NATIONAL EDUCATION MONITORING PROJECT

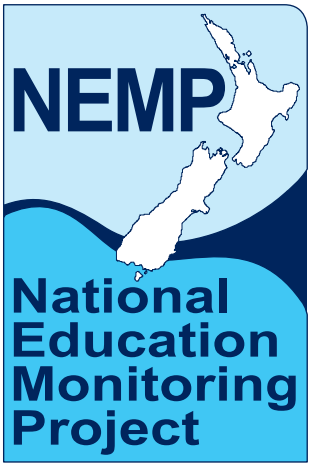
Mathematics

Assessment Results 2009

Terry Crooks, Jeffrey Smith, Lester Flockton
Educational Assessment Research Unit

MATHEMATICS ASSESSMENT RESULTS 2009

NEMP Report 52



NEW ZEALAND

Mathematics

Assessment Results

2009

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NATIONAL EDUCATION MONITORING REPORT 52

MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

NEMP REPORTS

CYCLE 1

1995	1	Science
	2	Art
	3	Graphs, Tables and Maps
1996	4	Music
	5	Aspects of Technology
	6	Reading and Speaking
1997	7	Information Skills
	8	Social Studies
	9	Mathematics
1998	10	Listening and Viewing
	11	Health and Physical Education
	12	Writing

CYCLE 2

1999	13	Science
	14	Art
	15	Graphs, Tables and Maps
	16	Māori Students' Results
2000	17	Music
	18	Aspects of Technology
	19	Reading and Speaking
	20	Māori Students' Results
2001	21	Information Skills
	22	Social Studies
	23	Mathematics
	24	Māori Students' Results
2002	25	Listening and Viewing
	26	Health and Physical Education
	27	Writing
	28	Māori Students' Results

CYCLE 3

2003	29	Science
	30	Visual Arts
	31	Graphs, Tables and Maps
	42	Māori Medium Students' Results
2004	32	Music
	33	Aspects of Technology
	34	Reading and Speaking
	43	Māori Medium Students' Results
2005	35	Information Skills
	36	Social Studies
	37	Mathematics
	38	Māori Medium Students' Results
2006	39	Listening and Viewing
	40	Health and Physical Education
	41	Writing

CYCLE 4

2007	44	Science
	45	Visual Arts
	46	Graphs, Tables and Maps
2008	47	Music
	48	Aspects of Technology
	49	Reading and Speaking
2009	50	Information Skills for Inquiry Learning
	51	Social Studies
	52	Mathematics

Note that reports are published the year after the research is undertaken.

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Contents

2 Acknowledgements
3 Summary
5 Chapter 1 : The National Education Monitoring Project
8 Chapter 2 : Assessing Mathematics
11 Reading the Tasks and Results

12 Chapter 3 : Number and Algebra

trend:

13 Jumpers ('97)
14 Number Facts (Multiplication) ('01/'05)
15 Number Facts (Addition) ('01/'05)
16 Quick Way
17 Chocolate Fractions
18 Division Facts
19 Sprint Times
20 Sheep
21 Subtraction Facts
22 Population Change
23 Raffle Tickets
24 What Next?
25 Time Machine
26 Muffin Mix (Y4 & Y8)
27 Fractious Fractions (Y4)
28 Work It Out (Y4)
28 Addition (Y4)
29 Multiplication (Y4)
29 Consecutive Numbers
30 Fractious Fractions (Y8)
31 Work It Out (Y8)
31 Which is Bigger?
32 Bridge
33 Tryathlon
34 Addition (Y8)
35 Pointless
36 Multiplication (Y8)

released:

37 Number Line Places
38 Fraction Problems
39 Less Than

links:

40 Link Tasks 1–8
41 Link Tasks 9–18
42 Link Tasks 19–26

43 Chapter 4 : Measurement

trend:

44 Posting Parcels
45 Jars and Marbles
46 Jelly
47 How Much Could It Hold?
48 Which Unit?
49 Toyota Camry
50 Shopping List (Y4 & Y8)
51 Playing With Perimeter
52 Measuring Up
53 Hot and Cold
53 Wall Paint

released:

54 Estimates
56 On Sale

links:

57 Link Tasks 27–38

58 Chapter 5 : Geometry

trend:

59 Spotlight
60 Cheeses
61 Point of View
62 Mirror Image
63 Shape Lines ('97)
64 Sketching Nets
65 Pyramid
65 Bigger

links:

66 Link Tasks 39–43

67 Chapter 6 : Statistics

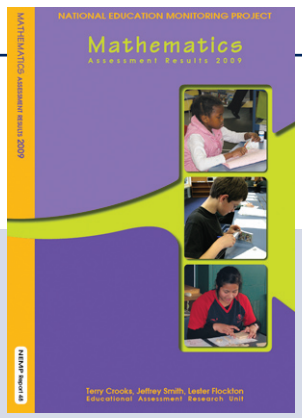
trend:

68 Travelling to School
69 Counting Cars
70 Tossing a Die
71 Black Jelly Beans

links:

72 Link Tasks 44–45

73 Chapter 7 : Mathematics Survey
76 Chapter 8 : Performance of Subgroups
80 Appendix : The Sample of Schools and Students in 2009



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- members of the Project's Mathematics Advisory Panel
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- principals, staff and Board of Trustee members of the 228 schools included in the 2009 sample
- the 2638 children in the samples for the assessments, and their parents
- the 88 teachers who administered the assessments to the children
- the 44 senior tertiary students who assisted with the marking process
- the 160 teachers who assisted with the marking of tasks early in 2010
- the people and organisations who granted permission for the publication of their work in this report, to illustrate our assessment resources (acknowledged in full below).

Resource Acknowledgements

pg	task	resource	reference
20	**Sheep**	Photo	Potten, C. (2001). *Above New Zealand*. Nelson, N.Z.: Craig Potten Publishing.
54	**Estimates**	Books	Bourke, A. & Rendell, J. (2009). *Christian The Lion*, London.: Red Fox, Random House.

Summary

Overview: This report addresses student knowledge, strategies and skills in four areas of mathematics: number, measurement, geometry and statistics. More than half of the assessment tasks were number tasks. Year 8 students, on average, performed at a substantially higher level than year 4 students, but on most tasks there was a substantial overlap in performance. Mathematics is a popular subject, second in popularity among year 4 subjects and third among year 8 subjects.

Performance in mathematics did not improve overall between 2005 and 2009, although there were marked differences from this pattern on some individual tasks. Taking a longer term view, there is evidence of a small improvement for year 4 students from 1997 to 2009, although this has been constrained by a drop in performance on tasks requiring quick recall or derivation of number facts. Over the same 12-year period there has been no meaningful performance change overall for year 8 students.

On average, year 4 boys perform a little better than girls, with no meaningful difference for year 8 boys and girls. At both year levels, Pakeha students averaged moderately to strongly higher than Māori students and strongly higher than Pasifika students, but there were exceptions on some tasks (for instance, Pasifika students performed similarly to Pakeha students on most addition tasks). There always was a substantial overlap in performance, with students of all ethnicities among the high and low performers on each task. Over the last 12 years there has been no clear downwards or upwards trend in performance differences among the ethnic subgroups, nor in the high proportion of mathematics tasks showing performance differences by school decile rating.

New Zealand's National Education Monitoring Project commenced in 1993, with the task of assessing and reporting on the achievement of New Zealand primary school children in all areas of the school curriculum. Children are assessed at two class levels: year 4 (halfway through primary education) and year 8 (at the end of primary education). Different curriculum areas and skills are assessed each year, over a four-year cycle. The main goal of national monitoring is to provide detailed information about what children know, think and can do, so that patterns of performance can be recognised, successes celebrated, and desirable changes to educational practices and resources identified and implemented.

Each year, random samples of children are selected nationally, then assessed in their own schools by teachers specially seconded and trained for this work. Task instructions are given orally by teachers, through video presentations, on laptop computers, or in writing. Many of the assessment tasks involve the children in the use of equipment and materials. Their responses are presented orally, by demonstration, in writing, in computer files, or through submission of other physical products. Many of the responses are recorded on videotape for subsequent analysis.

ASSESSING MATHEMATICS

In 2009, the third year of the fourth cycle of national monitoring, three areas were assessed: mathematics, social studies, and information skills. This report presents details of the mathematics assessments.

The use of many tasks with both year 4 and year 8 students allows comparisons of the performance of year 4 and 8 students in 2009. Because about 45% of the tasks have been used twice, in both 2005 and 2009, trends in performance across that four-year period can also be analysed. Four tasks allow direct consideration of longer-term trends: two with data from 1997 and 2009, and two with data from 2001 as well as from 2005 and 2009.

Chapter 2 explains the place of mathematics in the New Zealand curriculum and presents the mathematics framework. It identifies four areas of content (number and algebra, measurement, geometry, and statistics) linked to eight processes. The importance of attitudes and motivation is also highlighted.

NUMBER AND ALGEBRA

Chapter 3 presents the students' results on 56 number and algebra tasks. There was strong progress from year 4 to year 8. Averaged across 217 task components administered to year 4 and year 8 students in 2009, 30% more year 8 than year 4 students succeeded with these components.

Overall, performance at both year levels was unchanged between 2005 and 2009. Averaged across 137 task components attempted by year 4 students in both years, the same percentage of students succeeded in 2009 as in 2005. At year 8 level also, on average, across 172 task components, the same percentage succeeded in 2009 as in 2005. The most notable change in performance was a decline for year 8 students on multiplication problems (p36), where changes in computation strategy were clearly evident.

Three tasks allowed study of trends over periods longer than four years. One involved number patterns and sequences, with substantial improvement from 1997 to 2009 for year 4 students and smaller improvement for year 8 students. Two tasks involving knowledge of addition and multiplication facts had been used in the 2001 and 2005 assessments, when they showed substantial losses for year 4 students in both areas and a small loss for year 8 students on multiplication facts. There was negligible further change on these tasks between 2005 and 2009.

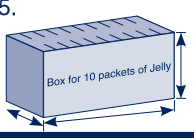
Students at both levels scored poorly in tasks involving estimation and tasks involving fractions (especially fractions other than halves and quarters). There was clear evidence that students have adopted changes in number strategy taught in recent years. This appears to have been advantageous in responses to some tasks and disadvantageous in responses to other tasks.

MEASUREMENT

Chapter 4 presents the results for 25 measurement tasks. There was strong progress from year 4 to year 8. Averaged across 95 task components administered to both year 4 and year 8 students, 28% more year 8 than year 4 students succeeded with these components.

Overall, there was no evidence of change between 2005 and 2009 for year 4 students, but a slight reduction in the performance of year 8 students. Averaged across 34 trend task components attempted by year 4 students in both years, the same percentage succeeded in 2009 as in 2005. At year 8 level, on average across 59 task components, 2.5% fewer students succeeded in 2009 than in 2005.

A good range of measurement systems, processes and applications was covered in the set of tasks attempted by students. At both levels students' skills of reading measurements were substantially stronger than those of making good estimations. Year 8 students were quite weak in the understanding of perimeter, area and volume.

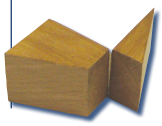


GEOMETRY

Chapter 5 presents the results for 13 geometry tasks. There was quite strong progress from year 4 to year 8. Averaged across 15 task components administered to both year 4 and year 8 students, 21% more year 8 than year 4 students succeeded with these components.

Overall, there was no meaningful change in performance for year 4 or year 8 students between 2005 and 2009. Averaged across 17 trend task components attempted by year 4 students in both years, 2% more students succeeded in 2009 than in 2005, but the small number of tasks and components mean that this change should not be regarded as meaningful. At year 8 level, the same percentage of students succeeded on 41 task components in 2009 as in 2005.

A small decline in capability to identify cross sections of three-dimensional objects was evident in one task previously used in the 1997 assessments.



Many students were able to identify the symmetry lines of two-dimensional shapes, and year 8 students had good success with drawing the nets of some three-dimensional objects. Students had less success with visualising the internal structure and cross sections of three-dimensional objects, and with following instructions involving angle measurements expressed in fractions of complete turns or in degrees.

STATISTICS

Chapter 6 presents the results of six statistics tasks. Readers should note that much of what is usually taught and assessed in this area is covered in separate NEMP reports on using *Graphs, Tables and Maps*: most recently Report 46 on the 2007 assessments. The one task administered at both year 4 and year 8 in 2009 showed moderate growth, with, on average, a 12% increase in performance from year 4 to year 8 on seven task components.

Year 4 students improved markedly on one trend task between 2005 and 2009, with little change on the other trend task. There was no meaningful change between 2005 and 2009 across three trend tasks for year 8 students.

Students generally performed well on tasks related to recording or directly interpreting data, but much less well in applying probability-related ideas to data.

SURVEY

Chapter 7 focuses on the results of a survey that sought information from students about their strategies for, involvement in, and enjoyment of mathematics. Mathematics was the second most popular of 14 subjects for year 4 students and the third most popular for year 8 students, the same result as in 2005 and one place higher at both levels than in 2001.

An open-ended question asked students, "What are some interesting maths things you do in your own time?" The emphasis on basic facts and tables among year 4 students had declined substantially between 2001 and 2005, from 56% to 36% of students, but increased in 2009 to 47% of year 4 students.

The student responses to 11 rating items showed that about 10% more year 8 than year 4 students have distinctly negative views about studying mathematics in school and about their own capabilities, while 32% more year 8 than year 4 students are negative about doing maths in their own time. These patterns have stayed quite consistent from the first survey in 1997 to the 2005 survey. Over the same period, there have been moderate reductions in the percentages of students who said that they didn't know how good their parents thought they were at maths, or how good their teacher thought that they were at maths.

PERFORMANCE OF SUBGROUPS

Chapter 8 details the results of analyses comparing the performance of different demographic subgroups. Community size, school size, school type (for year 8 students) and geographic zone did not seem to be important factors predicting achievement on the mathematics tasks. The same was true for the 2005, 2001 and 1997 assessments. However, there were statistically significant differences in the performance of students from low, medium and high decile schools on 85% of the tasks at year 4 level (compared to 63% in 2005, 87% in 2001 and 85% in 1997) and 83% of the tasks at year 8 level (compared to 65% in 2005, 76% in 2001 and 77% in 1997).

Effect sizes were used for the comparisons of boys with girls, Pakeha with Māori, Pakeha with Pasifika students, and students for whom the predominant language at home was English with those for whom it was not. Effect size is the difference in mean (average) performance of the two groups, divided by the pooled standard deviation of the scores on the particular task. For this summary, these effect sizes were averaged across all tasks.

Year 4 boys averaged slightly higher than girls, with a mean effect size of 0.14 (a little higher than the mean effect sizes of 0.08 in 2005 and 0.10 in 2001). Year 8 boys averaged very slightly higher than girls, with a mean effect size of 0.03 (in both 2005 and 2001, girls were ahead of boys by an identical margin).

Pakeha students averaged moderately to substantially higher than Māori students, with mean effect sizes of 0.42 for year 4 students (similar to 0.37 in 2005 and 0.46 in 2001) and 0.38 for year 8 students (similar to 0.35 in 2005 and 0.42 in 2001).

Year 4 Pakeha students averaged substantially higher than Pasifika students, with a mean effect size of 0.50 (compared with 0.35 in 2005 and 0.59 in 2001). Year 8 Pakeha students also averaged substantially higher than Pasifika students, with a mean effect size of 0.53 (essentially unchanged from 0.51 in 2005 and 0.53 in 2001). Responses to the Mathematics Survey showed a clear tendency for Pasifika students to be more enthusiastic about studying mathematics than their Pakeha counterparts.

Compared to students for whom the predominant language at home was English, students from homes where other languages predominated averaged moderately lower, with mean effect sizes of 0.20 for year 4 students and 0.24 for year 8 students (compared to 0.10 for both year levels in 2005). Comparative figures are not available for the assessments in 2001. Year 4 and year 8 students whose predominant language at home was not English tended to be more positive about studying mathematics than students whose predominant language at home was English.

OVERALL TRENDS

Considering the results on all of the trend tasks in this report, it is appropriate to conclude that there has been no change overall between 2005 and 2009 in the mathematics performance of year 4 or year 8 students. Between 2001 and 2005, averaged across about 200 trend task components included in the report on the 2005 assessments, the percentage of year 4 students succeeding with each component decreased by an average of just over 2%, while the performance of year 8 students was unchanged. The decrease for year 4 in 2005 came entirely from a decline in performance on basic number fact tasks: the result on other tasks showed a small increase. Between 1997 and 2001, in the report in the 2001 assessments, there had been an average increase of 4% on year 4 trend task components, and of 1% on year 8 trend task components. Putting these three trend periods together suggests that over the 12 years from 1997 to 2009 there has been a small net improvement in mathematics performance at year 4 level (held back from a larger improvement by the decline between 2001 and 2005 in basic fact knowledge), and essentially no net change in mathematics performance at year 8 level.

1 The National Education Monitoring Project

This chapter presents a concise outline of the rationale and operating procedures for national monitoring, together with some information about the reactions of participants in the 2009 assessments. Detailed information about the sample of students and schools is available in the Appendix (p80).

Purpose of National Monitoring

The New Zealand Curriculum Framework (1993, p26) states that the purpose of national monitoring is *to provide information on how well overall national standards are being maintained, and where improvements might be needed.*

The focus of the National Education Monitoring Project (NEMP) is on the educational achievements and attitudes of New Zealand primary and intermediate school children. NEMP provides a national "snapshot" of children's knowledge, skills and motivation, and a way to identify which aspects are improving, staying constant or declining. This information allows successes to be celebrated and priorities for curriculum change and teacher development to be debated more effectively, with the goal of helping to improve the education which children receive.

Assessment and reporting procedures are designed to provide a rich picture of what children can do and thus to optimise value to the educational community. The result is a detailed national picture of student achievement. It is neither feasible nor appropriate, given the purpose and the approach used, to release information about individual students or schools.

Monitoring at Two Class Levels

National monitoring assesses and reports what children know and can do at two levels in primary and intermediate schools: year 4 (ages 8-9) and year 8 (ages 12-13).

National Samples of Students

National monitoring information is gathered using carefully selected random samples of students, rather than all year 4 and year 8 students. This enables a relatively extensive exploration of students' achievement, far more detailed than would be possible if all students were to be assessed. The national samples of 1320 year 4 children and 1320 year 8 children represent about 2.2% of the children at those levels in New Zealand schools, large enough samples to give a trustworthy national picture.

Three Sets of Tasks at Each Level

So that a considerable amount of information can be gathered without placing too many demands on individual students, different students attempt different tasks. The 1320 students selected in the sample at each year level are divided into three groups of 440 students, comprising four students from each of 110 schools. Each group attempts one third of the tasks.

Timing of Assessments

The assessments take place in the second half of the school year, between August and November. The year 8 assessments occur first, over a five-week period. The year 4 assessments follow, over a similar period. Each student participates in about four hours of assessment activities spread over one week.

Specially Trained Teacher Administrators

The assessments are conducted by experienced teachers, usually working in their own region of New Zealand. They are selected from a national pool of applicants, attend a week of specialist training in Wellington led by senior Project staff and then work in pairs to conduct assessments of 60 children over five weeks. Their employing school is fully funded by the Project to employ a relief teacher during their secondment.

Four-Year Assessment Cycle

Each year, the assessments cover about one quarter of the areas within the national curriculum for primary schools. The New Zealand Curriculum Framework is the blueprint for the school curriculum. It places emphasis on seven essential learning areas, eight essential skills and a variety of attitudes and values. National monitoring aims to address all of these areas, rather than restrict itself to pre-selected priority areas.

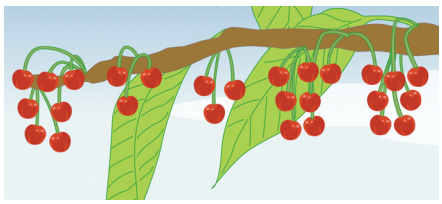
The first four-year cycle of assessments began in 1995 and was completed in 1998. The second cycle ran from 1999 to 2002. The third cycle began in 2003 and finished

in 2006. The fourth cycle began in 2007. The areas covered each year and the reports produced are listed opposite the contents page of this report.

