a large proportion (46%) did not like learning mathematics and about the same proportion (44%) lacked confidence in their mathematics ability.
52. In science, 90% of Year 5 students reported they liked learning science which is similar to the international average, yet only 24% felt 'very confident' in the subject. More than three-quarters of New Zealand Year 9 students value science and like learning science. However, 45% of Year 9 students were classified as 'not confident' in science. Compared to international averages, New Zealand had a higher proportion of lower secondary school students who do not value science, do not like learning science and were not confident in science.

#### ***Students' perceptions of school***

53. In New Zealand, nine in ten Year 5 students reported feeling positive about school, teachers and classmates. Two-thirds reported a high sense of belonging at school and this was related to higher levels of achievement. Compared with the last cycle, more students reported feeling safe at school, liked being there and felt they belonged.

Seven out of ten New Zealand Year 9 students were positive about their schools, teachers and classmates, and nearly half had a high sense of school belonging.

54. Despite feeling safe and having a high sense of belonging at school, New Zealand students also reported high rates of bullying behaviour. Approximately 60% of Year 5 students reported experiencing bullying behaviour monthly or more often, compared with 43-44% internationally. There has been a small trend downward in this reported behaviour since 2010.
55. In contrast to students reports, 71% of Year 5 principals reported they had "hardly any" problems with school discipline and safety.
56. There was a negative correlation between bullying and achievement; students who reported experiencing bullying behaviours more frequently had lower levels of achievement, on average, than those experiencing these behaviours less frequently.
57. New Zealand students also reported higher levels of bullying at Year 9 than other countries (45% reported experiencing bullying behaviours monthly or more often cf. 37% internationally). There has been a small increase in this reported behaviour since 2010. Compared to other countries including most of the high-achieving countries, New Zealand lower secondary school principals were less positive about school discipline.

#### ***School resources and climate***

58. The majority of New Zealand teachers and principals in the study reported 'high' or 'very high' emphasis on academic success. Within any given country, having a higher emphasis on academic success tended to be positively associated with higher levels of achievement. However, 'emphasis on academic success' was not as strongly correlated with success *between* countries, which suggests the relationship between aspiration and achievement is more complex than it appears on the surface. It is not always the countries with the highest reported level of emphasis that have the highest achievers.
59. New Zealand teachers identified a lack of time to assist individual students and administrative burdens as among the greatest challenges to effective teaching. About two-thirds of Year 5 teachers reported they felt the level of individual student need was limiting their ability to teach maths. Nearly three-quarters of Year 9 mathematics teachers felt the same, although this proportion was lower for science teachers (63%).
60. From a resource perspective, New Zealand teachers were less likely to report problems than many of their international counterparts. Where they did cite problems, Year 5 teachers most commonly reported a lack of technological resources, lack of support for using technology, and inadequate workspace as moderate or serious problems. At the Year 9 level, the most commonly reported challenges were that the school buildings needed significant repair, and that teachers do not have adequate workspace.
61. A lack of technologically competent staff was the most common barrier to effective teaching identified by Year 5 principals. Other resources commonly reported as hindering instruction were: a lack of teachers with a specialisation in mathematics or science; computer software; library resources for mathematics instruction; computer technology for teaching and learning; science equipment and materials for experiments; and resources for students with disabilities.

62. At the Year 9 level, a lack of computer software/applications was the most commonly reported issue hindering instruction. A lack of secondary teachers with a specialisation in mathematics was also identified as an issue. Principals were more likely to identify a lack of maths teachers as an issue than a lack of science teachers.
63. While the teachers and principals indicated that technology resources were a challenge, New Zealand had a higher proportion of students with access to computers during maths and science lessons than any other country in the study.

### PISA Key findings

64. New Zealand 15-year-olds remain well above the OECD average in reading, maths and science. The declines observed between 2009 and 2012 have stabilised; our average scores did not significantly change between 2012 and 2015. The following table summarises New Zealand 2015 PISA results:

New Zealand PISA results						
Subject	NZ's average score			NZ's simple rank		Comments
	2012	2015	2015 OECD average score	2012	2015	
Science	516	513	493	18/65	12/70	The score decrease between 2012 and 2015 is not statistically significant
Maths	500	495	490	23/65	21/70	The score decrease between 2012 and 2015 is not statistically significant
Reading	512	509	493	13/65	10/70	The score decrease between 2012 and 2015 is not statistically significant

65. New Zealand's relative standing in science and reading improved slightly since 2012 (from 13<sup>th</sup> to 10<sup>th</sup> for reading, and from 18<sup>th</sup> to 12<sup>th</sup> for science). This is mainly due to a decrease in performance for some countries that were higher or similar in score to us in 2012. Poland, Ireland, Germany and Australia declined in science while Chinese Taipei, Japan and Korea declined in reading. Appendix 3 shows how New Zealand compares with other countries on PISA.
66. PISA scores are classified into different proficiency levels. A 'low achiever' is a student who scores below PISA proficiency level 2, which is considered the baseline for participation in life situations relating to that subject area. In PISA being a 'top performer' means scoring at level 5 or above.
67. When comparing 2015 results to 2012, there has been no change in the proportions of low achievers across the three subjects. There has also been no change since 2012 in the proportion of top performers in reading and science. However, there has been a small but statistically significant drop in the proportion of top performers in maths (from 15% in 2012 to 11% in 2015).
68. Over the longer term, the proportion of students in the lower levels of proficiency has increased and the proportion of students at the higher levels of PISA proficiency has declined. In 2006 18% of our students were in the top two proficiency levels in science; by 2015 this was 13% and reading had a similar change. In maths the decline has been from 21% in 2002 to 12% in 2015.

69. While these longer-term trends are concerning, the proportion of New Zealand students achieving at the highest level (level 6) of science is still one of the largest among participating countries in PISA. This is also the case for reading. Around 20% of New Zealand students are among the top performers in at least one subject area, compared with the OECD average of 15%.
70. In PISA 2015, 6% of New Zealand students were top performers in all three subjects. This compares with an OECD average of 4%.

***Ethnicity, gender, socio-economic status and achievement***

71. There has been little change in the mean scores for boys and girls since 2012. Boys remain slightly ahead of girls in maths, while girls are well ahead of boys in reading. There is no significant difference between boys and girls in their science achievement.

PISA achievement by gender, 2015			
Subject	2015 - boys	2015 - girls	Difference
Science	516	511	Not a significant difference
Maths	499	491	A significant difference
Reading	493	526	A significant difference

72. Initial findings indicate that there has been little change for Māori students since 2012 across the three subject areas (in 2015 science was 466, reading 465 and maths 452).
73. For Pasifika students the average score in maths moved from 431 in 2012 to 441 in 2015 and in science the average score moved from 439 in 2012 to 446 in 2015. While these changes are in the right direction they were not statistically significant.
74. Scores for Asian students declined in 2015 in reading and maths (from 525 in 2012 to 509 in reading, and 530 to 503 for maths). These changes are statistically significant.
75. In PISA, socio-economic status is measured through the PISA index of economic, social and cultural status (ESCS). Socio-economically advantaged students perform better than those who are disadvantaged. This is consistent across all measures and across all participating countries.
76. There are two different key measures in PISA that look at equity in education outcomes for individual students: the strength of the relationship between performance and socio-economic status, and the size of performance differences across socio-economic groups.
77. New Zealand appears to be reasonably equitable on the first of these measures, and this has improved in this cycle of the study relative to previous cycles. In 2012, 18% of the variation in New Zealand's science achievement could be explained by the socio-economic background of New Zealand students. In 2015, this had reduced to 13%, which is equal to the OECD average. This suggests that New Zealand is more equitable in 2015 than it was in 2012.

78. On the other hand, the second measure of equity suggests that New Zealand has larger gaps between the highest and lowest performers than many other countries. On average across OECD countries, a one unit increase in ESCS is associated with a 38 score point achievement increase in the average science score which is similar across reading and maths. For New Zealand, a one-unit increase in ESCS is associated with a 49 score point increase in science achievement. This inequitable relationship is similar across all three subjects. This means that there is a wider difference between the average score for low SES students and high SES students in New Zealand than for the same groups across the OECD.

79. What these data show is that the achievement gaps between the most and least wealthy students are larger in New Zealand than elsewhere, but that we also have a system that allows disadvantaged students to achieve well (and for wealthy students to fall behind). The OECD notes that in circumstances like this, it is not advised to target students based on their socio-economic status because extra support would be given to students who are already performing relatively well. Instead, the OECD suggests that resource allocation is better targeted based on level of achievement, which is the direction the funding review is taking.

#### **Science**

80. Science was the main domain in PISA 2015. This means that more test questions were devoted to science and more questionnaire information was collected about the context for science learning.

81. In PISA 2015 the average scientific literacy score of New Zealand students (513 points) was higher than the OECD average (493 points). This is significantly below nine other countries (see Appendix 3). Seven other countries had similar scores to New Zealand.

82. While there was little change in New Zealand's science score between 2012 and 2015 (516 cf. 513 points), there has been a significant decline since 2006 (from 530). The majority of that decline was between 2009 and 2012. New Zealand is one of 28 countries where there has been a downward trend in science scores in each of the last three cycles.

83. From 2012 to 2015 the OECD average science score decreased from 501 to 493 because several OECD countries had a decrease in their average score. As a result, compared to PISA 2012, New Zealand's relative ranking has improved (from 18<sup>th</sup> to 12<sup>th</sup>).

84. In 2015, the proportion of New Zealand students performing below level 2 (17%) is smaller than the OECD average (21%). These students did not achieve the basic science assessment questions in PISA.

85. New Zealand had a slightly larger proportion of top performing students in science at level 5 or above (13%) compared to the OECD average (8%). Only Singapore (6%) had more students performing at level 6 than New Zealand (3%).

86. New Zealand students achieved higher on all scientific competencies than the OECD averages. Our students' relative strength was in our ability to 'evaluate and design scientific enquiry' (517 points). Our students were weaker in their ability to 'interpret data and evidence scientifically' (512 points) and 'explain phenomena scientifically' (511 points). This pattern is similar to Singapore.



87. New Zealand students performed equally well on tasks related to physical systems (515 points), earth and space (513 points) and living systems (512 points).
88. In terms of students' attitudes and beliefs about science, New Zealand 15-year-olds held stronger positive epistemic beliefs<sup>7</sup> about science than the OECD average but they were at a similar level to other English-speaking countries. More positive epistemic beliefs are correlated with higher achievement.
89. PISA 2015 looked at student motivation around science, both intrinsic (based around enjoyment of science) and instrumental (students view of the usefulness of the subject for future plans).
90. New Zealand students were generally more positive in their enjoyment of learning science than the OECD average. There has been an increase in the proportion of our students agreeing with the 'enjoyment' statements since PISA 2006. Whereas most of the percentages have stayed similar on average across the OECD. In contrast to TIMSS, PISA finds that students with high levels of enjoyment have higher achievement than those with low levels of enjoyment.
91. New Zealand students had higher levels of interest in broad science topics than the OECD average and this was lower than only two of the high achieving countries (Canada and Singapore). Those who had higher levels of interest in the examined science topics had higher achievement than those with low levels of interest.
92. Most of the English speaking countries in PISA, including New Zealand, had significantly higher levels of instrumental motivation than the OECD average. Those students with the highest level of instrumental motivation had higher achievement on average than those with the lowest level.
93. PISA measured students' belief in their competency to perform science related tasks. This was one of the few indices examined in the national science report where New Zealand was lower than the OECD average, as well as lower than the other English-speaking countries. Students in the lowest quarter of this index tended to have lower achievement than those in the highest.
94. Almost half of New Zealand students were in schools that offered a science club and 83% were in schools that offered science competitions. These rates were higher than the OECD average. Across the OECD, the socio-economic status of the school was correlated with these two activities. Schools with higher ESCS were more likely to provide these activities.
95. New Zealand students were less likely to be involved in science-related activities outside of the classroom than other OECD countries. Those who did these activities with moderation had the highest level of achievement.
96. The proportion of New Zealand students who expected to have a science-related career at age 30 was similar to students across the OECD (25% and 24% respectively). This rate has not significantly changed for New Zealand since PISA 2006.

<sup>7</sup> Epistemic beliefs in PISA are described as the nature of knowledge in science and about the validity and value of scientific methods of enquiry as source of knowing.

97. Boys reported higher levels of interest in science topics than girls. They also reported higher levels of self-efficacy and participation in science-related activities. There were no significant differences on the other attitudinal measures. A higher proportion of girls expected to work in a science-related field than boys, mostly because a higher proportion of girls expected to work as health professionals. Where boys did think they would work in a science-related professional it was mainly in direct science, engineering or ICT. This was a similar pattern across the OECD.
98. Māori students had less positive attitudes, motivation, and engagement with science than non-Māori students, whereas Asian students were more positive than non-Asian students. Pākehā/European students had higher levels of epistemic beliefs and self-efficacy than other groups. However they reported lower levels of enjoyment, instrumental motivation, and participated less in science-related activities than non-Pākehā/European students. Pasifika students reported lower levels of epistemic beliefs and self-efficacy than non-Pasifika students.

### **Reading**

99. New Zealand students' average score for reading literacy in PISA 2015 (509 points) was higher than the OECD average (493 points) and similar to Norway and Germany as well as our own 2012 score (512). It is lower than the 2000 reading score of 529. Most of the decline occurred between 2009 and 2012.
100. The proportion of New Zealand students performing below level 2 (17%) was less than the OECD average (20%). In 2000, just under 14% of students in New Zealand had reading skills at this level. Students who perform below level 2 are not able to perform the basics required in the PISA test. Our proportion of low achievers was similar to Germany and the Netherlands, countries with similar average scores, but also similar to countries such as Spain, Portugal and Chinese Taipei which have lower average scores than New Zealand.
101. In terms of high performers in reading, the 2015 results showed that 14% of students reached level 5 or above. Only Singapore had a larger proportion of students reading at this level (18%). While this shows that New Zealand has a high proportion of advanced readers, the proportion in this category has declined since 2000 (from 19% to 14%). In terms of students reaching the advanced level 6 in 2015, New Zealand's proportion of 3% was similar to Singapore (4%).