Approximately 45% of the tasks are kept constant from one cycle to the next. This re-use of tasks allows trends in achievement across a four-year interval to be observed and reported.

Important Learning Outcomes Assessed

The assessment tasks emphasise aspects of the curriculum which are particularly important to life in our community, and which are likely to be of enduring importance to students. Care is taken to achieve balanced coverage of important skills, knowledge and understandings within the various curriculum strands, but without attempting to follow the finer details of current curriculum statements. Such details change from time to time, whereas national monitoring needs to take a long-term perspective if it is to achieve its goals.



Wide Range of Task Difficulty

National monitoring aims to show what students know and can do. Because children at any particular class level vary greatly in educational development, tasks spanning multiple levels of the curriculum need to be included if all children are to enjoy some success and all children are to experience some challenge. Many tasks include several aspects, progressing from aspects most children can handle well to aspects that are less straightforward.

Engaging Task Approaches

Special care is taken to use tasks and approaches that interest students and stimulate them to do their best. Students' individual efforts are not reported and have no obvious consequences for them. This means that worthwhile and engaging tasks are needed to ensure that students' results represent their capabilities rather than their level of motivation. One helpful factor is that extensive use is made of equipment and supplies which allow students to be involved in hands-on activities. Presenting some of the tasks on computer also allows the use of richer stimulus material and standardises the presentation of those tasks.

	YEAR	NEW ZEALAND CURRICULUM		
1	2007 (2003) (1999) (1995)	Science Visual Arts Information Skills: *graphs, tables, maps, charts & diagrams*	Communication skills Problem-solving skills Self-management and competitive skills Social and cooperative skills Work and study skills	Attitudes
2	2008 (2004) (2000) (1996)	Language: *reading and speaking* Aspects of Technology Music		
3	2009 (2005) (2001) (1997)	Mathematics and Statistics: *numeracy skills* Social Studies Information Skills for Inquiry Learning: *library, research*		
4	(2006) (2002) (1998)	Language: *writing, listening, viewing* Health and Physical Education		

Positive Student Reactions to Tasks

At the conclusion of each assessment session, students completed evaluation forms in which they identified tasks that they particularly enjoyed, tasks they felt relatively neutral about and tasks that did not appeal. Averaged across all tasks in the 2009 assessments, 73% of year 4 students indicated that they particularly enjoyed the tasks. The range across the 124 tasks was from 95% down to 47%. As usual, year 8 students were more demanding. On average, 55% of them indicated that they particularly enjoyed the tasks, with a range across 171 tasks from 89% down to 31%. One task was more disliked than liked, by year 8 students only: a task involving the functioning of New Zealand's parliament.

Appropriate Support for Students

A key goal in Project planning is to minimise the extent to which student strengths or weaknesses in one area of the curriculum might unduly influence their assessed performance in other areas. For instance, skills in reading and writing often play a key role in success or failure in paper-and-pencil tests in areas such as science, social studies, or even mathematics. In national monitoring, a majority of tasks are presented orally by teachers or on computer, and most answers are given orally or by demonstration rather than in writing. Where reading or writing skills are required to perform tasks in areas other than reading and writing, teachers are happy to help students to understand these tasks or to communicate their responses. Teachers are working with no more than four students at a time, so are readily available to help individuals.

To free teachers further to concentrate on providing appropriate guidance and help to students, so that the students achieve as well as they can, teachers are not asked to record judgements on the work the students are doing. All marking and analysis is done later, when the students' work has reached the Project office in Dunedin. Some of the work comes on paper, but much of it arrives recorded on videotape. In 2009, about half of the students' work came in that form, on a total of about 3250 videotapes. The video recordings give a detailed picture of what students and teachers did and said, allowing rich analysis of both process and task achievement.

Four Task Approaches Used

In 2009, four task approaches were used. Each student was expected to spend about an hour working in each format. The four approaches were:

- *One-to-one interview*
  Each student worked individually with a teacher, with the whole session recorded on videotape.
- *Stations*
  Four students, working independently, moved around a series of stations where tasks had been set up. This session was not videotaped.
- *Team*
  Four students worked collaboratively, supervised by a teacher, on some tasks. This was recorded on videotape.
- *Group and Independent*
  Four students worked collaboratively, supervised by a teacher, on one or two tasks. The students then worked individually on some paper-and-pencil tasks.

Professional Development Benefits for Teacher Administrators

The teacher administrators reported that they found their training and assessment work very stimulating and professionally enriching. Working so closely with interesting tasks administered to 60 children in at least five schools offered valuable insights. Some teachers have reported major changes in their teaching and assessment practices as a result of their experiences working with the Project. Given that 88 teachers served as teacher administrators in 2009, or about 0.3% of all primary teachers, the Project is making a major contribution to the professional development of teachers in assessment knowledge and skills. This contribution will steadily grow, since preference for appointment each year is given to teachers who have not previously served as teacher administrators. The total after 15 years is 1365 different teachers, 108 of whom have served more than once.

Marking Arrangements

The marking and analysis of the students' work occurs in Dunedin. The marking process includes extensive discussion of initial examples and careful checks of the consistency of marking by different markers.

Tasks which can be marked objectively or with modest amounts of professional experience usually are marked by senior tertiary students, most of whom have completed two or three years of pre-service preparation for primary school teaching. Forty-four student markers worked on the 2009 tasks, employed five hours per day for about four weeks.

The tasks that require higher levels of professional judgement are marked by teachers, selected from throughout New Zealand. In 2009, 160 teachers were appointed as markers. Most teachers worked either mornings or afternoons for one week. Teacher professional development through participation in the marking process is another substantial benefit from national monitoring. In evaluations of their experiences on a four-point scale ("dissatisfied" to "highly satisfied"), 70% to 96% of the teachers who marked student work in January 2010 chose "highly satisfied" in response to questions about:

- the instructions and guidance given during marking sessions
- the degree to which marking was professionally satisfying and interesting
- its contribution to their professional development in the area of assessment
- the overall experience.

Analysis of Results

The results are analysed and reported task by task. Most task reports include a total score, created by adding scores for appropriate task components. Details of how the total score has been constructed for particular assessment tasks can be obtained from the NEMP office (earu@otago.ac.nz).

Although the emphasis is on the overall national picture, some attention is also given to possible differences in performance patterns for different demographic groups and categories of school. The variables considered are:

- *Student gender:*
  - male
  - female
- *Student ethnicity:*
  - Māori
  - Pasifika
  - Pakeha (includes all other students)
- *Home language:*
  (predominant language spoken at home)
  - English
  - any other language
- *Geographical zone:*
  - Greater Auckland
  - other North Island
  - South Island
- *Size of community:*
  - main centre over 100,000
  - provincial city of 10,000 to 100,000
  - rural area or town of less than 10,000
- *Socio-economic index for the school:*
  - lowest three deciles
  - middle four deciles
  - highest three deciles
- *Size of school:*
  YEAR 4 SCHOOLS
  - fewer than 25 year-4 students
  - 25 to 60 year-4 students
  - more than 60 year-4 students

  YEAR 8 SCHOOLS
  - fewer than 35 year-8 students
  - 35 to 150 year-8 students
  - more than 150 year-8 students
- *Type of school* (for year 8 sample only):
  - full primary school
  - intermediate school
  - year 7–13 high school
  (some students were in other types of schools, but too few to allow separate analysis).

Categories containing fewer children, such as Asian students or female Māori students, were not used because the resulting statistics would be based on the performance of fewer than 70 children, and would therefore be unreliable.

An exception to this guideline was made for Pasifika children and children whose home language was not English because of the agreed importance of gaining some information about their performance.

Funding Arrangements

National monitoring is funded by the Ministry of Education, and organised by the Educational Assessment Research Unit at the University of Otago, under the direction of Professors Terry Crooks and Jeffrey Smith. The current contract runs until June 2011. The cost is about $2.7 million per year, less than one tenth of a percent of the budget allocation for primary education. Almost half of the funding is used to pay for the time and expenses of the teachers who assist with the assessments as task developers, teacher administrators or markers.

Further Information

A more extended description of national monitoring, including detailed information about task development procedures, is available in:

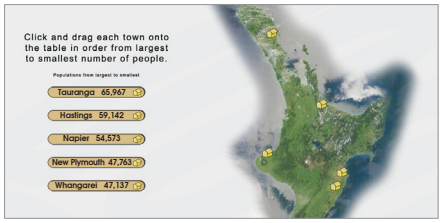
Flockton, L. (1999). *School-wide Assessment: National Education Monitoring Project.* Wellington: New Zealand Council for Educational Research.

2 Assessing Mathematics

The aims of mathematics education, like those of other learning areas, are developed and shaped to reflect understandings and processes that are meaningful, important and useful to individuals and society. Just as knowledge expands, circumstances alter and needs change with time, so too is the content and structure of mathematics programmes adjusted and refined from time to time to reflect current needs and future visions for learners. Expecting students to get the right answers in the shortest possible time with the least amount of thinking is no longer a prime goal of mathematics education. For most students a major aim is to help them develop attitudes and abilities to be flexible, creative thinkers who can cope with open-ended, real-world problems. This requires them to become confident in their understanding and application of mathematical ideas, procedures and processes.

Because much conceptual knowledge and skill in mathematics takes time to develop, fundamental ideas introduced at the early years of schooling are repeatedly elaborated on and extended as students progress through their years at school. It is appropriate, therefore, that assessment in mathematics includes a substantial proportion of tasks which allow us to observe the extent of progress in conceptual knowledge and skill over time.

Although conceptual understanding is clearly one of the major goals of mathematics education, students' capacity for exploring, applying and communicating their mathematical understandings within real-world contexts is also important. Mathematics education is very much concerned with such matters as students' confidence, interest and inventiveness in working with a range of mathematical ideas. The NEMP assessment framework recognises this by making provision for students to demonstrate their mathematical skills through a range of situations which involves them in asking questions, making connections, and applying understandings and processes to novel, as well as familiar, situations. Although the place for assessing confidence and efficiency in basic mathematical facts is recognised in NEMP assessments, there is also a substantial focus on thinking, reasoning and problem-solving skills that require more open tasks that allow students to demonstrate their number sense, reason, make decisions and explain.



Framework for Assessment of Mathematics

National monitoring task frameworks are developed with the Project's curriculum advisory panels. These frameworks have two key purposes. They provide a valuable guideline structure for the development and selection of tasks, and they bring into focus those important dimensions of the learning domain which are arguably the basis for valid analyses of students' skills, knowledge, understandings and attitudes.

The assessment frameworks are intended to be flexible and broad enough to encourage and enable the development of tasks that lead to meaningful descriptions of what students know and can do. They are also designed to help ensure a balanced representation of important learning outcomes.

The mathematics framework has a central organising theme and four areas of content linked to eight processes. Key aspects of content are listed under each heading and attention is drawn in the final section of the framework to the importance of students' attitudes and motivation.

The most important message emerging from the use of the framework is the pervasive interrelatedness that exists among mathematics content, processes and attitudes. To regard each as a discrete entity of learning, whether for teaching or assessment purposes, assumes clear-cut boundaries that frequently do not exist. In developing and administering tasks, it was sometimes difficult to assign tasks specifically to one aspect rather than another. However, for purposes of reporting assessment information, tasks were allocated to particular categories according to the balance of emphasis. The results are arranged in chapters according to the content areas.

NEMP MATHEMATICS FRAMEWORK

Confident mathematical and statistical thinking and application of ideas, procedures and processes

CONTENT

NUMBER & ALGEBRA
- properties/principles of number operations
- patterns, relationships and generalisations
- number knowledge
- number strategy
- symbols, equations, graphs and diagrams

MEASUREMENT
- systems of measurement and their use
- selecting and using measuring devices
- measurement sense
- issues of measurement and accuracy

GEOMETRY
- shape and space
- position and orientation
- transformation

STATISTICS
- collection, organisation, display and interpretation of statistical data
- estimation of probabilities and use of probabilities for prediction
- critical interpretation of others' data

PROCESSES
- making sense and finding connections
- posing questions and solving problems
- visualising and representing
- using and interacting with technologies
- reflecting and communicating
- estimating and being precise
- seeking patterns and generalising
- explaining and justifying

ATTITUDES AND MOTIVATION

– Valuing –

– Perseverance –

– Interest and enjoyment –

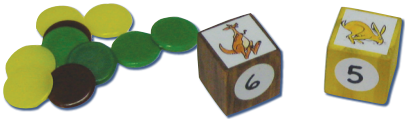
– Confidence and willingness to take risks –

– Voluntary engagement –

The Choice of Tasks for National Monitoring

The choice of tasks for national monitoring is guided by a number of educational and practical considerations. Uppermost in any decisions relating to the choice or administration of a task is the central consideration of validity and the effect that a whole range of decisions can have on this key attribute. Tasks are chosen because they provide a good representation of important knowledge and skills, but also because they meet a number of requirements to do with their administration and presentation. For example:

- Each task with its associated materials needs to be structured to ensure a high level of consistency in the way it is presented by specially trained teacher administrators to students of wide-ranging backgrounds and abilities, and in diverse settings throughout New Zealand.
- Tasks need to span the expected range of capabilities of year 4 and 8 students and to allow the most able students to show the extent of their abilities while also giving the least able the opportunity to show what they can do.
- Materials for tasks need to be sufficiently portable, economical, safe and within the handling capabilities of students. Task materials also need to have meaning for students.
- The time needed for completing an individual task has to be balanced against the total time available for all of the assessment tasks, without denying students sufficient opportunity to demonstrate their capabilities.
- Each task needs to be capable of sustaining the attention and effort of students if they are to produce responses that truly indicate what they know and can do. Since neither the student nor the school receives immediate or specific feedback on performance, the motivational potential of the assessment is critical.
- Tasks need to avoid unnecessary bias on the grounds of gender, culture or social background while accepting that it is appropriate to have tasks that reflect the interests of particular groups within the community.



National Monitoring Mathematics Assessment Tasks and Survey

One hundred mathematics tasks were administered, together with an interview questionnaire that investigated students' interests, attitudes and involvement in mathematics.

Twenty-seven tasks were administered in one-to-one interview settings, where students used materials and visual information. One task was presented in a team situation involving small groups of students working together. Thirty-two tasks were attempted in a stations arrangement, where students worked independently on a series of tasks, some presented on laptop computers. The final 40 tasks were administered in an independent approach, where students sat at desks or tables and worked through a series of paper-and-pencil tasks.

Twenty-six of the tasks were identical for year 4 and year 8 students. Three tasks were slightly modified between year 4 and year 8. A further 20 tasks included common components for both years, together with more challenging components for year 8 students and, in two cases, less demanding components for year 4 students. Of the remaining tasks, 12 were specifically for year 4 students and 39 for year 8 students. Eleven of these single-year tasks had some parallel or identical components at the two levels.

Trend Tasks

Forty-six of the tasks were previously used in the 2005 mathematics assessments. These were called link tasks in the 2005 report, but were not described in detail to avoid any distortions in the 2009 results that might have occurred if the tasks had been widely available for use in schools since 2005. In the current report, these tasks are called trend tasks and are used to examine trends in student performance: whether they have improved, stayed constant or declined over the four-year period since the 2005 assessments. Further trend information comes from two tasks previously used in the 1997 assessments, and from two tasks used in both the 2001 and 2005 assessments.

Link Tasks

To allow comparisons between the 2009 and subsequent assessments, 45 of the tasks used in 2009 have been designated link tasks. Results of student performance on these tasks are presented in this report, but the tasks are described only in general terms because they may be used again in a future study.

Marking Methods

The students' responses were assessed using specially designed marking procedures. The criteria used had been developed in advance by Project staff, but were sometimes modified as a result of issues raised during the marking. Tasks that required marker judgement and were common to year 4 and year 8, or to 2009 and earlier assessment years, were intermingled during marking sessions, with the goal of ensuring that the same scoring standards and procedures were used for both.

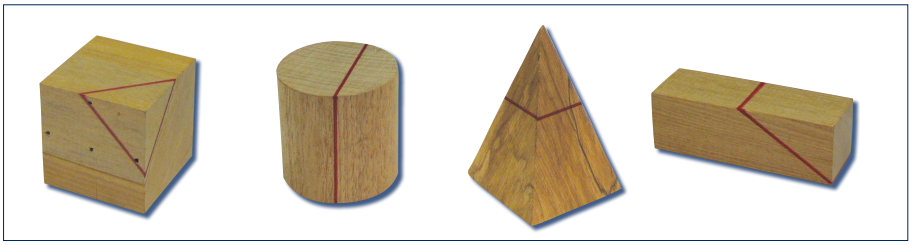
Task-by-task Reporting

National monitoring assessment is reported task by task so that results can be understood in relation to what the students were asked to do.

Access Tasks

Teachers and principals have expressed considerable interest in access to NEMP task materials and marking instructions, so that they can use them within their own schools. Some are interested in comparing the performance of their own students to national results on some aspects of the curriculum, while others want to use tasks as models of good practice. Some would like to modify tasks to suit their own purposes, while others want to follow the original procedures as closely as possible. There is obvious merit in making available carefully developed tasks that are seen to be highly valid and useful for assessing student learning.

Some of the tasks in this report cannot be made available in this way. Link tasks must be saved for use in four years' time, and other tasks use copyright or expensive resources that cannot be duplicated by NEMP and provided economically to schools. There are also limitations on how precisely a school's administration and marking of tasks can mirror the ways that they are administered and marked by the Project. Nevertheless, a substantial number of tasks are suitable to duplicate for teachers and schools. In this report, these access tasks are identified with the symbol above. These tasks are bundled into access kits and can be purchased online, from the NEMP website *(http://nemp.otago.ac.nz)*. Teachers are also encouraged to use the website to view tasks and results.



Reading the Tasks and Results

The content, instructions and key resources are shown for each task, as they were presented to the students. Sentences in bold blue are an instruction to the teacher administrator. The students' results are shown in red.

ABOUT THE TASK

WHAT THE STUDENTS READ OR HEARD (BLUE)
MARKING CRITERIA (RED)

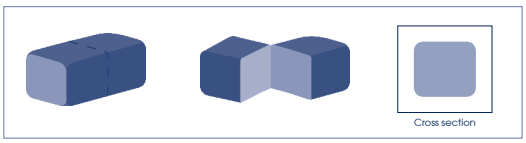
PERFORMANCE PATTERNS

Trend Task: Cheeses

Approach: Independent
Year: 4 & 8
Focus: Identifying shapes of cross sections
Resources: Answer booklet

Questions / instructions:

The cheese has been cut through with one straight cut. The cut made a square shaped cross section.

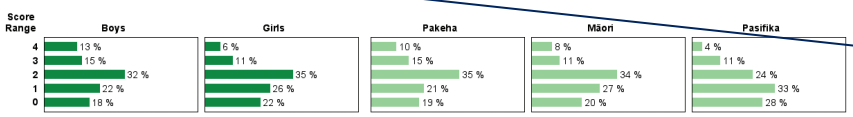


Look at the pictures. They show the places where the different cheeses have been cut.
Draw the cross section for each cheese.

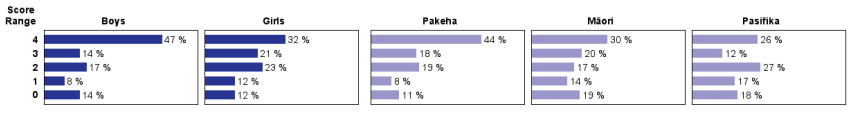
			% response 2009 ('05) year 4	year 8
1.	Drew:	circle	77 (68)	85 (80)
2.	Drew:	rectangle	18 (7)	47 (46)
	✗	triangle	40 (43)	27 (18)
3.	Drew:	triangle	55 (51)	77 (71)
4.	Drew:	rectangle	18 (10)	52 (54)
	✗	curved shape *(semicircle, circle, etc)*	50 (49)	29 (23)
	Total Score:	4	9 (2)	40 (40)
		3	14 (11)	17 (18)
		2	33 (35)	20 (12)
		1	24 (24)	10 (13)
		0	20 (28)	13 (17)

Subgroup Analyses:

Year 4



Year 8



Commentary:

The second and fourth shapes caused greater visualisation problems that the other two, with many students seeing the surface rather than the cross section. Year 4 students scored a little higher in 2009 than in 2005, but there was little change for year 8 students. Year 4 Pakeha and Māori students performed similarly.