### **Mathematics**

102. In PISA 2015, New Zealand students performed above the OECD average (495 points and 490 points, respectively). New Zealand had similar scores to 10 other countries including Australia and the United Kingdom.
103. However, between 2003 and 2015, New Zealand's 15-year-olds' average mathematics literacy score has declined significantly (from 523 to 495 points). During the same period Finland also had a significant drop (33 points) as did Australia (30 points). For New Zealand, most of this decline occurred between 2009 and 2012. There was no significant change in New Zealand scores between PISA 2012 and PISA 2015 (500 to 495 points, respectively). During the same time the OECD average went from 494 to 490 points.

104. There has been a small but significant drop in the proportion of top performers in maths (from 15% in 2012 to 11% in 2015). The 2015 proportion was the same as the OECD average. The proportion of New Zealand students achieving this level has declined from 21% in 2003. The proportion of students who attained level 6 and are able to do complex mathematical tasks is also lower in 2015 (3%) than in 2003 (7%).

### **Teachers, Teaching and Resources**

105. New Zealand had a much higher rate of computers available in schools than the OECD average (1.12 per student cf. .77 per student, respectively) and 99% of these are connected to the internet (OECD average 96%). Unlike other OECD areas, in New Zealand this access did not vary across SES, public and private schools, or school location.
106. In terms of the science teaching workforce (as reported by principals), New Zealand had a higher level of fully certified teachers who also have a degree-level qualification with a major in science compared to the OECD average. New Zealand also had one of the highest proportions of professional development programme attendance across the OECD and above average rates of in-house professional development. In New Zealand 78% of all teachers of students in the PISA study had some form of PD in the three months prior to the assessment of PISA 2015.
107. Teacher qualifications were uncorrelated with student achievement after accounting for socio-economic profiles of the students and schools. Professional development was also uncorrelated with student achievement. In PISA, school size, PD for any teacher and science teachers specifically, large class sizes and the student teacher ratio did not have significant relationships with science achievement once SES profiles are accounted for.
108. Students reported how often teachers used particular teaching practices in the science classroom. New Zealand had higher rates than the OECD average, of students in schools where the teachers used:
- teacher-directed science instruction
  - perceived feedback from science teachers
  - adaptive instruction in science lessons
  - enquiry based science.
109. Higher rates of teacher-directed instruction methods and adaptive instruction in science lessons were associated with higher achievement, whereas higher rates of perceived feedback from science teachers and enquiry-based science instruction were associated with lower achievement. This seems counter-intuitive given that John Hattie's work has shown a strong positive relationship between feedback and student achievement. It is possible that the patterns observed here reflect reverse causation – that is, students who are most in need of help may be receiving the most effective pedagogical response.
110. New Zealand was noted as being one of the top three PISA participating countries in terms of the amount of responsibility for the curriculum held by teachers (71%, as reported by principals). We also stand out as among the top five participating countries with high level of responsibility held by principals for establishing student assessment.

### Next steps

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111. We have previously sent you a report with options to lift the quality of teaching and learning in mathematics, statistics and Pāngarau [METIS 1014654 refers] and provided you information on interventions related to mathematics in New Zealand.
112. Over the coming weeks we will work to ensure that key external stakeholders are briefed on the results. We have outlined our proposed approach in the attached communications approach. We propose to identify opinion leaders who may wish to provide context for subsequent media reporting.
113. We will keep your office apprised of our progress in conducting these briefings and the interest of these stakeholders in proactively speaking with the media after the results are published.,
114. We will be providing your office with an advance copy of the reports, flyers and fact sheets for the TIMSS New Zealand results on Thursday 24 November and the PISA New Zealand results Thursday 1 December.
115. We will also be providing your office with a proposed communications approach for the PISA results and a draft media release Thursday 1 December.