Students did this task independently. See page 6 for descriptions of all four approaches used.

What this task was aiming to evaluate.

The resources used in this task.

- In 2009, 77% of year 4 students drew a circle for the cross section of Cheese 1.
- In 2005, 68% of year 4 students drew a circle for the cross section of Cheese 1.
- In 2009, 85% of year 8 students drew a circle for the cross section of Cheese 1.
- In 2005, 80% of year 8 students drew a circle for the cross section of Cheese 1.

The total score is created by adding those marking criteria that seem to capture best the overall task performance. For some tasks this is all of the criteria but for others, it is just one or two of the criteria.

Performance patterns for boys and girls; Pakeha, Māori and Pasifika students, based on their total scores on the task. Note that Pakeha is defined as everyone not included in Māori or Pasifika.

Comments that assist with interpreting the results.

3 Number and Algebra

Overview: Year 8 students performed substantially better than year 4 students on mathematics tasks involving number knowledge, strategies and skills, with an average of 30% more year 8 than year 4 students succeeding on the same number task components. On average, there was no meaningful change in number task performance between 2005 and 2009, for either year 4 or year 8 students. There was clear evidence of substantial change in the number task strategies that students use. These appeared to help with some tasks and hinder with others.

The assessments included 56 tasks investigating students' understandings, processes and skills in the areas of mathematics called number and algebra. Number includes the ways numbers are represented, their value, operations on number, accuracy and efficiency in calculating, estimating and making approximations. Algebra involves patterns and relationships in mathematics in the real world, the use of symbols, notation and graphs and diagrams to represent mathematical relationships and ideas, and the use of algebraic expressions for solving problems.

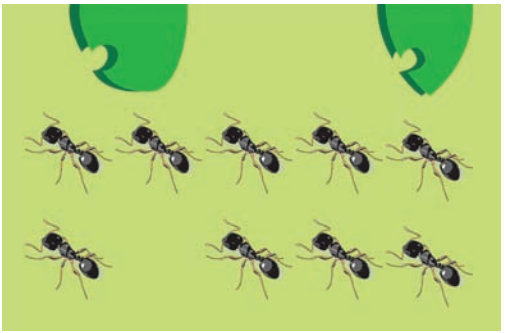
Twenty-six of the 56 tasks are trend tasks (fully described with data for both 2005 and 2009 – and for two tasks also from 2001). One is a longer-term trend task, with data from both 1997 and 2009. Three are released tasks (fully described with data for 2009 only) and 26 are link tasks (to be used again in 2010, so only partially described here). Trend tasks are presented first, then released tasks and finally link tasks.

There was major improvement in number and algebra knowledge and skills from year 4 to year 8. Averaged across 217 task components administered to both year 4 and year 8 students, 30% more year 8 than year 4 students succeeded with these components. Year 8 students performed better on every component. As expected, the differences were generally larger on more difficult components – often components that many year 4 students would not yet have had much opportunity to learn in school or to practise.

Overall, performance at both year levels was unchanged between 2005 and 2009. Averaged across 137 trend task components attempted by year 4 students in both years, the same percentage of students succeeded in 2009 as in 2005. Gains occurred on 66 of the 137 components. At year 8 level also, on average, the same percentage succeeded in 2009 as in 2005. Gains occurred on 79 of the 172 trend task components. The most notable change in performance was a decline for year 8 students on multiplication problems (p36), where changes in computation strategy were clearly evident.

The first three tasks allowed exploration of trends over periods longer than four years. *Jumpers* (p13) showed substantial improvement from 1997 to 2009 for year 4 students and smaller improvement for year 8 students. *Number Facts (Multiplication)* (p14) and *Number Facts (Addition)* (p15) had data for 2001, 2005 and 2009. There was very little change on these tasks at both year levels between 2005 and 2009, after substantial losses for year 4 students on both tasks between 2001 and 2005 and a small loss for year 8 students on multiplication facts.

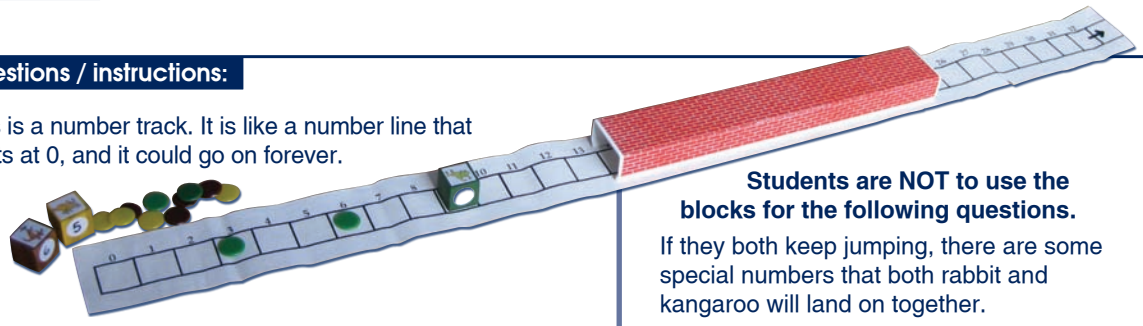
Students at both levels scored poorly in tasks involving estimation and tasks involving fractions (especially fractions other than halves and quarters). There was clear evidence that students have adopted changes in number strategy taught in recent years. This appears to have been advantageous in responses to some tasks and disadvantageous in responses to other tasks.



Trend Task: Jumpers

Approach:	One to one
Year:	4 & 8
Focus:	Number knowledge; patterns/sequences
Resources:	Number line, recording book, frog, rabbit and kangaroo blocks, plastic coloured markers, tunnel

Questions / instructions:



This is a number track. It is like a number line that starts at 0, and it could go on forever.

Set up number track and show animals.

This frog is a three-jumper. Starting at 0 it can jump three numbers at a time. It can make one jump and land on this number **(put on 3)** or two jumps and land on 6 **(place marker on 3 and place frog on 6)** or three jumps to 9 **(place marker on 6 and place frog on 9)**.

		Linked to 1997 % response 2009 ('97) year 4	year 8
1. What is the next number the jumping frog would land on? Put a marker on the 9 then put the frog where you think it would land.	12	95 (94)	99 (100)

If student does not put the frog on 12, assist them with a correction explaining why it would be 12. Place the tunnel to cover the numbers 14 to 24.

Now I've put a tunnel over part of the number track.

2. What is the next number the frog would land on – in the tunnel?	15	89 (88)	98 (96)
3. What is the first number it would land on when it came out of the tunnel?	27	43 (31)	76 (66)
4. Altogether, how many jumps from zero would the frog have made before it landed there?	9	22 (17)	60 (50)

Clear the number line to start again.

This rabbit is a 5 jumper, and the kangaroo is a 6 jumper.

Jump rabbit from 0 to 5 – place marker, then jump it onto 10 and leave it there. Jump kangaroo from 0 to 6 – place marker, then jump it onto 12 and leave it there.

Students are NOT to use the blocks for the following questions.

If they both keep jumping, there are some special numbers that both rabbit and kangaroo will land on together.

		Linked to 1997 % response 2009 ('97) year 4	year 8
5. What is the **first** number that they would land on together?	30	31 (21)	80 (76)
6. How many jumps will rabbit have made to reach **(say the number given by student)**, starting from zero? correct number of jumps *(e.g. 6 jumps to reach 30)*		36 (21)	76 (71)
7. How many jumps will kangaroo have made to reach **(say the number given by student)**, starting from zero? correct number of jumps *(e.g. 5 jumps to reach 30)*		34 (20)	73 (70)

If they both keep on jumping, there is another number that both the rabbit and the kangaroo will land on that is the same number.

8. What number do you think it will be?	60	21 (12)	71 (66)
9. How did you work that out?	not marked	• (•)	• (•)

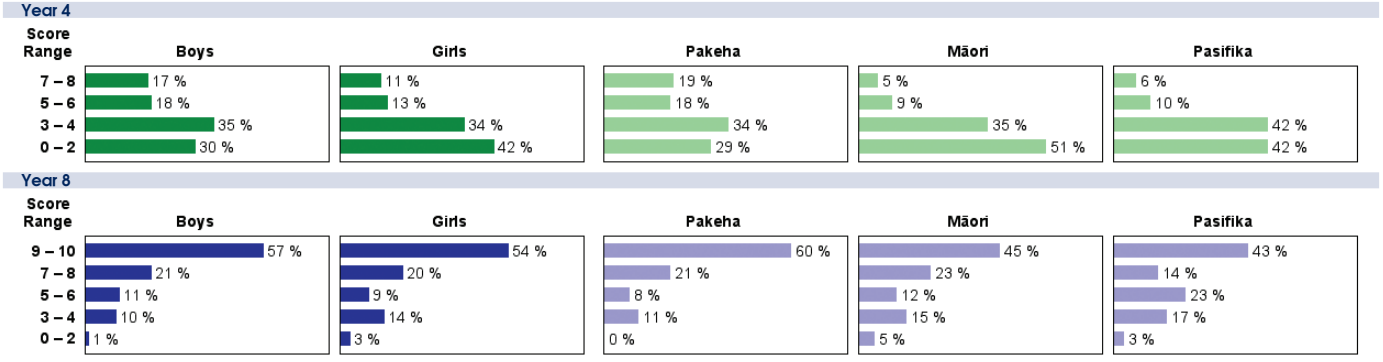
YEAR 8 ONLY:

Put all three animals on 30. Place the tunnel to cover the numbers 14 to 24.

If each animal started at 30 and made three jumps backward, only one animal would get right through the tunnel.

10. Work out which animal that would be and tell me.	kangaroo		89 (90)
11. What number would that animal land on?	12		74 (70)
Total Score:	9–10	• (•)	55 (43)
	7–8	14 (10)	21 (27)
	5–6	15 (8)	10 (16)
	3–4	35 (28)	12 (12)
	0–2	36 (54)	2 (2)

Subgroup Analyses:



Commentary:

This task was previously used in the 1997 assessments. The results show moderate improvements over the 12-year period both at the top and bottom for year 4 students and at the top for year 8 students. Year 4 boys scored significantly higher than year 4 girls.

Trend Task: Number Facts (Multiplication)

Approach:	Station
Focus:	Recall basic facts
Resources:	Computer program on laptop computer, answer booklet
Year:	4 & 8

Questions / instructions:

This activity uses the computer.

[Problems were presented on a computer screen, with sound track, at four-second intervals. Students responded in answer booklets that showed each problem and had a blank for entering the response.]

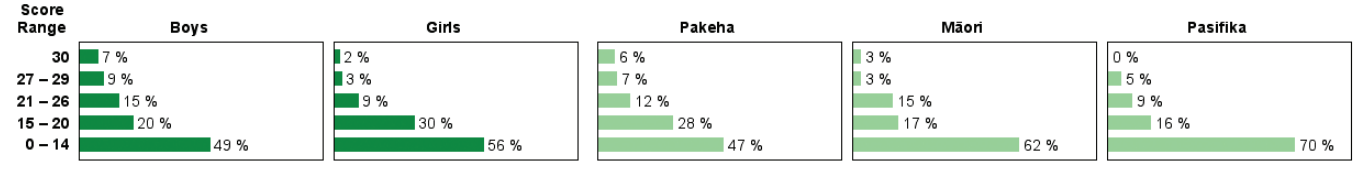
	Linked to 2005 & 2001 % response 2009 ('05) ['01] year 4	year 8
4 × 7 = 28	34 (37) [47]	81 (82) [92]
9 × 1 = 9	79 (84) [85]	98 (98) [99]
3 × 9 = 27	38 (36) [55]	85 (88) [90]
6 × 4 = 24	29 (35) [45]	83 (83) [91]
9 × 8 = 72	23 (21) [28]	78 (77) [84]
0 × 7 = 0	69 (71) [73]	93 (94) [92]
8 × 7 = 56	15 (11) [20]	65 (65) [77]
3 × 5 = 15	70 (76) [77]	97 (97) [98]
6 × 9 = 54	21 (17) [26]	76 (76) [79]
2 × 4 = 8	78 (80) [81]	97 (96) [98]
8 × 8 = 64	17 (15) [22]	69 (69) [79]
5 × 5 = 25	71 (72) [78]	95 (95) [98]
0 × 0 = 0	95 (94) [92]	99 (99) [100]
7 × 3 = 21	42 (42) [55]	89 (89) [94]
6 × 7 = 42	16 (14) [24]	71 (73) [79]

	Linked to 2005 & 2001 % response 2009 ('05) ['01] year 4	year 8
4 × 8 = 32	22 (22) [30]	76 (78) [86]
0 × 1 = 0	64 (65) [68]	90 (94) [93]
9 × 2 = 18	67 (62) [70]	96 (95) [97]
7 × 5 = 35	45 (48) [61]	93 (90) [95]
3 × 6 = 18	35 (35) [52]	89 (87) [93]
5 × 2 = 10	75 (76) [80]	99 (96) [98]
8 × 6 = 48	11 (11) [19]	65 (66) [76]
2 × 1 = 2	80 (82) [84]	96 (96) [97]
7 × 0 = 0	70 (62) [65]	91 (89) [93]
9 × 9 = 81	34 (34) [36]	88 (87) [90]
9 × 3 = 27	32 (26) [45]	84 (84) [90]
1 × 6 = 6	80 (82) [82]	99 (98) [99]
4 × 4 = 16	39 (39) [57]	90 (87) [94]
1 × 8 = 8	78 (81) [83]	99 (98) [99]
9 × 4 = 36	24 (23) [37]	81 (81) [88]

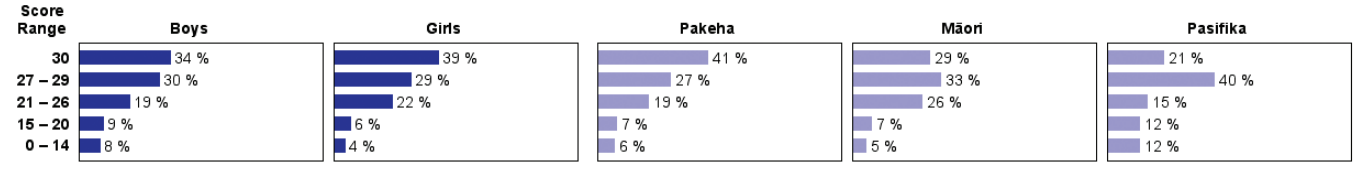
Total Score:	30	4 (2) [7]	37 (41) [47]
	27–29	5 (7) [10]	29 (26) [30]
	21–26	14 (14) [18]	20 (18) [15]
	15–20	24 (23) [25]	8 (9) [5]
	0–14	53 (54) [40]	6 (6) [3]

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task, focusing on knowledge of basic facts, was used previously in both 2001 and 2005. Both at year 4 and year 8 levels, there was very little change in performance from 2005 to 2009, which means that the drop in performance from 2001 to 2005 has been maintained in 2009. That drop is particularly evident where the multiplication involves digits other than 0, 1, 2 and 5. Year 4 boys scored significantly higher than year 4 girls, but there was a small opposite trend at year 8 level.

Trend Task: Number Facts (Addition)

Approach:	Station	Year:	4 & 8
Focus:	Recall basic facts		
Resources:	Computer program on laptop computer, answer booklet		

Questions / instructions:

This activity uses the computer.

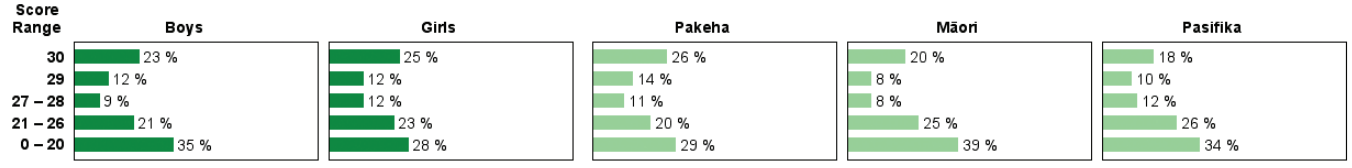
[Problems were presented on a computer screen, with sound track, at four-second intervals. Students responded in answer booklets that showed each problem and had a blank for entering the response.]

		Linked to 2005 & 2001 % response 2009 ('05) ['01] year 4	year 8
3 + 6 =	9	88 (85) [91]	99 (99) [99]
4 + 2 =	6	91 (87) [93]	98 (96) [95]
5 + 7 =	12	71 (72) [85]	96 (94) [97]
3 + 0 =	3	93 (93) [93]	99 (98) [97]
8 + 9 =	17	65 (63) [83]	96 (95) [97]
0 + 5 =	5	89 (87) [87]	97 (95) [95]
4 + 6 =	10	82 (78) [89]	98 (98) [98]
6 + 8 =	14	57 (58) [84]	94 (95) [97]
2 + 6 =	8	85 (85) [93]	99 (99) [98]
7 + 8 =	15	57 (56) [81]	93 (93) [98]
1 + 7 =	8	91 (91) [93]	97 (98) [99]
0 + 6 =	6	89 (88) [86]	97 (95) [96]
9 + 7 =	16	63 (61) [85]	97 (96) [98]
2 + 8 =	10	88 (89) [92]	99 (98) [99]
5 + 4 =	9	85 (85) [91]	98 (97) [98]

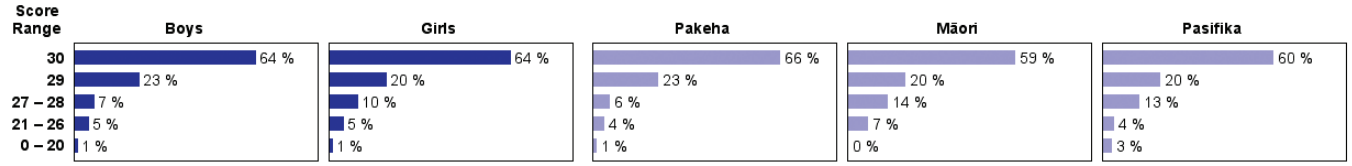
		Linked to 2005 & 2001 % response 2009 ('05) ['01] year 4	year 8
9 + 9 =	18	83 (79) [88]	97 (98) [99]
6 + 6 =	12	92 (87) [94]	99 (98) [99]
5 + 9 =	14	67 (66) [88]	98 (97) [98]
7 + 6 =	13	57 (61) [88]	96 (95) [97]
8 + 3 =	11	82 (80) [93]	97 (97) [98]
0 + 4 =	4	90 (86) [87]	98 (95) [96]
6 + 9 =	15	60 (60) [85]	96 (96) [98]
8 + 0 =	8	93 (90) [94]	99 (98) [96]
8 + 5 =	13	70 (68) [87]	97 (96) [97]
4 + 3 =	7	80 (76) [93]	97 (97) [99]
8 + 4 =	12	72 (70) [90]	97 (98) [99]
3 + 9 =	12	78 (76) [90]	98 (98) [99]
7 + 4 =	11	67 (66) [89]	98 (96) [97]
4 + 9 =	13	65 (68) [88]	97 (97) [99]
3 + 7 =	10	75 (74) [91]	98 (98) [99]
Total Score:	30	24 (22) [43]	64 (64) [68]
	29	12 (12) [19]	22 (22) [19]
	27–28	10 (11) [15]	8 (7) [9]
	24–26	9 (14) [7]	5 (4) [3]
	21–23	13 (7) [6]	0 (1) [0]
	15–20	19 (18) [3]	1 (1) [1]
	0–14	13 (16) [7]	0 (1) [0]

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task, focusing on knowledge of basic facts, was used previously in both 2001 and 2005. Both at year 4 and year 8 level, there was very little change in performance from 2005 to 2009, which means that the marked drop in performance for year 4 students from 2001 to 2005 had been maintained in 2009. That drop is particularly evident where neither number added is 0, 1 or 2, and the sum is more than 12. Pasifika students performed similarly to Pakeha students at both year levels, as did year 8 Māori students.