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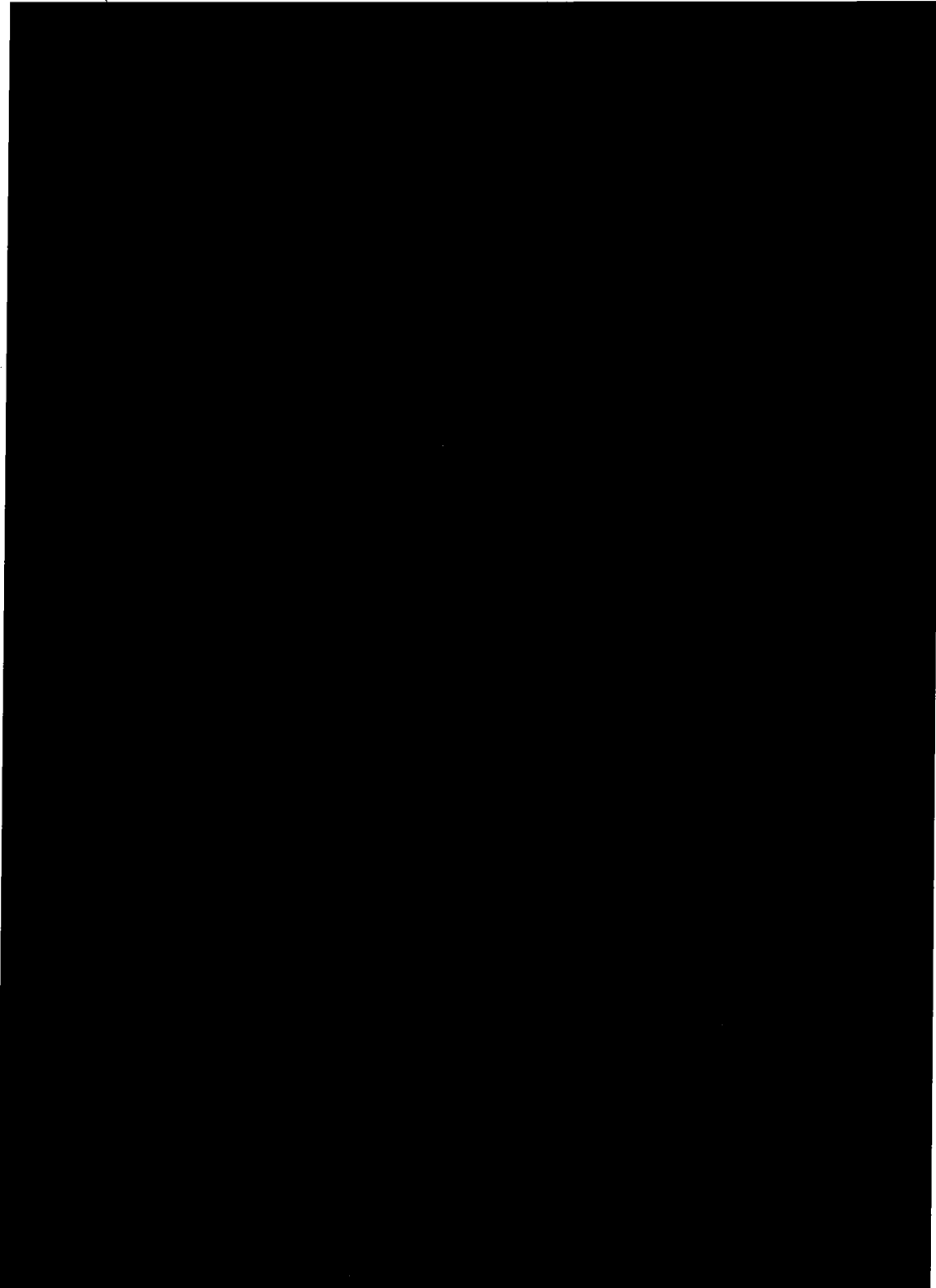
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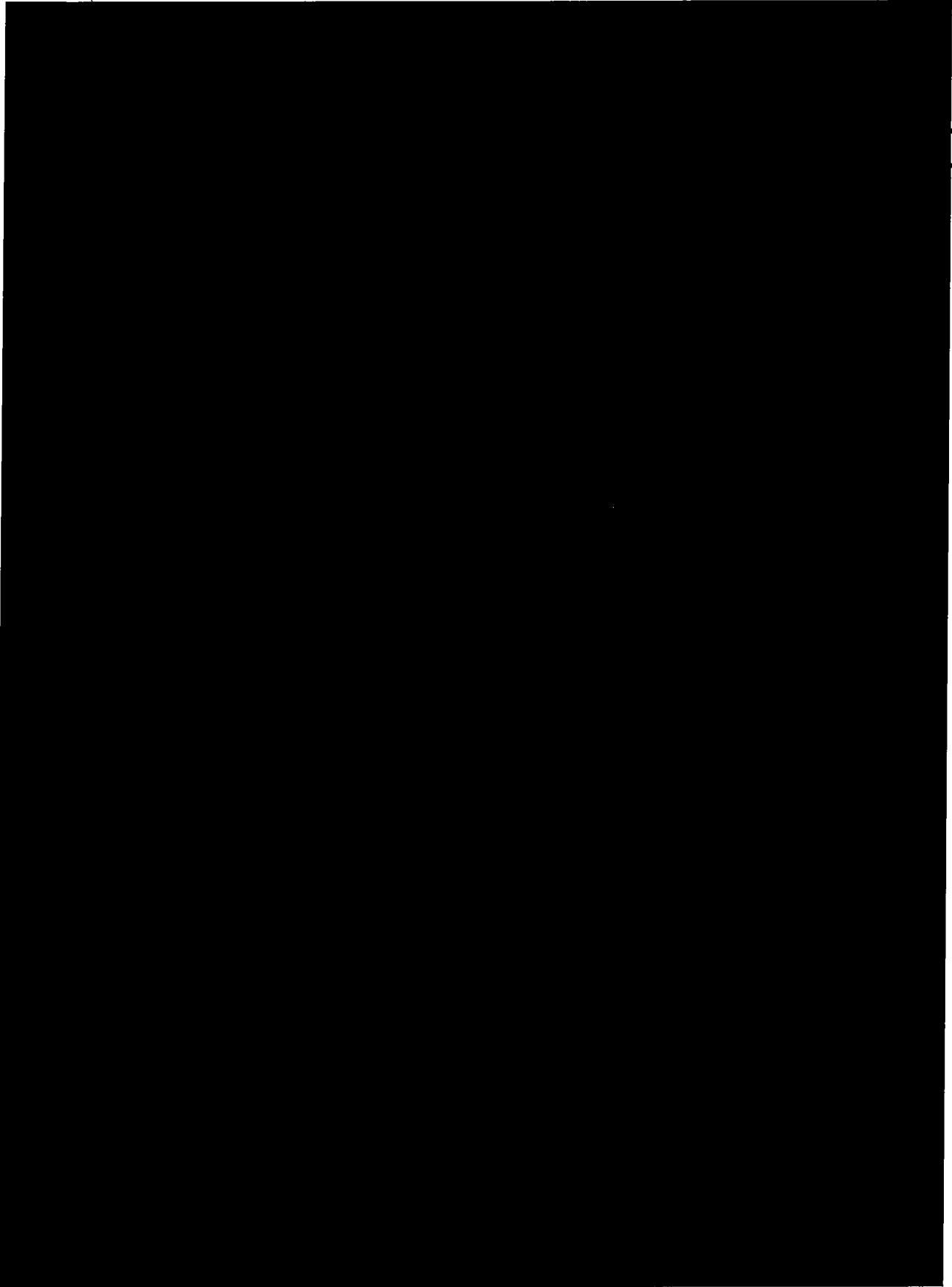
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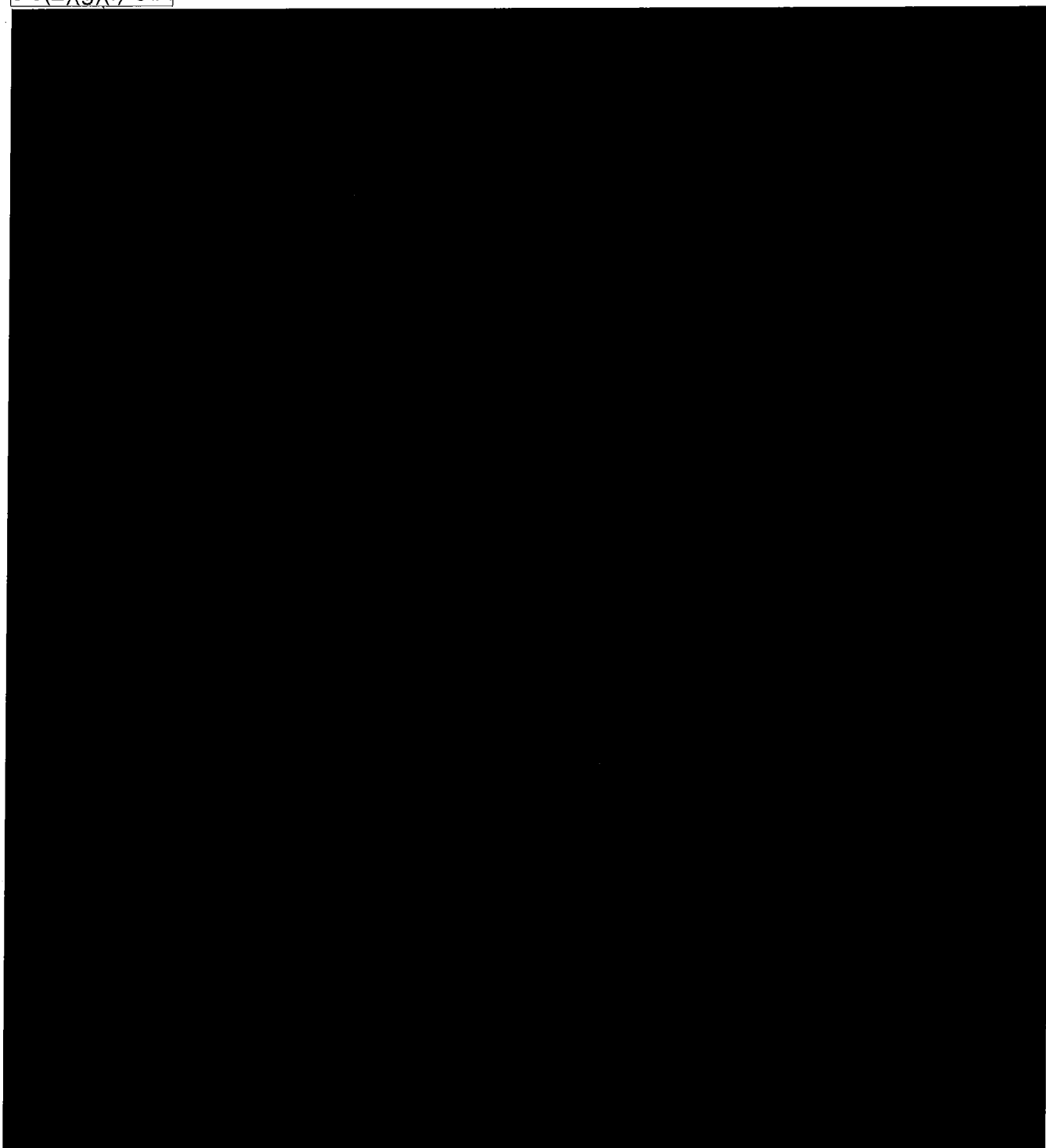
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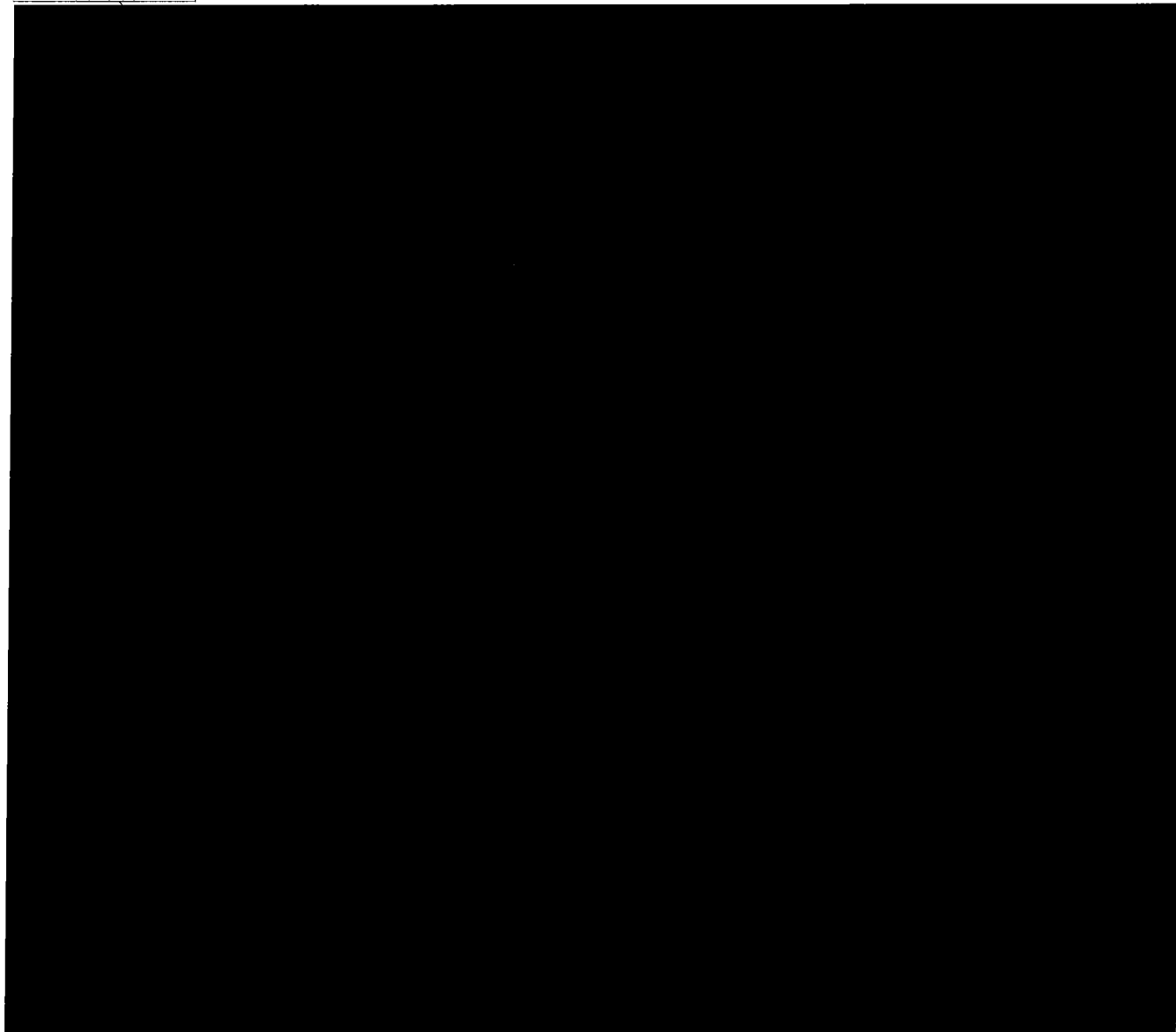
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## Appendix 2