Trend Task: Quick Way

NEMP Access Task

Approach:	One to one
Focus:	Patterns; computation strategies
Resources:	4 pictures *[simulated resources shown below.]*
Year:	4 & 8

Questions / instructions:

I'm going to show you some pictures of different objects.

Try to think of a quick way to work out how many objects there are without counting each one.

Here is the first page of objects.

Hand student picture 1. Allow time.

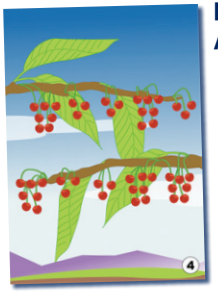
		% response 2009 ('05) year 4	year 8
1. How many lizards are there?	15	87 (81)	95 (97)
2. How did you work out your answer?			
solution involved multiplication *(5 × 3 or 3 × 5)*		34 (35)	82 (83)
solution involving addition (5 + 5 + 5)		43 (39)	11 (12)
other sound approach not involving counting one by one		5 (9)	2 (0)
any other response, including counting one by one/counting in twos		18 (17)	5 (5)

Hand student picture 2. Allow time.

		% response 2009 ('05) year 4	year 8
3. Use a quick way for working out the number of ants.	22	53 (49)	75 (80)
4. How did you work out your answer?			
solution involving multiplication *(5 × 2 + 3 × 4 or 5 × 5 – 3)*		8 (14)	45 (51)
solution involving equivalent groupings *(e.g. 9 + 9 + 4)*		7 (8)	8 (8)
solution involving just addition *(5 + 4 + 4 + 5 + 4)*		34 (27)	21 (18)
other sound approach not involving counting one by one		10 (5)	5 (6)
any other response, including counting one by one/counting in twos		41 (46)	21 (17)

Hand student picture 3. Allow time.

		% response 2009 ('05) year 4	year 8
5. Use a quick way for working out the number of frogs.	16	63 (55)	74 (76)
6. How did you work out your answer?			
solution involving multiplication *(4 × 4)*		1 (1)	6 (8)
solution involving recognising top and bottom have equivalent groupings *(e.g. 6 + 4 + 6; 2 + 4 + 6 + 4)*		21 (23)	47 (46)
solution involving row by row addition *(4 + 4 + 4 + 4 or 1 + 2 + 3 + 4 + 3 + 2 + 1)*		29 (29)	20 (22)
other sound approach not involving counting one by one		10 (7)	7 (6)
any other response, including counting one by one/counting in twos		39 (40)	20 (17)

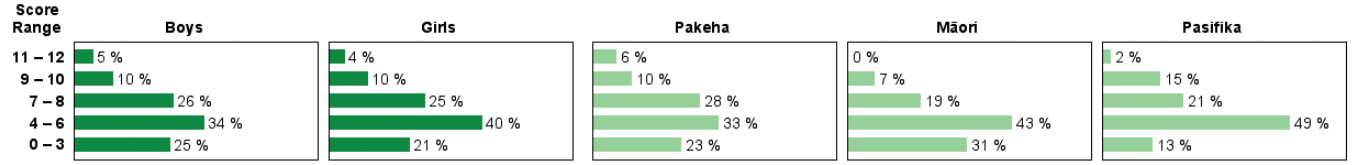


Hand student picture 4. Allow time.

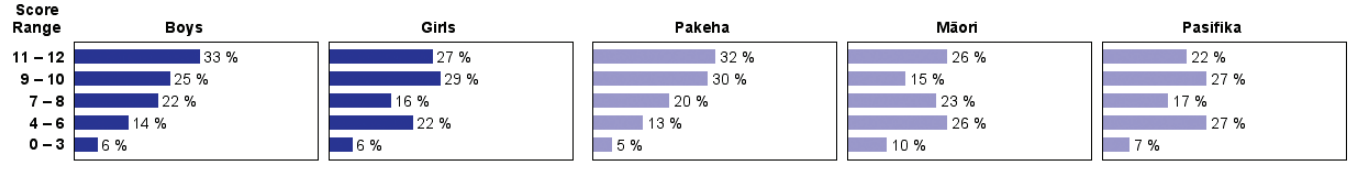
		% response 2009 ('05) year 4	year 8
7. Use a quick way for working out the number of cherries.	50	29 (26)	52 (48)
8. How did you work out your answer?			
solution involving multiplication *(7 × 5 + 5 × 3 or [3 + 7] × 5)*		6 (8)	38 (36)
solution involving addition *(of 5 tens or of 5 sevens and 5 threes)*		21 (30)	18 (23)
other sound approach not involving counting one by one		21 (12)	18 (18)
any other response, including counting one by one/counting in twos		52 (50)	26 (23)
Total Score:	11–12	4 (0)	30 (28)
	9–10	11 (16)	27 (33)
	7–8	25 (18)	19 (19)
	4–6	37 (44)	18 (16)
	0–3	23 (22)	6 (4)

Subgroup Analyses:

Year 4



Year 8



Commentary:

There was little change in performance at both year levels from 2005 to 2009. Year 4 Pasifika students performed similarly to Pakeha students.

Trend Task: NEMP Access Task

Chocolate Fractions

Approach:	One to one
Focus:	Calculating fractions using equipment
Resources:	4 chocolate bars (divided into $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, whole), 5 fraction problem cards, photo

Year: 4 & 8

Questions / instructions:

Arrange the four chocolate bars on the desk as shown in the photo.

Here are four chocolate bars. Use the chocolate bars to help answer some fraction problems. Here is the first problem.
[Cards identical to fractions in brackets.]

Hand student card 1 and read it ($\frac{1}{2} + \frac{1}{2} =$).

1. What is the answer? Use the chocolate bars to explain your answer. 1

Explanation:

Hand student card 2 and read it ($\frac{1}{2} + \frac{1}{4} =$).

2. What is the answer? Use the chocolate bars to explain your answer. $\frac{3}{4}$

Explanation:

Hand student card 3 and read it ($1 - \frac{1}{3} =$).

3. What is the answer? Use the chocolate bars to explain your answer. $\frac{2}{3}$

Explanation:

YEAR 8 ONLY:

Hand student card 4 and read it ($1\frac{1}{4} - \frac{1}{2} =$).

4. What is the answer? Use the chocolate bars to explain your answer. $\frac{3}{4}$

Explanation:

Hand student card 5 and read it ($2 \div \frac{1}{2} =$).

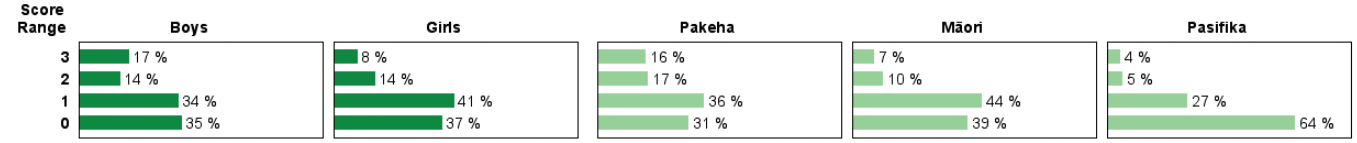
5. What is the answer? You might want to use the chocolate bars to explain your answer. 4

Explanation:

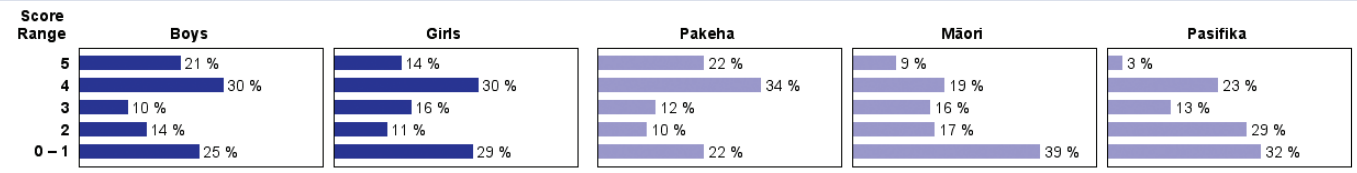
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1		62 (63)	92 (93)
clear and appropriate explanation		55 (48)	81 (84)
on right track but not clear/complete		7 (14)	8 (6)
2		22 (29)	57 (61)
clear and appropriate explanation		17 (17)	47 (46)
on right track but not clear/complete		8 (10)	12 (15)
3		18 (22)	61 (59)
clear and appropriate explanation		17 (14)	48 (45)
on right track but not clear/complete		4 (10)	12 (12)
4			55 (56)
clear and appropriate explanation			44 (42)
on right track but not clear/complete			10 (11)
5			25 (26)
clear and appropriate explanation			17 (15)
on right track but not clear/complete			7 (6)
Y4 Total Score:	3	12 (18)	
	2	15 (12)	
	1	37 (37)	
	0	36 (33)	
Y8 Total Score:	5		17 (18)
	4		30 (26)
	3		13 (17)
	2		13 (18)
	0–1		27 (21)

Subgroup Analyses:

Year 4



Year 8



Commentary:

There was no meaningful change in performance from 2005 to 2009, at either year level. About two thirds of year 4 Pasifika students had no success with this task.

Trend Task: Division Facts

Approach:	Station
Focus:	Division facts
Resources:	Computer program on laptop computer, answer booklet
Year:	4 & 8

Questions / instructions:

This activity uses the computer.
[The problems were presented on the computer screen and soundtrack at eight-second intervals. The answer sheets did not show the problem again.]

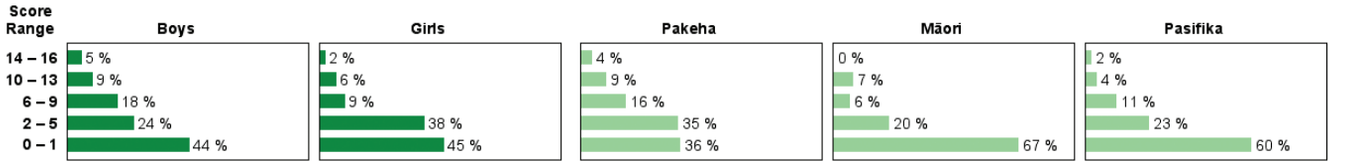
If you cannot answer a question, put an "x" where you would write the answer.

		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1.	36 ÷ 6 = [6]	23 (17)	76 (78)
2.	27 ÷ 3 = [9]	15 (15)	65 (69)
3.	4 ÷ 4 = [1]	40 (41)	83 (89)
4.	36 ÷ 9 = [4]	19 (17)	73 (78)
5.	12 ÷ 3 = [4]	36 (34)	84 (87)
6.	54 ÷ 6 = [9]	15 (11)	59 (63)
7.	8 ÷ [8] = 1	38 (35)	81 (84)
8.	42 ÷ [6] = 7	17 (10)	67 (70)
9.	10 ÷ [5] = 2	36 (39)	81 (81)
10.	32 ÷ [4] = 8	15 (15)	65 (67)
11.	50 ÷ [5] = 10	45 (46)	83 (90)
12.	21 ÷ [3] = 7	27 (25)	77 (81)
13.	[25] ÷ 5 = 5	8 (9)	41 (45)
14.	[8] ÷ 4 = 2	11 (9)	47 (55)
15.	[48] ÷ 6 = 8	2 (1)	34 (39)
16.	[63] ÷ 9 = 7	5 (2)	45 (48)

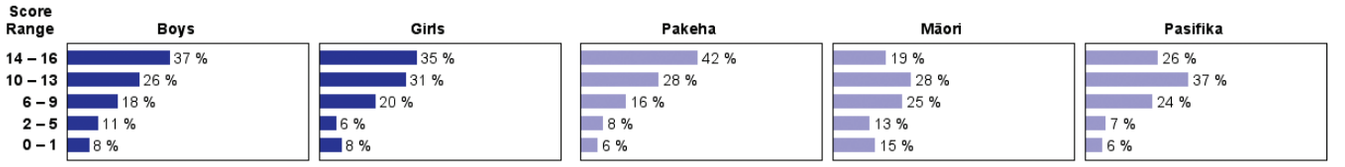
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
Total Score:	14–16	3 (1)	36 (42)
	10–13	8 (8)	28 (26)
	6–9	14 (12)	19 (17)
	2–5	30 (35)	9 (12)
	0–1	45 (44)	8 (3)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task focused on quick recall or derivation of basic division facts. Between 2005 and 2009 there was little change in performance for year 4 students and a small reduction for year 8 students. Year 8 Pasifika students performed similarly to Pakeha students.

Trend Task: NEMP Access Task

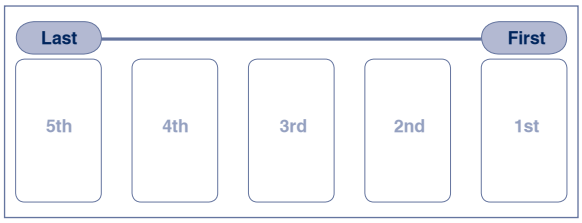
Sprint Times

Approach:	Station
Focus:	Placing time measurements in order
Resources:	5 stickers, answer booklet
Year:	4 & 8

Questions / instructions:

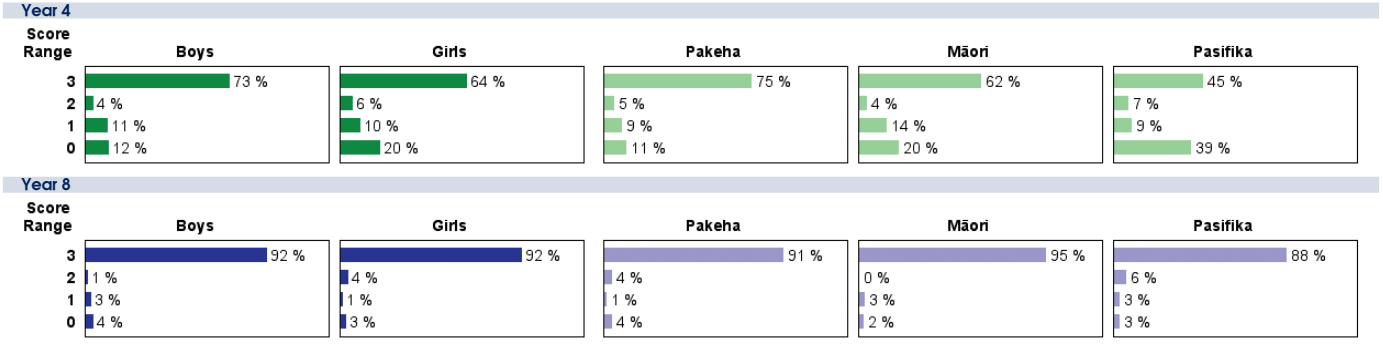
Five girls have just run a 100-metre race. The stopwatches show their finishing times in seconds.

Use the stickers to show their finishing times in order from slowest to fastest.



		% response 2009 ('05) year 4	year 8
Helen, Āwhina, Li-Ming, Kim, Tuila:			
all five in correct order		69 (75)	92 (91)
all five in reverse order		5 (3)	2 (2)
mostly correct		10 (10)	3 (5)
Total Score:	3	69 (75)	92 (91)
	2	5 (3)	2 (2)
	1	10 (10)	3 (5)
	0	16 (12)	3 (2)

Subgroup Analyses:



Commentary:

More than two thirds of students at both year levels succeeded fully with this task. There was little change at either year level between 2005 and 2009. At year 8 level, all subgroups performed similarly, but year 4 Pasifika students had markedly lower success than the other subgroups.

Trend Task: Sheep

NEMP Access Task

Approach:	Station
Focus:	Estimation
Resources:	Picture, answer booklet
Year:	4 & 8

Questions / instructions:

Look at the picture of sheep in a paddock.

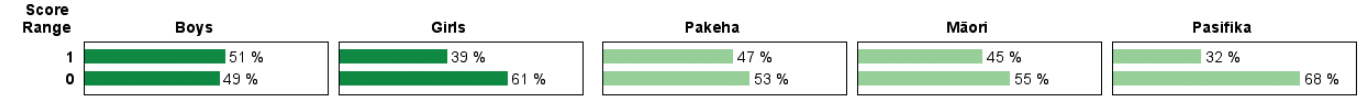
1. Which number do you think is nearest to the actual number of sheep? Circle your choice. *[Actual count: 810]*

		% response 2009 ('05) year 4	year 8
a. 50 sheep		2 (3)	1 (0)
b. 500 sheep	B	45 (53)	65 (69)
c. 5000 sheep		52 (44)	32 (30)

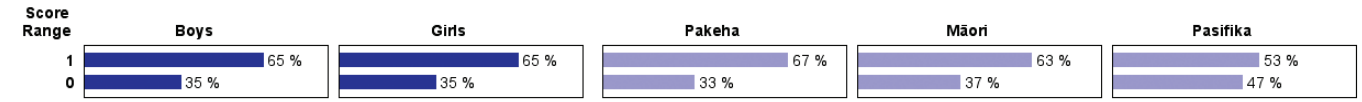
Total Score:	1	45 (53)	65 (69)
	0	55 (47)	35 (31)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students showed quite limited skills at estimation, despite the large differences between the answer choices. Performance declined a little between 2005 and 2009. Māori and Pakeha students performed very similarly at both year levels.

Trend Task: **Subtraction Facts**

Approach:	Station	**Year:**	4 & 8
Focus:	Subtraction facts		
Resources:	Computer program on laptop computer, answer booklet		

Questions / instructions:

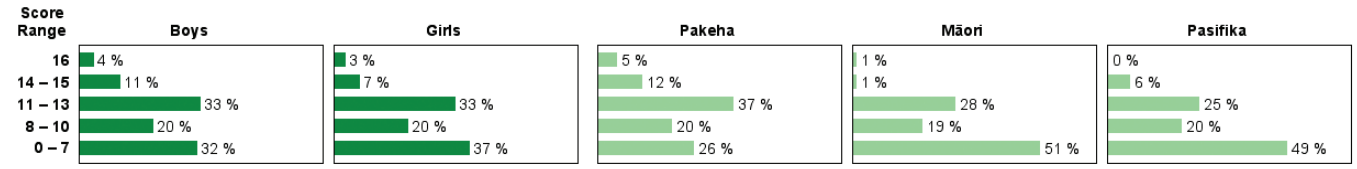
This activity uses the computer.
[The problems were presented on the computer screen and soundtrack at eight-second intervals. The answer sheets did not show the problem again.]
If you cannot answer a question, put an "x" where you would write the answer.