### TIMSS 2015 Maths

#### Year 5 maths

Malta	511	(2.9)
France	508	(2.9)
Turkey	507	(3.1)
Georgia	463	(3.6)
Chile	459	(2.4)
United Arab Emirates	452	(2.4)
Bahrain	451	(1.6)
Qatar	439	(3.4)
Iran, Islamic Rep. of	431	(3.2)
Oman	425	(2.5)
Indonesia	397	(3.7)
Yemen	388	(3.1)
Saudi Arabia	383	(4.1)
Morocco	377	(3.4)
South Africa	376	(3.5)
Kuwait	353	(4.6)

#### Year 5 maths

Malta	511	(2.9)
France	508	(2.9)
Turkey	507	(3.1)
Georgia	463	(3.6)
Chile	459	(2.4)
United Arab Emirates	452	(2.4)
Bahrain	451	(1.6)
Qatar	439	(3.4)
Iran, Islamic Rep. of	431	(3.2)
Oman	425	(2.5)
Indonesia	397	(3.7)
Yemen	388	(3.1)
Saudi Arabia	383	(4.1)
Morocco	377	(3.4)
South Africa	376	(3.5)
Kuwait	353	(4.6)

#### Year 9 maths

Malta	511	(2.9)
France	508	(2.9)
Turkey	507	(3.1)
Georgia	463	(3.6)
Chile	459	(2.4)
United Arab Emirates	452	(2.4)
Bahrain	451	(1.6)
Qatar	439	(3.4)
Iran, Islamic Rep. of	431	(3.2)
Oman	425	(2.5)
Indonesia	397	(3.7)
Yemen	388	(3.1)
Saudi Arabia	383	(4.1)
Morocco	377	(3.4)
South Africa	376	(3.5)
Kuwait	353	(4.6)

#### Year 9 maths

Malta	494	(1.0)
New Zealand	493	(3.4)
Malaysia	465	(3.6)
United Arab Emirates	465	(2.0)
Turkey	458	(4.7)
Bahrain	454	(1.4)
Georgia	453	(3.4)
Lebanon	442	(3.6)
Qatar	437	(3.0)
Iran, Islamic Rep. of	436	(4.6)
Thailand	431	(4.8)
Chile	427	(3.2)
Oman	403	(2.4)
Kuwait	392	(4.6)
Egypt	392	(4.1)
Botswana	391	(2.0)
Jordan	386	(3.2)
Morocco	384	(2.3)
South Africa	372	(4.5)
Saudi Arabia	368	(4.6)

## TIMSS 2015 Science

Year 5 science		
Singapore	590	(3.7)
Korea, Rep. of	589	(2.0)
Japan	569	(1.8)
Russian Federation	567	(3.2)
Hong Kong SAR	567	(2.9)
Chinese Taipei	555	(4.8)
Finland	554	(2.3)
Kazakhstan	550	(4.4)
Poland	547	(2.4)
United States	546	(2.2)
Slovenia	543	(2.4)
Hungary	542	(3.3)
Sweden	540	(3.6)
Norway	538	(2.6)
England	536	(2.4)
Bulgaria	536	(5.9)
Czech Republic	534	(2.4)
Croatia	533	(2.1)
Ireland	529	(2.4)
Germany	528	(2.4)
Lithuania	528	(2.5)
Denmark	527	(2.1)
Canada	525	(2.6)
Serbia	525	(3.7)

Year 5 science		
Australia	524	(2.9)
Slovak Republic	520	(2.6)
Northern Ireland	520	(2.2)
Spain	518	(2.6)
Netherlands	517	(2.7)
Italy	516	(2.6)
Belgium (Flemish)	512	(2.3)
Portugal	508	(2.2)
New Zealand	506	(2.7)
<b>TIMSS Scale Centrepoint</b>	500	(0.0)
France	487	(3.7)
Turkey	487	(4.3)
Cyprus	481	(2.6)
Chile	478	(2.7)
Bahrain	469	(2.6)
Georgia	451	(3.7)
United Arab Emirates	451	(2.8)
Qatar	436	(4.1)
Oman	431	(3.1)
Iran, Islamic Rep.	421	(4.0)
Indonesia	397	(4.8)
Saudi Arabia	390	(4.9)
Morocco	352	(4.7)
Kuwait	337	(6.2)

Year 9 science		
Singapore	597	(3.2)
Japan	571	(1.8)
Chinese Taipei	569	(2.4)
Korea, Rep. of	556	(2.7)
Slovenia	551	(2.4)
Hong Kong SAR	546	(3.9)
Russian Federation	544	(4.2)
England	537	(3.8)
Kazakhstan	533	(4.4)
Ireland	530	(2.8)
United States	530	(2.8)
Hungary	527	(3.4)
Canada	526	(2.2)
Sweden	522	(3.4)
Lithuania	519	(2.8)
New Zealand	513	(3.1)
Australia	512	(2.7)
Norway	509	(2.8)
Israel	507	(3.9)
<b>TIMSS Scale Centerpoint</b>	500	(0.0)

Year 9 science		
Italy	499	(2.4)
Turkey	493	(4.0)
Malta	481	(1.6)
United Arab Emirates	477	(2.3)
Malaysia	471	(4.1)
Bahrain	466	(2.2)
Qatar	457	(3.0)
Iran, Islamic Rep. of	456	(4.0)
Thailand	456	(4.2)
Oman	455	(2.7)
Chile	454	(3.1)
Georgia	443	(3.1)
Jordan	426	(3.4)
Kuwait	411	(5.2)
Lebanon	398	(5.3)
Saudi Arabia	396	(4.5)
Morocco	393	(2.5)
Botswana	392	(2.7)
Egypt	371	(4.3)
South Africa	358	(5.6)

## Appendix 3

### PISA 2015 Science

PISA Science		
*Singapore	556	(1.2)
Japan	538	(3.0)
Estonia	534	(2.1)
*Chinese Taipei	532	(2.7)
Finland	531	(2.4)
*Macao (China)	529	(3.1)
Canada	528	(2.1)
*Viet Nam	525	(3.9)
*Hong Kong (China)	523	(2.5)
**B-S-J-G (China)	518	(4.6)
Korea	516	(3.1)
<b>New Zealand</b>	513	(2.4)
Slovenia	513	(1.3)
Australia	510	(1.5)
United Kingdom	509	(2.6)
Germany	509	(2.7)
Netherlands	509	(2.3)
Switzerland	506	(2.9)
Ireland	503	(2.4)
Belgium	502	(2.3)
Denmark	502	(2.4)
Poland	501	(2.5)
Portugal	501	(2.4)
Norway	498	(2.3)
United States	496	(3.1)
Austria	495	(2.1)
France	495	(2.1)
Sweden	493	(3.6)
<b>OECD Average</b>	493	(0.4)
Czech Republic	493	(2.3)
Spain	493	(2.1)
Latvia	490	(1.6)
*Russian Federation	487	(2.9)
Luxembourg	483	(1.1)
Italy	481	(2.5)
Hungary	477	(2.4)

PISA Science		
*Lithuania	475	(2.7)
*Croatia	475	(2.5)
*Buenos Aires (Argentina)	475	(6.3)
Iceland	473	(1.7)
Israel	467	(3.4)
*Malta	465	(1.6)
Slovak Republic	461	(2.8)
Greece	455	(3.9)
Chile	447	(2.4)
*Bulgaria	446	(4.4)
*United Arab Emirates	437	(2.4)
*Uruguay	435	(2.2)
*Romania	435	(3.2)
*Cyprus	433	(1.4)
*Moldova	428	(2.0)
*Albania	427	(3.3)
Turkey	425	(3.9)
*Trinidad and Tobago	425	(1.4)
*Thailand	421	(2.8)
Costa Rica	420	(2.1)
*Qatar	418	(1.0)
*Colombia	416	(2.4)
Mexico	416	(2.1)
*Montenegro	411	(1.0)
*Georgia	411	(2.4)
*Jordan	409	(2.7)
*Indonesia	403	(2.6)
*Brazil	401	(2.3)
*Peru	397	(2.4)
*Lebanon	386	(3.4)
*Tunisia	386	(2.1)
***FYR Macedonia	384	(1.2)
*Kosovo	378	(1.7)
*Algeria	376	(2.6)
*Dominican Republic	332	(2.6)

\* non-OECD countries and economies

B-S-J-G (China) refers to the four PISA participating China provinces:

Beijing, Shanghai, Jiangsu, Guangdong.