		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1.	9 – 2 = 7	71 (70)	96 (88)
2.	15 – 6 = 9	61 (62)	94 (89)
3.	13 – 4 = 9	67 (67)	96 (94)
4.	7 – 0 = 7	84 (86)	97 (94)
5.	18 – 9 = 9	68 (66)	98 (93)
6.	12 – 6 = 6	74 (78)	97 (96)
7.	17 – 6 = 11	47 (47)	89 (86)
8.	8 – 3 = 5	72 (70)	97 (94)
9.	11 – 5 = 6	57 (58)	93 (91)
10.	9 – 9 = 0	66 (61)	90 (88)
11.	18 – 8 = 10	72 (71)	97 (95)
12.	1 – 0 = 1	72 (68)	95 (93)
13.	12 – 5 = 7	13 (14)	61 (60)
14.	14 – 4 = 10	32 (33)	76 (76)
15.	16 – 8 = 8	16 (20)	63 (65)
16.	10 – 7 = 3	15 (20)	65 (67)

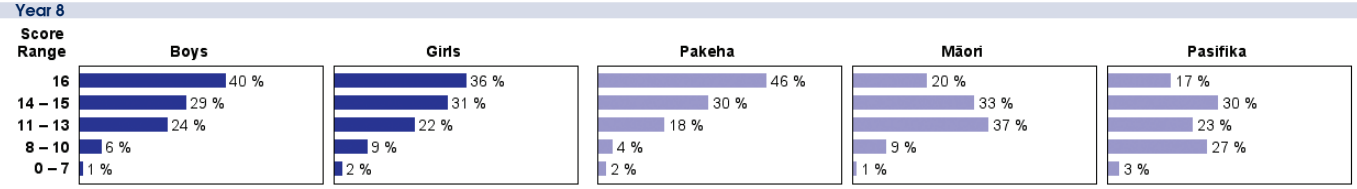
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
Total Score:	16	4 (5)	38 (35)
	14–15	8 (10)	30 (30)
	11–13	34 (27)	23 (25)
	8–10	19 (24)	7 (6)
	0–7	35 (34)	2 (4)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task focused on quick recall or derivation of basic subtraction facts. At both year levels, there was little change in performance between 2005 and 2009. Finding the first number in a subtraction, with the answer given, proved particularly difficult. Year 4 Māori students and year 8 Pasifika students scored substantially lower than their Pakeha counterparts.

Trend Task: Population Change

Approach:	Station	Year:	4 & 8
Focus:	Understanding place value		
Resources:	Computer program on laptop computer		

Questions / instructions:

This activity uses the computer.

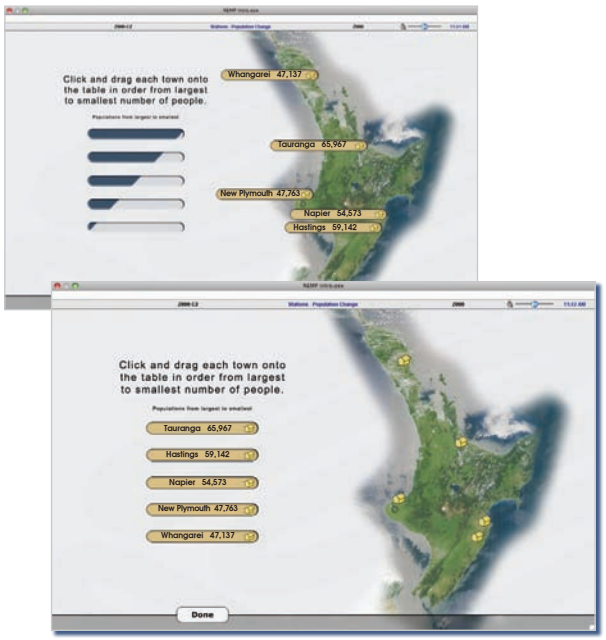
Click on the button which says **Population Change**. The computer will tell you what to do.

VIDEO VOICEOVER:

You are going to order some numbers.

On the screen you will see numbers that show how many people live in some North Island towns.

Click and drag each town onto the table in order from the largest to the smallest number of people.

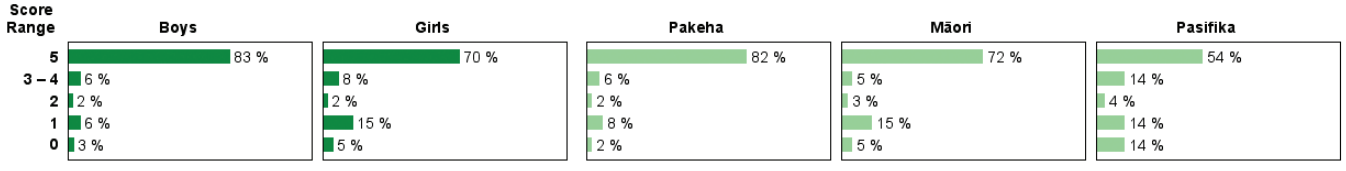


[Population figures based on 2005, as at time of task development.]

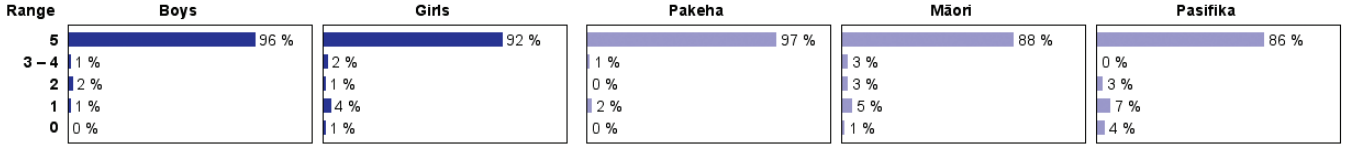
				% response 2009 ('05) year 4	year 8
Ordered as:	1st	Tauranga	65,967	87 (80)	98 (95)
	2nd	Hastings	59,142	86 (69)	96 (93)
	3rd	Napier	54,573	81 (86)	96 (97)
	4th	New Plymouth	47,763	83 (69)	96 (94)
	5th	Whangarei	47,137	80 (75)	95 (94)
Total Score:			5	76 (64)	94 (92)
			3–4	7 (12)	2 (2)
			2	3 (3)	1 (1)
			1	10 (17)	2 (4)
			0	4 (4)	1 (1)

Subgroup Analyses:

Year 4



Year 8



Commentary:

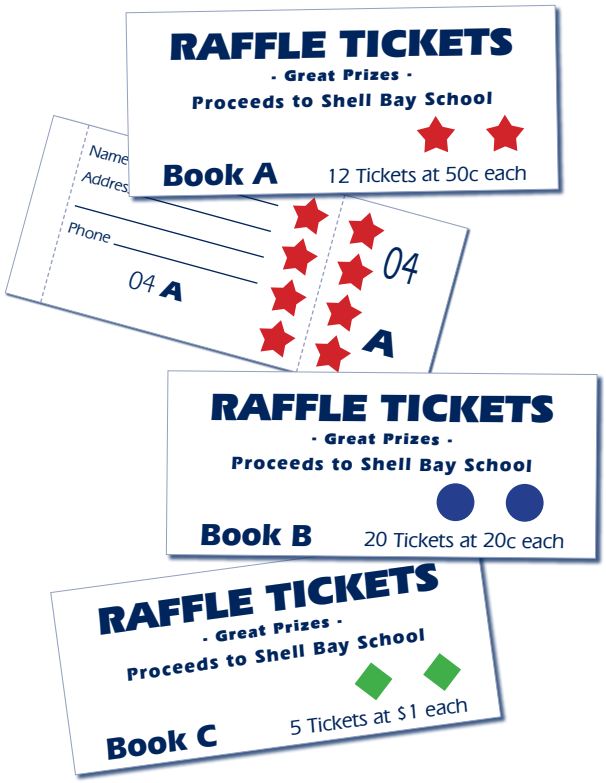
Placing the five towns in order by size proved easy for most students. Between 2005 and 2009 the performance of year 4 students improved a little, with no meaningful change for year 8 students. Year 4 boys scored significantly higher than year 4 girls.

Approach:	Station
Focus:	Multiplication
Resources:	3 booklets of raffle tickets, answer booklet
Year:	4 & 8

Questions / instructions:

Look at the three booklets of raffle tickets.

Each booklet has a different number of tickets, and each booklet has a different ticket price.



If each booklet of raffle tickets was sold, which booklet would make the **most** money?

Tick the best answer.

		% response 2009 ('05) year 4	year 8
Booklet A	✓	30 (33)	66 (74)
Booklet B		33 (29)	16 (13)
Booklet C		33 (37)	14 (8)

Total Score:			
	2	30 (33)	66 (74)
	1	33 (37)	14 (8)
	0	37 (30)	20 (18)

Subgroup Analyses:

Year 4

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
2	29 %	30 %	34 %	25 %	12 %
1	35 %	32 %	32 %	34 %	38 %
0	36 %	38 %	34 %	41 %	50 %

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
2	64 %	68 %	68 %	62 %	48 %
1	15 %	13 %	13 %	16 %	30 %
0	21 %	19 %	19 %	22 %	22 %

Commentary:

Solving this task involved multiplication or repeated addition of individual ticket costs for each booklet of tickets. Because almost equal percentages of year 4 students chose each option, there is very little evidence of this capability for year 4 students. Performance at both year levels was a little lower in 2009 than in 2005. At both year levels, Māori students performed similarly to Pakeha students.

Trend Task: What Next?

NEMP Access Task

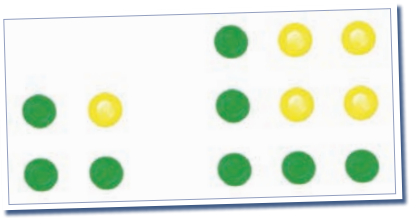
Approach:	Station
Focus:	Patterns and relationships
Resources:	Picture, green and yellow pencils, answer booklet

Year: 4 & 8

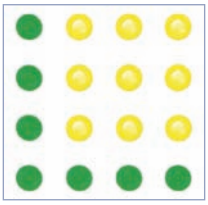
Questions / instructions:

Look at the picture.

It shows a pattern made with counters.



1. Use the green and yellow pencils to draw the next pattern – pattern number 3.



	% response 2009 ('05) year 4	% response 2009 ('05) year 8
pattern drawn appropriately	25 (31)	53 (71)

YEAR 8 ONLY:

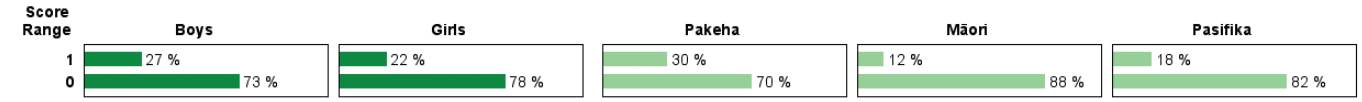
2. This table shows the pattern in numbers. Finish the table by filling in the missing numbers.

Pattern	Green	Yellow		% response 2009 ('05) year 8
1	3	1		
2	5	4		
3	7	9	both correct	43 (47)
			one correct	36 (36)
4	9	16	both correct	29 (30)
			one correct	46 (48)
5	11	25	both correct	23 (27)
			one correct	50 (48)
100	201	10 000	both correct	3 (5)
			one correct	5 (7)

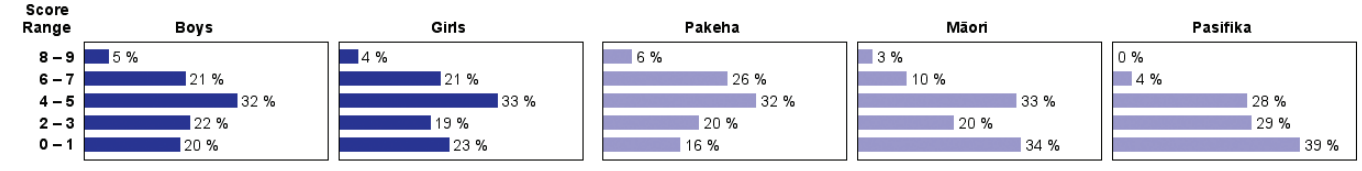
Total Score:	% response 2009 ('05) year 8
8–9	5 (9)
6–7	21 (23)
4–5	32 (33)
2–3	20 (16)
0–1	22 (19)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task involved recognition and extrapolation of patterns. Very few year 8 students managed the final step of generalising the pattern to the 100th step. Performance dropped a little for both year 4 and year 8 students between 2005 and 2009. At year 8 level, Pasifika students were much less successful, on average, than Pakeha students.

Approach:	Independent	Year:	4 & 8
Focus:	Addition and subtraction; place value		
Resources:	Answer booklet		

Questions / instructions:

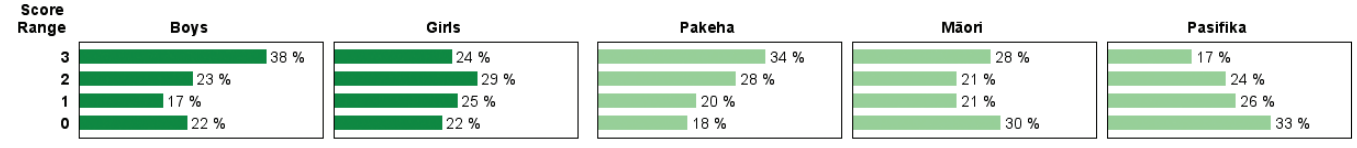
Imagine you have a time machine. You can travel in it from this year (2005) back to the past and forward to the future. The trip meter can be set to show you what year you will travel to.

	% response 2009 ('05) year 4	% response 2009 ('05) year 8
1. Write what the trip meter will show if the time machine travels **two years into the future** from: 2005 → 2007	77 (76)	98 (95)
2. Write what the trip meter will show if the time machine travels **twenty years into the future** from: 2005 → 2025	57 (51)	94 (89)
3. Write what the trip meter will show if the time machine travels **two hundred years into the future** from: 2005 → 2205	32 (29)	85 (82)
YEAR 8 ONLY:		
4. Write what the trip meter will show if the time machine travels **two thousand years into the future** from: 2005 → 4005		88 (81)
5. Write what the trip meter will show if the time machine travels **two years back to the past** from: 2005 → 2003		96 (92)
6. Write what the trip meter will show if the time machine travels **twenty years back to the past** from: 2005 → 1985		74 (69)
7. Write what the trip meter will show if the time machine travels **two hundred years back to the past** from: 2005 → 1805		64 (63)
8. Write what the trip meter will show if the time machine travels **two thousand years back to the past** from: 2005 → 0005 *(zeros were left out)*		72 (66)

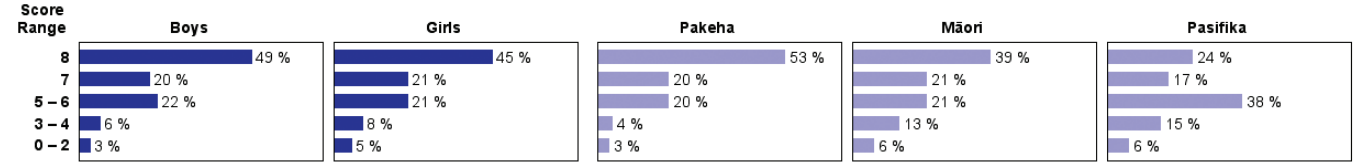
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
Y4 total score:	3	31 (27)	
	2	26 (24)	
	1	21 (27)	
	0	22 (22)	
Y8 total score:	8		47 (37)
	7		20 (25)
	5–6		22 (23)
	3–4		7 (8)
	0–2		4 (7)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Between 2005 and 2009 there was a small improvement for year 8 students. Year 4 students were much less successful in changing the hundreds digit than the tens or ones digit.

Trend Task: Muffin Mix

Approach:	Independent
Focus:	Double and triple fractions and whole numbers
Resources:	Answer booklet

Year: 4 & 8

Questions / instructions:

This recipe makes 10 muffins.

For 10 Muffins:

- 2 eggs
- $1\frac{1}{2}$ cups of self-raising flour
- $\frac{3}{4}$ cup of milk
- $\frac{1}{4}$ cup of sugar
- $\frac{2}{3}$ cup of diced apple
- 75 grams of butter

YEAR 4:

1. For each ingredient write down how much you would need to make **20** muffins.

	% response 2009 ('05) year 4
4 eggs	66 (69)
$\frac{1}{2}$ cup of sugar	14 (37)
3 cups of self-raising flour	13 (16)
$1\frac{1}{3}$ or $\frac{4}{3}$ cups of diced apple	11 (13)
$1\frac{1}{2}$ or $1\frac{2}{4}$ or $\frac{6}{4}$ cups of milk	10 (9)
150 grams of butter	26 (22)

Total Score:	% response 2009 ('05) year 4
5–6	6 (7)
3–4	11 (17)
1–2	53 (48)
0	30 (28)

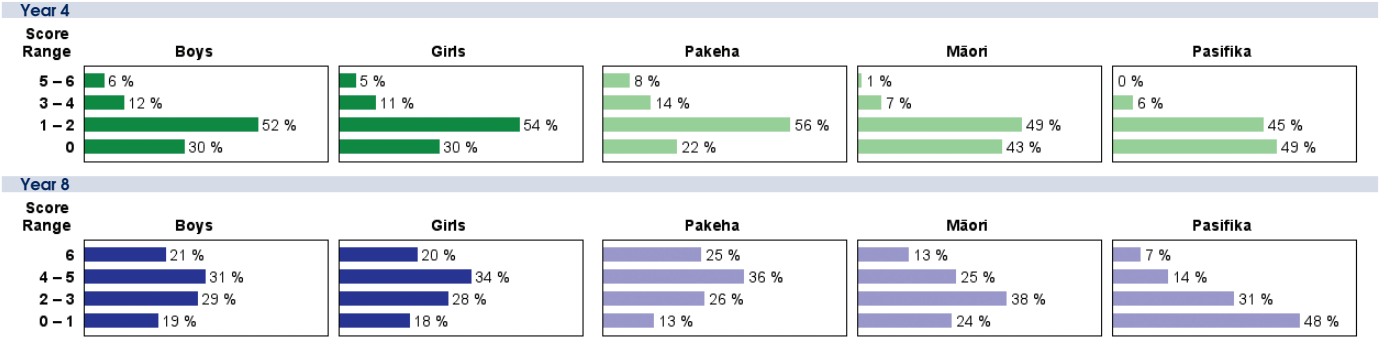
YEAR 8:

1. For each ingredient write down how much you would need to make **30** muffins.

	% response 2009 ('05) year 8
6 eggs	88 (88)
$\frac{3}{4}$ cup of sugar	70 (66)
$4\frac{1}{2}$ cups of self-raising flour	60 (60)
2 cups of diced apple	39 (31)
$2\frac{1}{4}$ cups of milk	38 (32)
225 grams of butter	60 (62)

Total Score:	% response 2009 ('05) year 8
6	21 (16)
4–5	32 (35)
2–3	29 (30)
0–1	18 (19)

Subgroup Analyses:



Commentary:

The tasks were different for year 4 and year 8 students, so their results cannot be compared directly. There was little change in performance from 2005 to 2009 at both year levels. Pasifika students averaged much lower than Pakeha students at year 8 level.

NEMP Access Task

Approach:	One to one	Year:	4
Focus:	Fractions of an amount		
Resources:	24 multilink blocks, 4 cards		

Questions / instructions:

Hand students 24 multilink blocks and card 1. $\frac{1}{2}$

Here are 24 blocks.

		% response 2009 ('05) year 4
1. What is $\frac{1}{2}$ of 24?	12	77 (79)
Tell me how you worked this out. You can use the blocks if you want to.		
Calculation strategy:	24 ÷ 2 = 12	2 (4)
	2 × 12 = 24; 12 + 12 = 24	22 (23)
	2 equal groups with blocks, count 1 group	26 (23)
	any other appropriate strategy	21 (30)

Hand student card 2. $\frac{1}{4}$

2. What is $\frac{1}{4}$ of 24?	6	53 (54)
Tell me how you worked this out. You can use the blocks if you want to.		
Calculation strategy:	24 ÷ 4 = 6	2 (2)
	4 × 6 = 24	4 (2)
	4 equal groups with blocks, count 1 group	18 (12)
	any other appropriate strategy	29 (37)

Hand student card 3. $\frac{1}{3}$

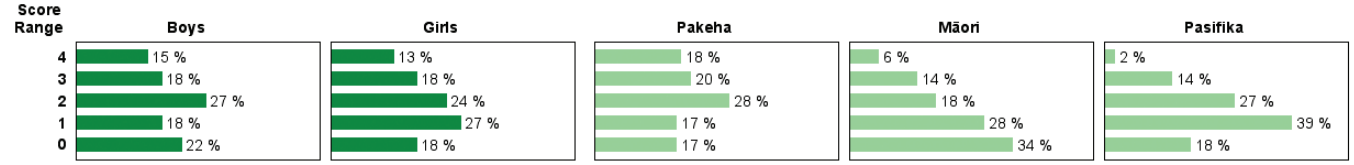
3. What is $\frac{1}{3}$ of 24?	8	36 (34)
Tell me how you worked this out. You can use the blocks if you want to.		
Calculation strategy:	24 ÷ 3 = 8	2 (2)
	3 × 8= 24	5 (5)
	3 equal groups with blocks, count 1 group	22 (21)
	any other appropriate strategy	5 (6)

Hand student card 4. $\frac{2}{3}$

4. What is $\frac{2}{3}$ of 24?	16	16 (13)
Tell me how you worked this out. You can use the blocks if you want to.		
Calculation strategy:		
	double question 3's answer	9 (5)
	24 ÷ 3 = 8 and 2 × 8 = 16	1 (1)
	3 × 8 = 24 and 2 × 8 = 16	1 (2)
	3 equal groups with blocks, count 2 groups	3 (3)
	any other appropriate strategy	2 (4)
Total Score:	4	14 (12)
	3	18 (18)
	2	26 (27)
	1	22 (26)
	0	20 (17)

Subgroup Analyses:

Year 4

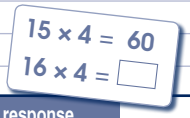


Commentary:

Very few students used division as a strategy. There was no meaningful change in performance between 2005 and 2009.