\*\*\* FYR Macedonia refers to Former Yugoslav Republic Macedonia

Country average significantly higher than New Zealand

Country average significantly lower than New Zealand

# PISA Reading

PISA Reading		
*Singapore	635	(1.6)
*Hong Kong (China)	527	(2.7)
Canada	527	(2.3)
Finland	526	(2.5)
Ireland	521	(2.5)
Estonia	519	(2.2)
Korea	517	(3.5)
Japan	516	(3.2)
Norway	513	(2.5)
<b>New Zealand</b>	509	(2.4)
Germany	509	(3.0)
*Macao (China)	509	(1.3)
Poland	506	(2.5)
Slovenia	505	(1.5)
Netherlands	503	(2.4)
Australia	503	(1.7)
Sweden	500	(3.5)
Denmark	500	(2.5)
France	499	(2.5)
Belgium	499	(2.4)
Portugal	498	(2.7)
United Kingdom	498	(2.8)
*Chinese Taipei	497	(2.5)
United States	497	(3.4)
Spain	496	(2.4)
*Russian Federation	495	(3.1)
**B-S-J-G (China)	494	(5.0)
<b>OECD Average</b>	493	(0.0)
Switzerland	492	(3.0)
Latvia	488	(1.8)
Czech Republic	487	(2.6)
*Croatia	487	(2.7)
*Viet Nam	487	(3.7)
Austria	485	(2.8)
Italy	485	(2.7)
Iceland	482	(2.0)

PISA Reading		
Luxembourg	481	(1.4)
Israel	479	(3.8)
*Buenos Aires (Argentina)	475	(7.2)
*Lithuania	472	(2.7)
Hungary	470	(2.7)
Greece	467	(4.3)
Chile	459	(2.6)
Slovak Republic	453	(2.8)
*Malta	447	(1.8)
*Cyprus	445	(1.7)
*Uruguay	437	(2.5)
*Romania	434	(4.1)
*United Arab Emirates	434	(2.9)
*Bulgaria	432	(5.0)
Turkey	428	(4.0)
*Costa Rica	427	(2.6)
*Trinidad and Tobago	427	(1.5)
*Montenegro	427	(1.6)
*Colombia	425	(2.9)
Mexico	423	(2.6)
*Moldova	416	(2.5)
*Thailand	409	(3.3)
Jordan	408	(2.9)
*Brazil	407	(2.8)
*Albania	405	(4.1)
*Qatar	402	(1.0)
*Georgia	401	(3.0)
*Peru	398	(2.9)
*Indonesia	397	(2.9)
*Tunisia	361	(3.1)
*Dominican Republic	358	(3.1)
***FYR Macedonia	352	(1.4)
*Algeria	350	(3.0)
*Kosovo	347	(1.6)
*Lebanon	347	(4.4)

\* non-OECD countries and economies

\*\* B-S-J-G (China) refers to the four PISA participating China provinces:

Beijing, Shanghai, Jiangsu, Guangdong.

\*\*\* FYR Macedonia refers to Former Yugoslavian Republic Macedonia

Country average significantly higher than New Zealand

Country average significantly lower than New Zealand

# PISA Maths

PISA Maths		
*Singapore	564	(1.5)
*Hong Kong (China)	548	(3.0)
*Macao (China)	544	(1.1)
*Chinese Taipei	542	(3.0)
Japan	532	(3.0)
**B-S-J-G (China)	531	(4.9)
Korea	524	(3.7)
Switzerland	521	(2.9)
Estonia	520	(2.0)
Canada	516	(2.3)
Netherlands	512	(2.2)
Denmark	511	(2.2)
Finland	511	(2.3)
Slovenia	510	(1.3)
Belgium	507	(2.4)
Germany	506	(2.9)
Poland	504	(2.4)
Ireland	504	(2.1)
Norway	502	(2.2)
Austria	497	(2.9)
<b>New Zealand</b>	495	(2.3)
*Viet Nam	495	(4.5)
*Russian Federation	494	(3.1)
Sweden	494	(3.2)
Australia	494	(1.6)
France	493	(2.1)
United Kingdom	492	(2.5)
Czech Republic	492	(2.4)
Portugal	492	(2.5)
<b>OECD Average</b>	490	(0.4)
Italy	490	(2.8)
Iceland	488	(2.0)
Spain	486	(2.2)
Luxembourg	486	(1.3)
Latvia	482	(1.9)
*Malta	479	(1.7)
*Lithuania	478	(2.3)

PISA Maths		
Hungary	477	(2.5)
Slovak Republic	475	(2.7)
Israel	470	(3.6)
United States	470	(3.2)
*Croatia	464	(2.8)
*Buenos Aires (Argentina)	456	(6.9)
Greece	454	(3.8)
*Romania	444	(3.8)
*Bulgaria	441	(4.0)
*Cyprus	437	(3.7)
*United Arab Emirates	427	(4.1)
Chile	423	(2.5)
Turkey	419	(4.1)
*Moldova	418	(2.5)
*Uruguay	418	(2.5)
*Montenegro	418	(1.5)
*Trinidad and Tobago	417	(1.4)
*Thailand	415	(3.0)
*Albania	413	(3.4)
Mexico	408	(2.2)
*Georgia	404	(2.8)
*Qatar	402	(1.3)
*Costa Rica	400	(2.5)
*Lebanon	396	(3.7)
*Colombia	390	(2.3)
*Peru	387	(2.7)
*Indonesia	386	(3.1)
*Jordan	380	(2.7)
*Brazil	377	(2.9)
***FYR Macedonia	371	(1.3)
*Tunisia	367	(3.0)
*Kosovo	362	(1.6)
*Algeria	360	(3.0)
*Dominican Republic	328	(2.7)

\* non-OECD countries and economies

\*\* B-S-J-G (China) refers to the four PISA participating China provinces:  
Beijing, Shanghai, Jiangsu, Guangdong.

\*\*\* FYR Macedonia refers to Former Yugoslavian Republic Macedonia

Country average significantly higher than New Zealand

Country average significantly lower than New Zealand

## BRIEFING NOTE: PISA 2015 ethnicity data.

Date:	22 Decemeber 2016	Priority:	High
Security Level:	In confidence	METIS No:	1041580
Approved by:	Rochelle Barrows	DDI:	(04) 439 5406

This paper updates you on further analysis into PISA 2015 ethnicity data. This shows the drop in Asian students' achievement in the assessment was not as significant as initially reported due to a data error.

The Ministry released the New Zealand PISA 2015 results were released on the 6<sup>th</sup> December. Ethnicity is not included in the OECD international report. It was reported that average scores for Asian students had declined from 2012 (from 527 to 512 in science, 525 to 509 in reading, and 530 to 503 for maths).

Further analysis into that unexpected result has shown that a coding error during the data preparation phase of PISA 2015 meant 110 Tongan students were incorrectly included in the "Asian" ethnicity as well as the Pasifika grouping. The scores for these students were generally lower than those of Asian students.

The overall effect was to lower the average score of the Asian student sub-population. By removing the scores of those 110 students the Asian student sub-population scores rise. The scores of the Pasifika students are not affected.

As a result we can confirm that the 2015 Asian students' achievement scores are:

Subject	2012 average score	Previously reported 2015 average score	Amended 2015 average score
Science	527	512	525
Maths	530	503	515
Reading	525	509	521

The changes between 2012 and the amended 2015 scores are not statistically significant.

We have reviewed all other similar ethnicity achievement data coded through the same process and there are no errors in the reported results for any other ethnicity. We have reviewed all other analysis that incorporated the Asian ethnicity variable. There are very minor changes to four graph scales in the Science Context report, however no changes to the findings or reporting.

It appears a human error at the time of data cleaning was the cause of the error. As ethnicity data is specific to New Zealand it is not covered by OECD quality assurance. In the overall context of 100's of individual analyses it was small error and so not picked up through New Zealand quality assurance.

We intend to include additional checks for data coding to reduce any chance of this error happening in the future.