Trend Task: Work It Out (Y4)

Approach: One to one
Focus: Computation strategies
Resources: Card
Year: 4



Questions / instructions:

Hand card to student.

This card tells you that 15 times 4 is 60.
Use this fact to work out 16 times 4.

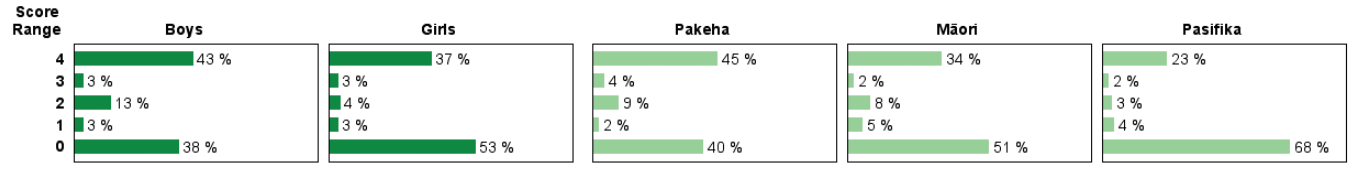
1. Tell me what you think the answer is. 64
2. Now tell me how you worked it out.

PROMPT: Can you explain that a bit more to me?

	% response 2009 ('05) year 4
explanation showing understanding that the answer must be 4 more than 60	41 (39)
another valid strategy that made use of information that 15 × 4 = 60	6 (4)
tried to directly calculate 16 × 4 *(i.e. did not make use of 15 × 4 = 60)*	6 (12)
any other response, including unclear explanation	47 (45)
Total Score: 4	40 (38)
3	3 (2)
2	9 (13)
1	3 (6)
0	45 (41)

Subgroup Analyses:

Year 4



Commentary:

About half of the year 4 students used an efficient number strategy to attempt to solve this task. Fifteen percent more boys than girls adopted such a strategy.

Trend Task: Addition (Y4)

Approach: Independent
Focus: Adding without a calculator
Resources: Answer booklet
Year: 4

Questions / instructions:

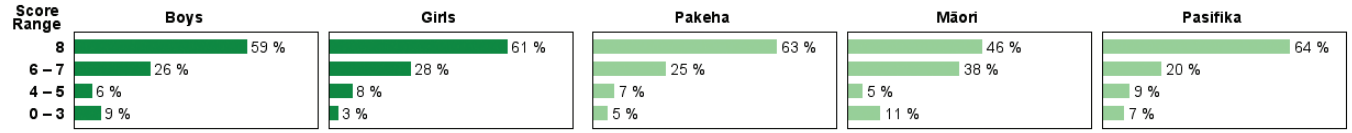
Work out the answers to the addition questions. Show how you work out your answers.

1. 5 + 1 + 2 = 8
2. 2 + 6 + 8 = 16
3. 4 + 2 + 9 + 5 + 3 = 23
4. 21 + 54 = 75

	% response 2009 ('05) year 4
Q1 correct	96 (93)
Q1 incorrect with clear computational error	0 (1)
Q1 incorrect/any other response	4 (6)
Q1 **Working used:** horizontal algorithm	26 (34)
Q1 vertical algorithm	0 (2)
Q2 correct	88 (88)
Q2 incorrect with clear computational error	1 (2)
Q2 incorrect/any other response	11 (10)
Q2 **Working used:** horizontal algorithm	26 (34)
Q2 vertical algorithm	0 (1)
Q3 correct	80 (75)
Q3 incorrect with clear computational error	2 (4)
Q3 incorrect/any other response	18 (21)
Q3 **Working used:** horizontal algorithm	24 (34)
Q3 vertical algorithm	0 (2)
Q4 correct	75 (68)
Q4 incorrect with clear computational error	2 (2)
Q4 incorrect/any other response	23 (30)
Q4 **Working used:** horizontal algorithm	22 (27)
Q4 vertical algorithm	2 (5)
Total Score: 8	60 (54)
6–7	27 (28)
4–5	7 (11)
0–3	6 (7)

Subgroup Analyses:

Year 4



Commentary:

Performance improved slightly from 2005 to 2009. Pasifika students performed very similarly to Pakeha students.

Trend Task: Multiplication (Y4)

Approach:	Independent	Year:	4
Focus:	Multiplying without a calculator		
Resources:	Answer booklet		

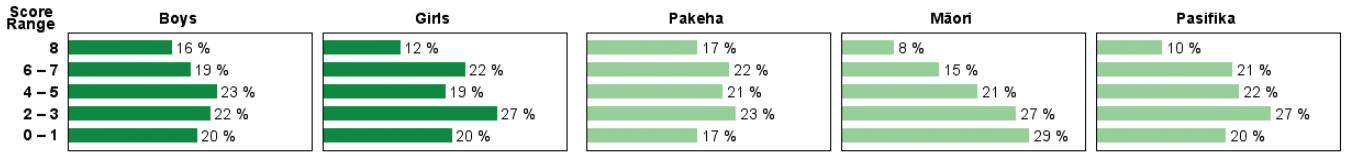
Questions / instructions:

Work out the answers to the multiplication questions. Show how you work out your answers.

		% response 2009 ('05) year 4
1. 6 × 7 = 42	correct	44 (48)
	incorrect with clear computational error	4 (3)
Working used:	multiplication	8 (13)
	addition	5 (7)
2. 2 × 14 = 28	correct	73 (71)
	incorrect with clear computational error	5 (2)
Working used:	multiplication	8 (11)
	addition	12 (12)
3. 22 × 3 = 66	correct	36 (49)
	incorrect with clear computational error	5 (2)
Working used:	multiplication	9 (12)
	addition	9 (10)
4. 19 × 4 = 76	correct	26 (28)
	incorrect with clear computational error	6 (3)
Working used:	multiplication	8 (11)
	addition	8 (9)
Total Score:	8	14 (18)
	6–7	21 (22)
	4–5	21 (21)
	2–3	24 (18)
	0–1	20 (21)

Subgroup Analyses:

Year 4



Commentary:

Year 4 students averaged slightly lower on these multiplication tasks in 2009 than in 2005. Only one of the four multiplications (2 x 14) was completed successfully by more than 50% of the students.

Trend Task: Consecutive Numbers

NEMP Access Task

Approach:	One to one	Year:	8
Focus:	Patterns, relationships, generalisations; verifying and proving		
Resources:	Card, calculator, recording book		

Questions / instructions:

Consecutive numbers are numbers that follow each other in order, like 1, 2, 3 or 9, 10, 11.

Hand student the *Consecutive Numbers* card.

Here is a card showing some sums with three consecutive numbers. Some people say that to add three consecutive numbers, you multiply the middle number by 3.

Hand out recording book, pencil, calculator.

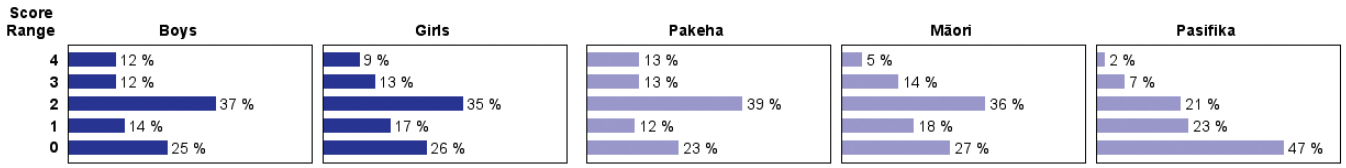
		% response 2009 ('05) year 8
1. Do you think this would always happen?	yes	73 (68)
	no	27 (32)
2. Explain to me why you think that.	generalisation *(middle number is always 1 less than biggest number and 1 more than smallest number, so multiplying the middle number by 3 will always give the same result as adding all three numbers together)*	10 (13)
	some explanation using one or more examples to justify	13 (11)
	some verification *(e.g. written/oral)* but not clear	36 (34)
	mathematical error justifying "no" as response to question 1	7 (15)
Total Score:	4	10 (13)
	3	13 (11)
	2	36 (34)
	1	15 (11)
	0	26 (31)

Some people say that to add three consecutive numbers, you multiply the middle number by 3.

9 + 10 + 11 = 30
19 + 20 + 21 = 60
99 + 100 + 101 = 300

Subgroup Analyses:

Year 8



Commentary:

While about three quarters of the year 8 students agreed that the sum of three consecutive whole numbers will always be the same as three times the middle number, only about one quarter could clearly explain why they gave that answer. On average, Pasifika students scored substantially lower than Pakeha and Māori students.

Trend Task: Fractious Fractions (Y8)

NEMP Access Task

Approach:	One to one
Focus:	Fractions of an amount
Resources:	24 multilink blocks, 4 cards
Year:	8

Questions / instructions:

Hand students 24 multilink blocks and card 1.

Here are 24 blocks. $\frac{1}{4}$

1. What is $\frac{1}{4}$ of 24? — 6

   Tell me how you worked this out.
   You can use the blocks if you want to.

   Calculation strategy:

	% response 2009 ('05) year 8
24 ÷ 4 = 6	26 (28)
4 × 6 = 24	20 (21)
4 equal groups with blocks, count 1 group	13 (16)
any other appropriate strategy	20 (18)

Hand student card 2. $\frac{2}{3}$

2. What is $\frac{2}{3}$ of 24? — 16 — 56 (51)

   Tell me how you worked this out.
   You can use the blocks if you want to.

   Calculation strategy:

	% response 2009 ('05) year 8
24 ÷ 3 = 8 and 2 × 8 = 16	24 (23)
3 × 8 = 24 and 2 × 8 = 16	14 (8)
3 equal groups with blocks, count 2 groups	14 (19)
any other appropriate strategy	5 (3)

Hand student card 3. $\frac{5}{6}$

3. What is $\frac{5}{6}$ of 24? — 20 — 56 (59)

   Tell me how you worked this out.
   You can use the blocks if you want to.

   Calculation strategy:

	% response 2009 ('05) year 8
24 ÷ 6 = 4 and 5 × 4 = 20	22 (24)
6 × 4 = 24 and 5 × 4 = 20	12 (8)
6 equal groups with blocks, count 5 groups	17 (25)
any other appropriate strategy	5 (5)

Remove the blocks from the student but leave them in sight. Hand student card 4. $1\frac{1}{2}$

4. If you had to find $1\frac{1}{2}$ lots of these blocks, how many would you need? — 36 — 53 (48)

   Tell me how you worked this out.
   You can use the blocks if you want to.

   Calculation strategy:

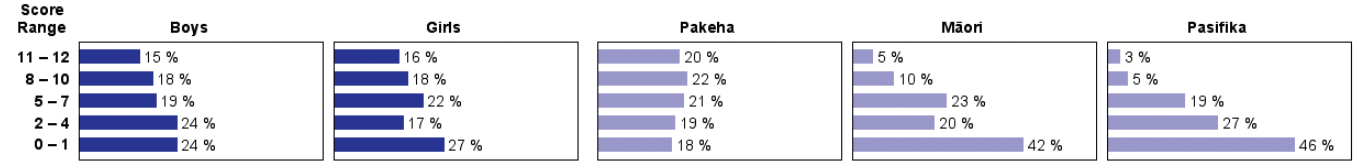
	% response 2009 ('05) year 8
24 ÷ 2 = 12 and 12 + 24 = 36; OR $\frac{1}{2}$ × 24 = 12 and 12 + 24 = 36	46 (47)
2 × 12 = 24 and 12 + 24 = 36	1 (0)
found $\frac{1}{2}$ of 24 blocks, added to 24	4 (0)
any other appropriate strategy	4 (4)

Total Score:

	% response 2009 ('05) year 8
11–12	15 (11)
8–10	18 (23)
5–7	21 (19)
2–4	20 (27)
0–1	26 (20)

Subgroup Analyses:

Year 8



Commentary:

There was no meaningful change in performance from 2005 to 2009. Both Māori and Pasifika students averaged substantially lower than Pakeha students.

Trend Task: Work It Out (Y8)

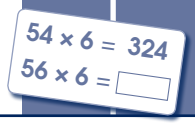
Approach:	One to one	Year:	8
Focus:	Computation strategies		
Resources:	Card		

Questions / instructions:

Hand card to student.

This card tells you that 54 times 6 is 324. Use this fact to work out 56 times 6.

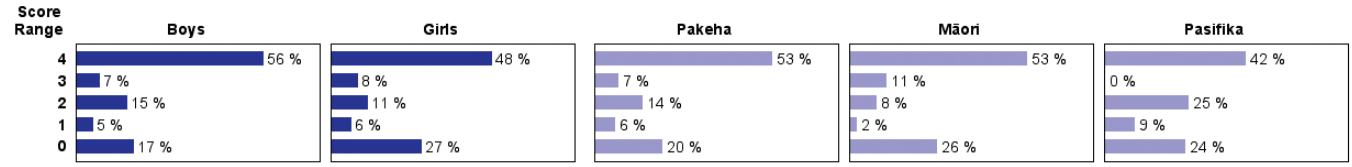
1. Tell me what you think the answer is. 336
2. Now tell me how you worked it out.
   PROMPT: Can you explain that a bit more to me?



	% response 2009 ('05) year 8
explanation show understanding that the answer must be 2 lots of six (12) more than 324	56 (42)
another valid strategy that made use of information that 54 × 6 = 324	5 (10)
tried to directly calculate 56 × 6 *(i.e. did not make use of 54 × 6 = 324)*	14 (18)
any other response, including unclear explanation	25 (30)
Total Score: 4	52 (39)
3	8 (7)
2	13 (20)
1	5 (9)
0	22 (25)

Subgroup Analyses:

Year 8



Commentary:

Between 2005 and 2009, the percentage of year 8 students using an efficient number strategy to solve this task increased substantially, leading to a smaller rise in success with the task. Boys did a little better than girls, on average, with only small differences between Pakeha, Māori and Pasifika students.

Trend Task: Which is Bigger? (Y8)

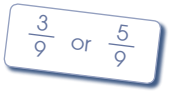
NEMP Access Task

Approach:	One to one	Year:	8
Focus:	Understanding fractions		
Resources:	3 fraction cards		

Questions / instructions:

I'm going to show you some cards with two fractions written on them. Try to work out which fraction is bigger and why.

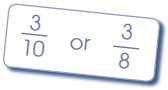
Hand student card 1. Read card to student.



1. Which fraction is bigger? $\frac{5}{9}$
2. Why is that fraction bigger?

	% response 2009 ('05) year 8
$\frac{5}{9}$ has more ninths than $\frac{3}{9}$	70 (72)
any other valid reason	39 (38)
	25 (23)

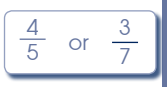
Hand student card 2. Read card to student.



3. Which fraction is bigger? $\frac{3}{8}$
4. Why is that fraction bigger?

eighths are bigger than tenths	75 (70)
any other valid response	38 (27)
	25 (26)

Hand student card 3. Read card to student.

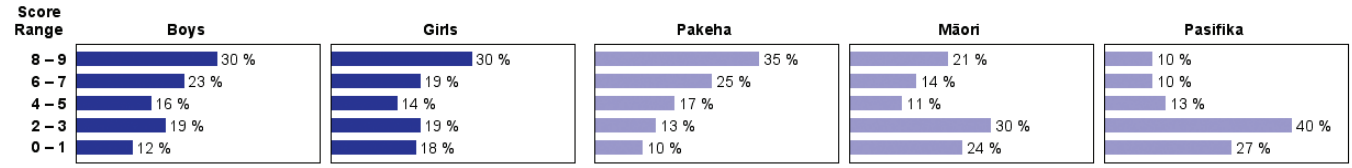


5. Which fraction is bigger? $\frac{4}{5}$
6. Why is that fraction bigger?

$\frac{4}{5}$ is almost a whole *(or more than half)*	75 (78)
and $\frac{3}{7}$ is less than half	29 (18)
any other valid response	28 (39)
Total Score: 8–9	30 (18)
6–7	21 (24)
4–5	15 (21)
2–3	20 (24)
0–1	14 (13)

Subgroup Analyses:

Year 8



Commentary:

Students were no better in 2009 than in 2005 at choosing which fraction in each pair was bigger, but more 2009 students gave good explanations for a correct choice. On average, Pakeha students scored substantially higher than Māori and Pasifika students.

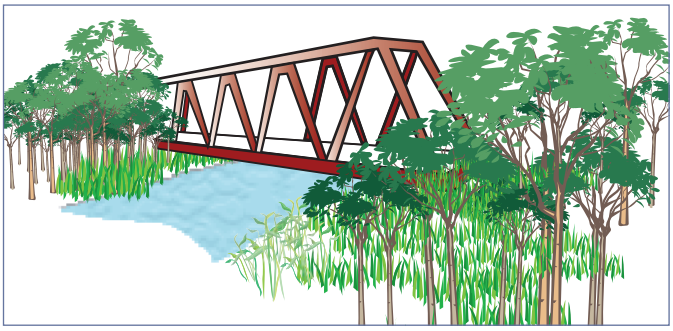
Trend Task: Bridge

NEMP Access Task

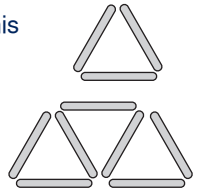
Approach:	Station	Year:	8
Focus:	Algebraic reasoning; patterns		
Resources:	16 iceblock sticks; answer booklet		

Questions / instructions:

This is a picture of a bridge.



With 3 sticks I can make this section of a bridge:



With 7 sticks I can make 3 sections of a bridge:

1. Use the sticks to make 5 sections of a bridge. Draw it here.

	% response 2009 ('05) year 8
5 sections shown	78 (71)
some sections shown	9 (11)

2. How many sticks would you need to make 11 sections of a bridge? 23

	% response 2009 ('05) year 8
	35 (45)

3. How did you work that out?

	% response 2009 ('05) year 8
clear description of general strategy	36 (30)
vague description of general strategy	21 (24)
drew the picture and counted	20 (22)

4. How many sticks would you need to make 100 sections of a bridge? 201

	% response 2009 ('05) year 8
	12 (16)

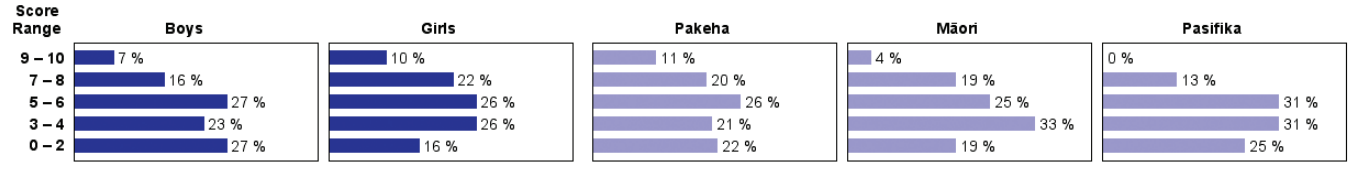
5 How did you work that out?