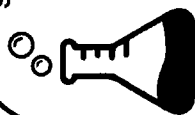


# TIMSS & PISA – key results

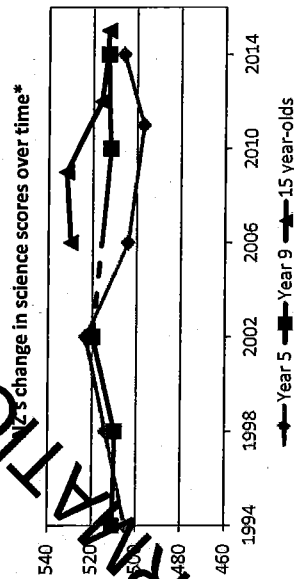
New Zealand results were stable across almost all subject areas & year levels.

## Science – Key results

- Our Y5 average science score has gone up & this is statistically significant.
- Our Y9 score appears to have gone up & our PISA score down, though these are not significant.
- YR5 & YR 9 students continue to have strength in earth & life / biology related science. For 15-year-old students, strengths were in physical systems & living systems.
- Y9 girls average score has increased back to 2002 levels, which was a statistically significant increase.
- In PISA there was little change in the NZ average score since 2012, however decreases for other countries means our relative standing improved.



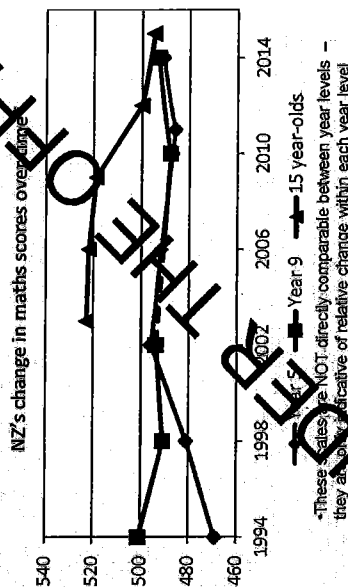
Science Assessment	Previous cycle	NZ's simple rank	Sig
TIMSS Y5	29/50	30/47	
TIMSS Y9	10/45	14/39	
PISA	18/65	12/70	
NZ's average score			
TIMSS Y5	497	506	
TIMSS Y9	512	513	
PISA	516	513	



\*These scales are NOT directly comparable between year levels – they are only indicative of relative change within each year level

↑ Indicates a statistically significant increase – indicates no significant change.

Maths Assessment	Previous cycle	NZ's simple rank	Sig
TIMSS Y5	29/50	33/49	
TIMSS Y9	12/45	17/39	
PISA	23/65	21/70	
NZ's average score			
TIMSS Y5	486	491	
TIMSS Y9	488	493	
PISA	500	495	



\*These scales are NOT directly comparable between year levels – they are only indicative of relative change within each year level

– Indicates no significant change.

## Maths – Key results



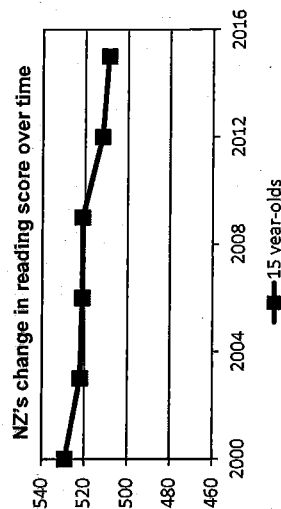
- Our average maths scores in Y5 & Y9 went up since last cycle & down in PISA, none of these changes were statistically significant.
- NZ Y5 & Y9 students did better in statistics related maths than number, geometry and algebra.
- Y9 girls average score has increased back to 2002 levels, which was a statistically significant increase.

## Reading – Key results



- Our reading score for 15-year-olds went down from 2012, though this is not statistically significant.
- While there has been no significant change from 2012 to 2015 there has been an increase in the proportion of students who had reading skills unlikely to support new learning over the longer term (14% in 2000 to 17% in 2015).
- Girls continue to score significantly higher than boys (526 to 493).

Reading Assessment	Previous cycle	NZ's simple rank	Sig
PISA	13/65	10/70	
NZ's average score			
PISA	512	509	



– Indicates no significant change.

# TIMSS & PISA – headline findings

New Zealand's results were stable across almost all subject areas & year levels.

## Socio-economic status

- At the Y5 & Y9 levels, NZ had one of the largest average score differences between students at schools considered low & high SES\*. The difference was larger than the international average.
- In PISA there are still large differences in student achievement due to SES.
- In TIMSS when socio-economic related variables are accounted for the gap in achievement between Māori & non-Māori and Pasifika & non-Pasifika narrows.

## Achievement of ethnicity groupings

- Across all year levels there was little change in average scores for Māori students. This was the same for Pasifika students in TIMSS though in PISA there was a slight but non-significant gain in their average maths & science scores.
- Māori & Pasifika students remain over represented in the lower achievement levels & under-represented at the higher levels across all year levels & subjects.



## Average achievement variation & benchmarks

- In PISA the proportion of NZ students achieving at the highest proficiency level in science & reading is still one of the largest among participating countries.
- However, the longer term trend shows a decline in the proportion of 15-year-olds at the higher PISA proficiency levels & an increase at the lower levels.
- Our Y5 & Y9 students to do better in reading higher benchmarks in science than maths.
- In science and maths, more NZ students reached the intermediate & higher benchmark than in the previous cycles.
- Compared with other countries NZ had a relatively wide spread between scores at the top & bottom levels of achievement for all subjects & year levels.
- For Y5 & Y9 students this difference widened over the last cycle. In PISA the NZ variance is larger than the OECD average.



## Teachers & teaching

- NZ Y5 teachers used same ability grouping more often than other countries in maths & whole class teaching less often. In contrast in science they used mixed ability grouping more often than same ability grouping.
- In PISA science teachers used teacher-based learning, adaptive & enquiry based science instruction more frequently than the OECD average. They also supplied feedback to students more often, however only teacher based & adaptive instruction had positive associations with science achievement.
- Compared with other countries fewer NZ Y5 teachers in the TIMSS study had specialised in maths or science in their initial teacher training. This was the same for Y9 teachers & maths. In contrast most Y9 science teachers had a science specialisation, were confident in their ability & felt well-prepared to teach the subject.
- Results indicated little association between teacher PD & student achievement.

## School climate / resources

- 90% of Y5 students reported they felt positive about school, teachers & classmates.
- 60% of Y5 students reported they had experienced bullying behaviour monthly or more<sup>^</sup>. This was one of the highest across participating countries. At Y9 45% of NZ students reported the same, this is still relatively high.
- NZ Y5 students had the highest level of computer access of all countries in TIMSS.
- In contrast Principals in TIMSS a commonly reported lack of technologically competent staff. As an issue, Teachers reported a lack of technological resources & a lack of support for technology as an issue impacting teaching.

## Funding

- NZ achieves higher in science than predicted by per capita GDP and spending on education according to PISA measures.
- NZ spending on education is similar to other TIMSS countries.
- For most of the OECD countries in PISA, factors other than the level of investment in education are better predictors of student performance.

<sup>^</sup> TIMSS gathers a wide range of different behaviours to categorise "bullying behaviour"

\* PISA & TIMSS provide benchmark levels which indicate relative levels of skills & abilities. In PISA they are "proficiency levels" and in TIMSS they are "benchmarks".