	% response 2009 ('05) year 8
clear description using equation	21 (17)
clear description using words	13 (16)
vague description of appropriate strategy	18 (20)

Total Score:	% response 2009 ('05) year 8
9–10	9 (11)
7–8	18 (14)
5–6	27 (28)
3–4	24 (22)
0–2	22 (25)

Subgroup Analyses:

Year 8



Commentary:

Performance on this task was very similar in 2005 and 2009. Girls scored significantly higher than boys. Differences between Pakeha, Māori and Pasifika students were quite small, on average, although few Pasifika students scored highly.

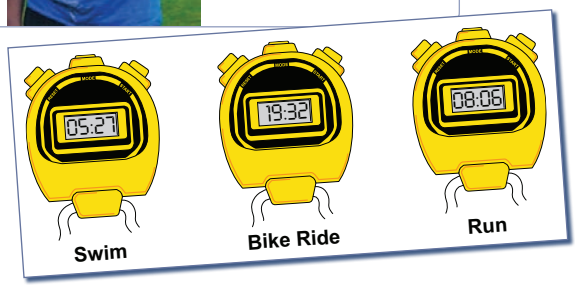
Trend Task: **Tryathlon**

Approach:	Station
Focus:	Problem solving; computation
Resources:	Stopwatch picture card; answer booklet

Year: 8

Questions / instructions:

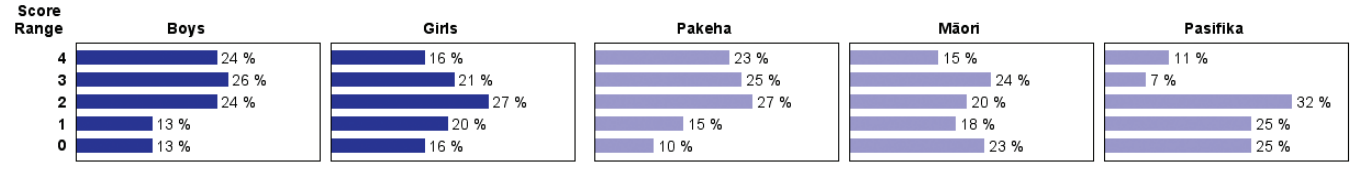
Matt did the Weet-Bix Tryathlon.
Look at how far he had to swim, run and ride.



		% response 2009 ('05) year 4	year 8
1. The pool used for the tryathlon was 25 metres long. How many lengths did Matt have to swim?	8		61 (70)
	4		8 (9)
2. The track used for the tryathlon was 500 metres long. How many laps of the track did Matt need to run?	3		62 (64)
3. Look at the times on the stopwatches. They show how long it took Matt to finish **each** part of the tryathlon. How long did it take Matt to do the whole tryathlon?			
	33 mins 5 secs		34 (30)
	32 mins 65 secs		28 (31)
Total Score:	4		20 (22)
	3		24 (23)
	2		26 (25)
	1		16 (19)
	0		14 (11)

Subgroup Analyses:

Year 8



Commentary:

Performance on this task was very similar in 2005 and 2009. Boys scored significantly higher than girls.

Trend Task: Addition (Y8)

Approach:	Independent
Focus:	Adding without a calculator
Resources:	Answer booklet

Year: 8

Questions / instructions:

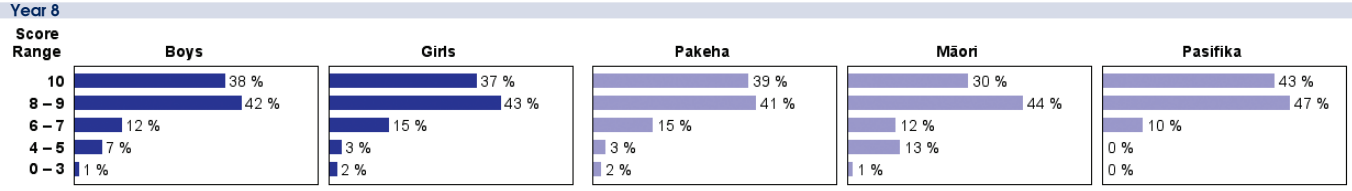
Work out the answers to the addition questions. Show how you work out your answers.

	% response 2009 ('05) year 8
1. 4 + 2 + 9 + 5 + 3 = 23 — correct	90 (85)
incorrect with clear computational error	4 (5)
incorrect/any other response	6 (10)
Working used: horizontal algorithm	49 (44)
vertical algorithm	5 (13)
2. 21 + 54 = 75 — correct	95 (95)
incorrect with clear computational error	2 (1)
incorrect/any other response	3 (4)
Working used: horizontal algorithm	37 (23)
vertical algorithm	18 (32)
3. 76 + 48 = 124 — correct	82 (80)
incorrect with clear computational error	5 (5)
incorrect/any other response	13 (15)
Working used: horizontal algorithm	36 (22)
vertical algorithm	21 (35)
4. 389 + 217 = 606 — correct	77 (78)
incorrect with clear computational error	7 (5)
incorrect/any other response	16 (17)
Working used: horizontal algorithm	35 (20)
vertical algorithm	26 (40)
5. 49 + 103 + 51 + 97 + 260 = 560	
correct	60 (62)
incorrect with clear computational error	15 (12)
incorrect/any other response	25 (26)
Working used: horizontal algorithm	39 (23)
vertical algorithm	25 (39)

Total Score:	% response 2009 ('05) year 8
10	38 (43)
8–9	42 (34)
6–7	14 (13)
4–5	5 (6)
0–3	1 (4)

Subgroup Analyses:

Year 8



Commentary:

This task is notable for the high performance of Pasifika students. Overall, performance in 2009 is very similar to performance in 2005.

Trend Task: **Pointless**

Approach:	Independent
Focus:	Number knowledge/estimation
Resources:	Answer booklet

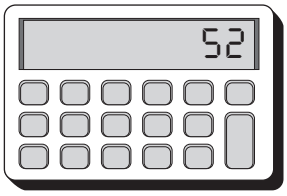
Year: 8

Questions / instructions:

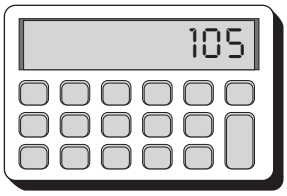
A boy used a calculator to work out some number problems.

There is something wrong with his calculator. It doesn't show the decimal point.

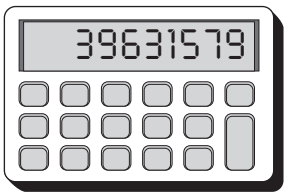
For each problem, put the decimal point where you think it should go. Make sure your decimal point is easy to read.



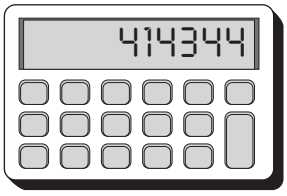
26 ÷ 5 = 5.2



1.5 × 7 = 10.5



753 ÷ 19 = 39.631579

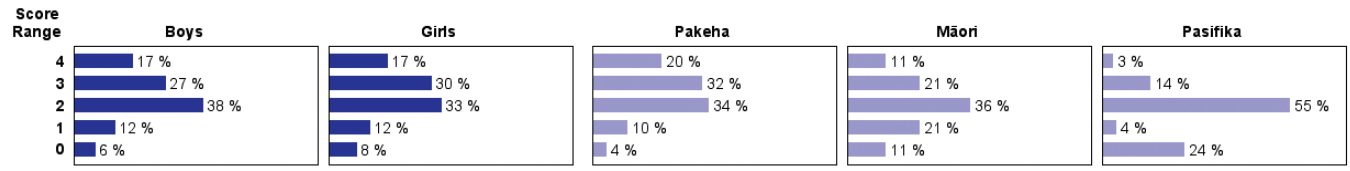


211.4 × 196 = 41434.4

	% response 2009 ('05) year 8		% response 2009 ('05) year 8
	89 (85)		
	78 (74)		
	39 (37)		
	30 (30)	Total Score: 4	17 (18)
		3	28 (23)
		2	36 (35)
		1	12 (15)
		0	7 (9)

Subgroup Analyses:

Year 8



Commentary:

Overall, performance is very similar in 2005 and 2009. On average, Pasifika students scored substantially lower than Pakeha students. Estimation skills for computations involving larger numbers appear to be weak.

Trend Task: Multiplication (Y8)

Approach:	Independent
Focus:	Multiplying without a calculator
Resources:	Answer booklet
Year:	8

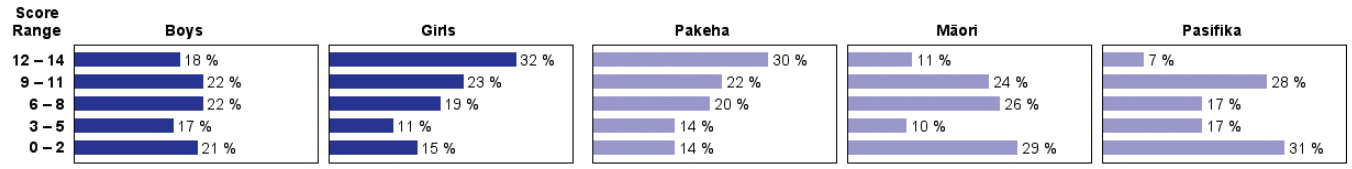
Questions / instructions:

Work out the answers to the multiplication questions. Show how you work out your answers.

		% response 2009 ('05) year 8
1. 22 × 3 = 66	correct	88 (93)
	incorrect with clear computational error	2 (0)
Working used:	horizontal strategy	39 (22)
	vertical algorithm	17 (39)
2. 39 × 6 = 234	correct	56 (63)
	incorrect with clear computational error	7 (4)
Working used:	horizontal strategy	37 (18)
	vertical algorithm	22 (48)
3. 4 × 421 = 1684	correct	64 (63)
	incorrect with clear computational error	6 (7)
Working used:	horizontal strategy	36 (16)
	vertical algorithm	22 (50)
4. 596 × 2 = 1192	correct	64 (75)
	incorrect with clear computational error	7 (6)
Working used:	horizontal strategy	33 (13)
	vertical algorithm	24 (54)
5. 5 × 2808 = 14040	correct	47 (61)
	incorrect with clear computational error	8 (4)
Working used:	horizontal strategy	30 (11)
	vertical algorithm	24 (53)
6. 59 × 32 = 1888	correct	25 (44)
	incorrect with clear computational error	7 (11)
Working used:	horizontal strategy	23 (5)
	vertical algorithm	27 (57)
7. 64 × 4037 = 258368	correct	17 (30)
	incorrect with clear computational error	7 (5)
Working used:	horizontal strategy	14 (4)
	vertical algorithm	29 (53)
Total Score:	12–14	24 (39)
	9–11	23 (22)
	6–8	21 (19)
	3–5	14 (8)
	0–2	18 (12)

Subgroup Analyses:

Year 8



Commentary:

There has been a large decrease in performance between 2005 and 2009, particularly where computation involved carrying or where both numbers included two or more digits. Strategy explanations show major change from vertical (algorithmic) strategies to horizontal strategies. Girls scored significantly higher than boys.

Task: Number Line Places

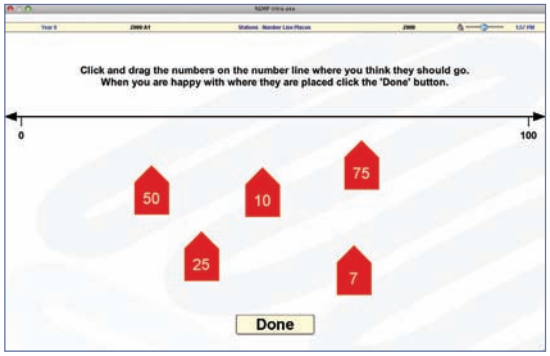
Approach:	Station	Year:	4 & 8
Focus:	Fractions, decimals, percentages		
Resources:	Computer program on laptop computer		

Questions / instructions:

This activity uses the computer.

Click on the button that says ***Number Line Places***.
[Instructions given as voice-over as well as on screen.]

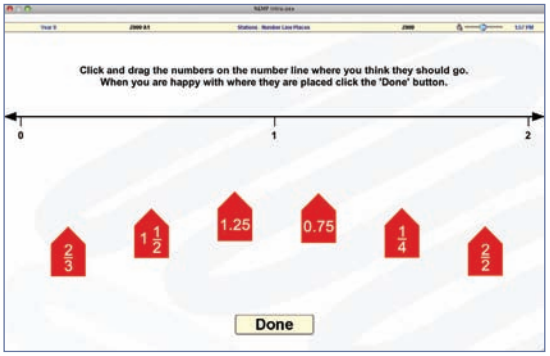
VOICE-OVER:
Click and drag the numbers onto the number line where you think they should go. When you are happy with where they are, click the 'Done' button.



	% responses y4	% responses y8
7 placed between 2 and 12	76	91
10 placed between 5 and 15	24	64
25 placed between 20 and 30	23	59
50 placed between 45 and 55	32	80
75 placed between 70 and 80	36	76

Y4 Total Score:	% responses y4	% responses y8
4–5	14	15
3	17	20
2	24	24
1	29	17
0	16	24

YEAR 8 ONLY:

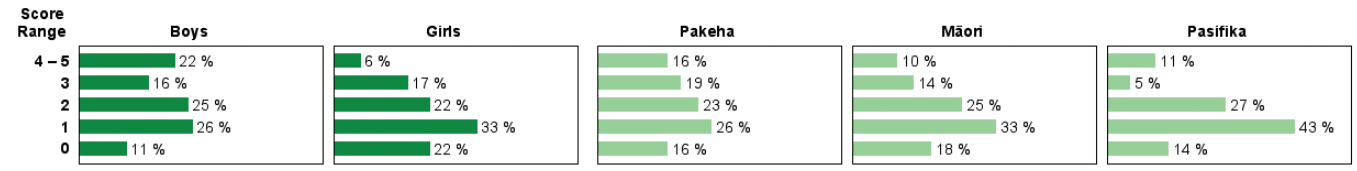


	% responses y4	% responses y8
$\frac{1}{4}$ placed between 0.15 and 0.35		44
$\frac{2}{3}$ placed between 0.56 and 0.76		25
$\frac{3}{4}$ placed between 0.65 and 0.85		56
$\frac{2}{2}$ placed between 0.90 and 1.10		35
1.25 placed between 1.15 and 1.35		68
$1\frac{1}{2}$ placed between 1.40 and 1.60		75
$\frac{2}{3}$ placed before $\frac{3}{4}$		35

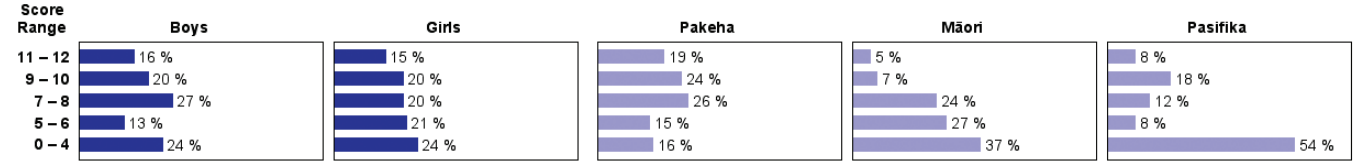
Y8 Total Score:	% responses y4	% responses y8
11–12		15
9–10		20
7–8		24
5–6		17
0–4		24

Subgroup Analyses:

Year 4



Year 8



Commentary:

On average, year 8 students were much more successful than year 4 students in placing numbers appropriately on the 0 to 100 scale. Year 4 boys were significantly more successful than year 4 girls, but there was little difference at year 8 level, where Pakeha students were substantially more successful than Māori and Pasifika students.

Task: Fraction Problems

Approach:	Station
Focus:	Calculations with fractions
Resources:	Answer booklet
Year:	4 & 8

Questions / instructions:

1. Write your answers to the fraction problems in the boxes.

a. $\frac{1}{2} + \frac{1}{2} =$ ☐

b. $3 + \frac{1}{4} =$ ☐

c. $\frac{1}{4} + \frac{2}{4} =$ ☐

d. $1 - \frac{1}{2} =$ ☐

e. $\frac{3}{4} - \frac{1}{4} =$ ☐

f. $\frac{3}{4} + \frac{3}{4} =$ ☐

YEAR 8 ONLY:

g. $2 \div \frac{1}{4} =$ ☐

h. $\frac{1}{4} \times \frac{1}{2} =$ ☐

i. $1\frac{1}{3} \div \frac{1}{3} =$ ☐

j. $\frac{1}{4} \div 2 =$ ☐

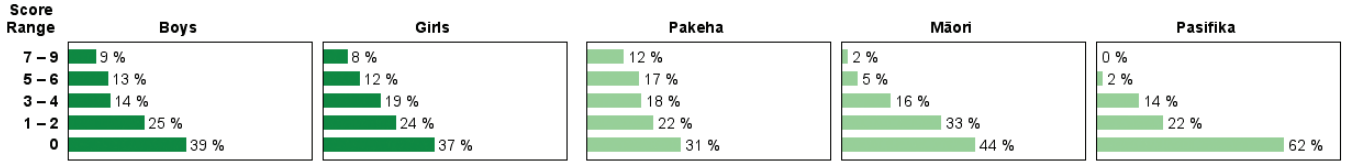
	% responses y4	% responses y8
a. 1	42	70
a. $\frac{2}{2}$	6	5
a. ✗ $\frac{2}{4}$	15	12
b. $3\frac{1}{4}$	19	63
c. $\frac{3}{4}$	30	70
c. ✗ $\frac{3}{8}$	22	14
d. $\frac{1}{2}$	26	62
e. $\frac{1}{2}$	7	18
e. $\frac{2}{4}$	23	48
f. $1\frac{1}{2}$	7	25
f. $1\frac{2}{4}$	5	17
f. $\frac{6}{4}$	11	9
f. ✗ $\frac{6}{8}$	26	20
g. 8		19
g. ✗ $\frac{1}{2}$ or $\frac{2}{4}$		18
h. $\frac{1}{8}$		24
h. ✗ $\frac{1}{4}$		3
i. 4		19
i. ✗ $\frac{4}{3}$		4
j. $\frac{1}{8}$		19
j. ✗ $\frac{1}{2}$		10

Y4 Total Score:	% responses y4	% responses y8
7–9	8	
5–6	13	
3–4	17	
1–2	24	
0	38	

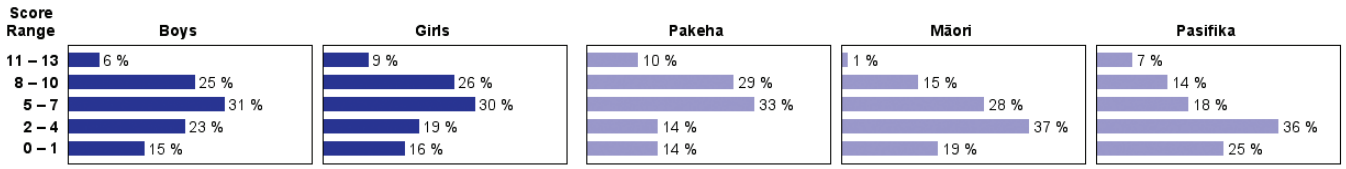
Y8 Total Score:	% responses y4	% responses y8
11–13		8
8–10		25
5–7		30
2–4		21
0–1		16

Subgroup Analyses:

Year 4



Year 8



Commentary:

All except the first component proved very difficult for year 4 students, with less than 30% succeeding with each component. The additional components for year 8 students also had low success rates.

Task: Less Than

Approach: Independent
Year: 4 & 8
Focus: Place and total value
Resources: Answer booklet

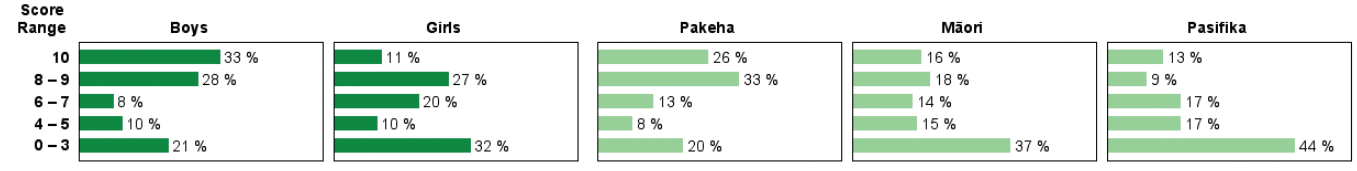
Questions / instructions:

			% responses y4	% responses y8
What is 1 less than:	a) 16	15	92	94
	b) 330	329	78	93
Year 4 only:	c) 999	998	83	
Year 8 only:	c) 1.7	0.7		50
What is 10 less than:	d) 184	174	66	91
	e) 1655	1645	59	88
What is 100 less than:	f) 327	227	69	90
	g) 1023	923	40	76
	h) 1225	1125	52	88
What is 1000 less than:	i) 3459	2459	59	87
	j) 27492	26492	39	81
YEAR 8 ONLY:				
What is .01 less than:	k) 3.25	3.24		76
	l) 10.1	10.09		22
	m) 20.99	20.98		78

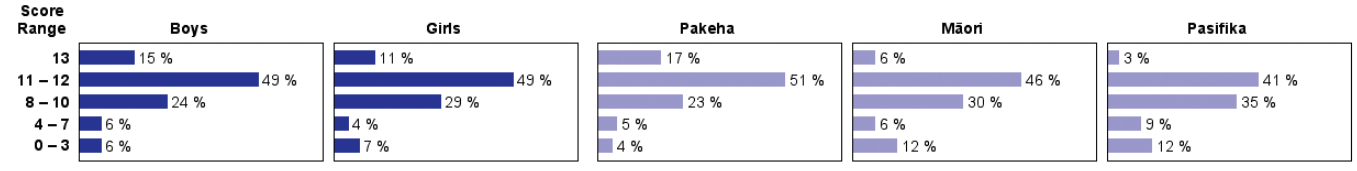
		% responses y4	% responses y8
Y4 Total Score:	10	22	
	8–9	27	
	6–7	14	
	4–5	11	
	0–3	26	
Y8 Total Score:	13		13
	11–12		49
	8–10		26
	4–7		6
	0–3		6

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students at both year levels enjoyed quite good success with this task, except when subtracting 1000 from 27,492 at year 4 level or .01 from 10.1 at year 8 level. Year 4 boys scored significantly higher than year 4 girls and many year 4 Māori and Pasifika students found the task difficult.

LINK TASK: 1

Approach:	One to one
Year:	4 & 8
Focus:	Solving word problems

		% responses y4	% responses y8
Total Score:	5	–	28
	4	–	15
	3	6	22
	2	33	18
	1	13	8
	0	48	9

LINK TASK: 2

Approach:	One to one
Year:	4 & 8
Focus:	Number knowledge

		% responses y4	% responses y8
Total Score:	5–6	6	40
	3–4	19	25
	1–2	38	23
	0	37	12

LINK TASK: 3

Approach:	One to one
Year:	4 & 8
Focus:	Place value; addition and subtraction using Dean's blocks

		% responses y4	% responses y8
Y4 Total Score:	9	64	
	7–8	12	
	5–6	9	
	0–4	15	
Y8 Total Score:	13		40
	12		17
	11		26
	0–10		17

LINK TASK: 4

Approach:	One to one
Year:	4 & 8
Focus:	Recording numbers; place and total value

		% responses y4	% responses y8
Total Score:	9	12	63
	8	14	17
	6–7	36	14
	0–5	38	6

LINK TASK: 5

Approach:	Station
Year:	4 & 8
Focus:	Number knowledge; computation strategy

		% responses y4	% responses y8
Y4 Total Score:	19–24	11	
	13–18	24	
	7–12	18	
	1–6	9	
	0	38	
Y8 Total Score:	29–36		12
	21–28		26
	11–20		26
	1–10		14
	0		22

LINK TASK: 6

Approach:	Station
Year:	4 & 8
Focus:	Fractions; number strategy

		% responses y4	% responses y8
Y4 Total Score:	2	40	
	1	31	
	0	29	
Y8 Total Score:	3		53
	2		29
	1		12
	0		6

LINK TASK: 7

Approach:	Independent
Year:	4 & 8
Focus:	Dividing without a calculator

		% responses y4	% responses y8
Y4 Total Score:	5–6	10	
	3–4	43	
	1–2	13	
	0	34	
Y8 Total Score:	9–10		15
	7–8		17
	5–6		21
	3–4		41
	0–2		6

LINK TASK: 8

Approach:	Independent
Year:	4 & 8
Focus:	Subtraction calculation

		% responses y4	% responses y8
Y4 Total Score:	5	15	
	3–4	30	
	2	18	
	0–1	37	
Y8 Total Score:	9		19
	7–8		33
	5–6		19
	3–4		16
	0–2		13

		% responses y4	% responses y8
LINK TASK: 9			
Approach:	Station		
Year:	4 & 8		
Focus:	Calculations with word problem fractions		
Y4 Total Score:	8–10	12	
	6–7	14	
	4–5	24	
	2–3	21	
	0–1	29	
Y8 Total Score:	13–14		17
	11–12		24
	8–10		28
	5–7		19
	0–4		12
LINK TASK: 10			
Approach:	Independent		
Year:	4 & 8		
Focus:	Equivalence		
Total Score:	6	7	42
	4–5	10	23
	2–3	17	13
	1	41	14
	0	25	8
LINK TASK: 11			
Approach:	Independent		
Year:	4 & 8		
Focus:	Place value		
Total Score:	10	20	57
	9	24	29
	7–8	23	8
	5–6	14	2
	0–4	19	4
LINK TASK: 12			
Approach:	One to one		
Year:	4		
Focus:	Place and total value		
Total Score:	4	15	
	3	19	
	2	14	
	1	7	
	0	45	
LINK TASK: 13			
Approach:	Station		
Year:	4		
Focus:	Patterns; using algebraic reasoning		
Total Score:	3	27	
	2	25	
	1	33	
	0	15	

		% responses y4	% responses y8
LINK TASK: 14			
Approach:	Independent		
Year:	4		
Focus:	Identifying forwards and backwards counting patterns		
Total Score:	12	29	
	10–11	19	
	8–9	21	
	5–7	11	
	0–4	20	
LINK TASK: 15			
Approach:	Independent		
Year:	4		
Focus:	Solving problems using a mix of operations		
Total Score:	4	21	
	3	20	
	2	16	
	1	16	
	0	27	
LINK TASK: 16			
Approach:	Independent		
Year:	4		
Focus:	Place and total value		
Total Score:	10	25	
	8–9	26	
	6–7	13	
	4–5	12	
	0–3	24	
LINK TASK: 17			
Approach:	One to one		
Year:	8		
Focus:	Place and total value		
Total Score:	6		35
	5		17
	4		24
	3		13
	0–2		11
LINK TASK: 18			
Approach:	One to one		
Year:	8		
Focus:	Number strategy		
Total Score:	4		17
	3		30
	2		28
	1		21
	0		4

LINK TASK: 19

Approach: Station
Year: 8
Focus: Patterns; using algebraic reasoning

Total Score:	% responses y8
6–7	5
4–5	25
2–3	55
0–1	15

LINK TASK: 20

Approach: Independent
Year: 8
Focus: Converting fractions, decimals and percentages

Total Score:	% responses y8
11–12	14
8–10	19
5–7	21
2–4	23
0–1	23

LINK TASK: 21

Approach: Independent
Year: 8
Focus: Identifying forwards and backwards counting patterns

Total Score:	% responses y8
15	35
12–14	28
9–11	18
6–8	13
0–5	6

LINK TASK: 22

Approach: Independent
Year: 8
Focus: Solving problems using a mix of operations

Total Score:	% responses y8
6–7	11
4–5	26
2–3	30
0–1	33

LINK TASK: 23

Approach: Independent
Year: 8
Focus: Place and total value

Total Score:	% responses y8
13	16
11–12	39
9–10	29
7–8	8
0–6	8

LINK TASK: 24

Approach: Independent
Year: 8
Focus: Equivalence; inverse operations

Total Score:	% responses y8
9–10	20
6–8	16
4–5	19
2–3	18
0–1	27

LINK TASK: 25

Approach: Independent
Year: 8
Focus: Fractions; solving problems

Total Score:	% responses y8
6	22
4–5	21
2–3	40
0–1	17

LINK TASK: 26

Approach: Independent
Year: 8
Focus: Identifying numbers, especially decimals, on a number line

Total Score:	% responses y8
7	22
5–6	28
3–4	34
0–2	16

4 Measurement

Overview: Year 8 students performed substantially better than year 4 students on mathematics tasks involving measurement, with an average of 28% more year 8 than year 4 students succeeding on the same measurement task components. On average, there was no change in measurement task performance between 2005 and 2009 for year 4 students, but a slight decrease for year 8 students. Estimation skills appeared to be weaker than most other measurement skills.

The assessments included 25 tasks investigating students' understandings, processes and skills in the area of mathematics called measurement. Measurement includes knowledge, understanding and use of systems of measurement, the use of measurement apparatus, and processes of predicting, calculating and recording. This chapter includes tasks relating to money.

Eleven of the 25 tasks are trend tasks (fully described with data for both 2005 and 2009), two are released tasks (fully described with data for 2009 only), and 12 are link tasks (to be used again in 2010, so only partially described here). Trend tasks are presented first, then released tasks and finally link tasks.

Strong progress was evident between year 4 and year 8. Averaged across 95 task components administered to both year 4 and year 8 students, 28% more year 8 than year 4 students succeeded with these components. Year 8 students performed better on all except two of the components. As expected, the differences were generally larger on more difficult tasks. These often were tasks that many year 4 students would not yet have had much experience with, in or out of school.

Overall, there was no evidence of change between 2005 and 2009 in the measurement capabilities of year 4 students, but a very slight reduction in the performance of year 8 students. Averaged across 34 trend task components attempted by year 4 students in both years, the same percentage succeeded in 2009 as in 2005. Gains occurred on 18 of the 34 components. At year 8 level, on average across 59 trend task components included, about 2.5% fewer students succeeded in 2009 than in 2005. Gains occurred on 14 components and losses on 41 components. Four years ago, a similar loss was reported for year 8 students between 2001 and 2005.

A good range of measurement systems, processes and applications was covered in the set of tasks attempted by students. At both levels students' skills of reading measurements were substantially stronger than those of making good estimations. Year 8 students were quite weak in the understanding of perimeter, area and volume.

Trend Task: Posting Parcels

Approach:	Station
Year:	4 & 8
Focus:	Measuring weight; reading a table
Resources:	3 parcels, scales, N.Z. Post table, answer booklet

Questions / instructions:

Look at the three parcels that need to be posted.

Use the scales to weigh each parcel.

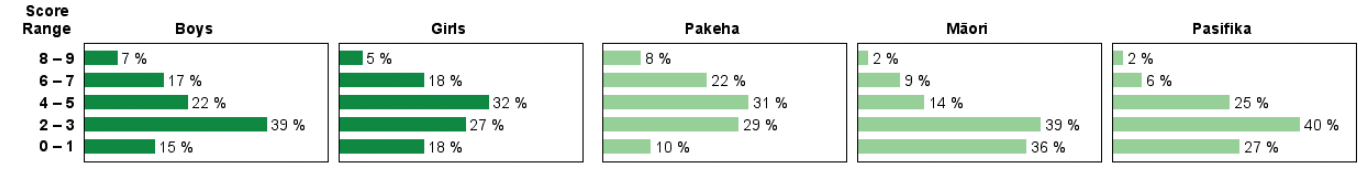
Parcel | Post Sector	Price					
	0-500g	500-1kg	1-1.5kg	1.5-2kg	2-2.5kg	2.5-3kg
Across Town *Within city boundaries*	$2.50				$5.00	
Short Haul *Up to 150km within an island*	$3.00			$6.50		
Within Islands *Over 150km within an island*	$4.20		$6.70		$8.40	
Between Islands *Between the North and South Island*	$6.80	$8.60	$10.90	$13.50	$15.30	$17.10

		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1. Write down how much each parcel weighs. Remember to write the unit of measurement.			
Parcel A *(300 gm)*:	275 – 310 gm	79 (75)	64 (61)
	> 310 gm	11 (13)	28 (30)
	< 275 gm	4 (8)	2 (5)
Appropriate units given:	yes	40 (39)	77 (82)
	no, no units	24 (20)	5 (7)
	no, inappropriate units	36 (41)	18 (11)
Parcel B *(1.1 kg)*:	1.075kg – 1.125 kg	22 (17)	54 (57)
	> 1.125 kg	22 (17)	21 (19)
	< 1.075 kg	31 (32)	9 (14)
Appropriate units given:	yes	41 (38)	68 (76)
	no, no units	27 (19)	5 (7)
	no, inappropriate units	32 (43)	27 (17)
Parcel C *(555 gm)*:	525 – 585 gm	6 (4)	28 (27)
	> 585 gm	72 (72)	55 (56)
	< 525 gm	14 (15)	7 (10)
Appropriate units given:	yes	39 (37)	74 (82)
	no, no units	27 (19)	5 (7)
	no, inappropriate units	34 (44)	21 (11)

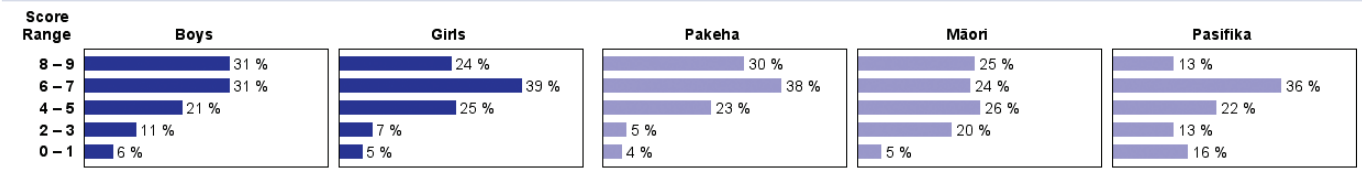
			% response 2009 ('05) year 4	% response 2009 ('05) year 8
Use the New Zealand Post chart to work out the answers to these questions.				
2. How much would it cost to send Parcel A *Across Town*?	$2.50		68 (61)	87 (93)
	$5.00		10 (15)	2 (3)
3. How much would it cost to send Parcel B *Between Islands*?	$10.90		22 (20)	56 (61)
	correct cost for reported weight		10 (13)	7 (7)
4. How much would it cost to send Parcel C *Within Islands*?	$4.20		43 (33)	68 (75)
	correct cost for reported weight		5 (7)	5 (1)
Total Score:		8–9	6 (3)	27 (30)
		6–7	18 (12)	35 (41)
		4–5	26 (25)	24 (18)
		2–3	33 (40)	8 (9)
		0–1	17 (20)	6 (2)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Many students weighed Parcel C to the nearest 100 grams (600gm), rather than more precisely (Parcel C actually weighed 555gm). Year 4 students scored slightly higher in 2009 than 2005, and year 8 students slightly lower. On average, year 4 Māori and Pasifika students scored substantially lower than Pakeha students.

Trend Task: Jars and Marbles

Approach:	Station	Year:	4 & 8
Focus:	Measuring capacity; measurement sense		
Resources:	Jar filled with marbles, film canister, 3 jars, answer booklet		

Questions / instructions:

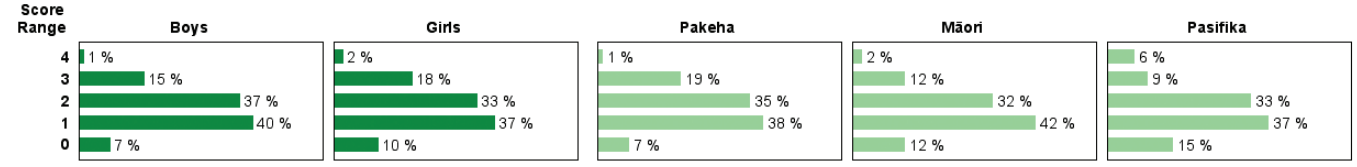
Look carefully at the jar of marbles.

Do **NOT** open the jar.

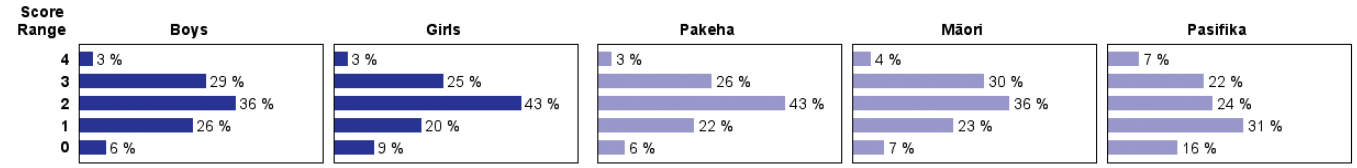
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1. If you were to pour the marbles into jar 1, about where would the marbles come up to? a. b. c. d.	C	78 (78)	78 (83)
2. If you were to pour the marbles into jar 2, about where would the marbles come up to? a. b. c. d.	C	35 (34)	43 (47)
3. If you were to pour the marbles into jar 3, about where would the marbles come up to? a. b. c. d.	B	39 (42)	62 (65)
4. Look at the film canister. About how many film canisters would you need for all the marbles?	12+	9 (7)	9 (6)
	✓ 9–11	11 (11)	12 (12)
	6–8	21 (20)	29 (25)
	0–5	49 (53)	44 (49)
Total Score:	4	2 (1)	3 (4)
	3	16 (16)	27 (31)
	2	35 (38)	40 (39)
	1	38 (37)	22 (20)
	0	9 (8)	8 (6)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students had particular difficulty estimating the number of the smallest containers (film canisters) that would be needed to hold all of the marbles. About 70% of students underestimated, many quite severely. Performance was very similar in 2005 and 2009. Pakeha, Māori and Pasifika students in both years performed similarly. On average, year 8 students scored only slightly higher than year 4 students.

Trend Task: Jelly

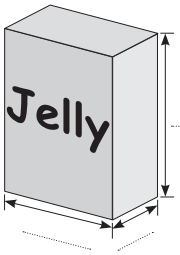
NEMP Access Task

Approach:	Station
Focus:	Measuring and calculating lengths and volume
Resources:	Jelly packet, ruler, calculator, answer booklet

Year: 4 & 8

Questions / instructions:

1. Measure the length, height and width of the **real** jelly packet. Write your measurements on the **picture** of the jelly packet.

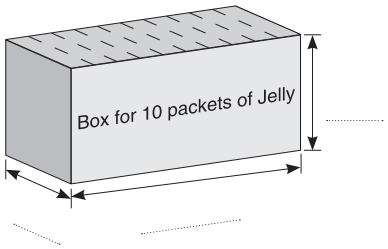


		% response 2009 ('05) year 4	year 8
Height:	86 – 90 mm	18 (17)	27 (19)
	< 86 mm	61 (63)	59 (72)
	> 90 mm	6 (9)	5 (4)
	appropriate units given	60 (67)	82 (87)
Width:	28 – 32 mm	43 (53)	76 (82)
	< 28 mm	28 (19)	10 (9)
	> 32 mm	15 (14)	4 (4)
	appropriate units given	62 (66)	82 (86)
Length:	74 – 78 mm	27 (32)	67 (78)
	< 74 mm	40 (37)	14 (12)
	> 78 mm	18 (18)	8 (5)
	appropriate units given	60 (65)	83 (86)

YEAR 8 ONLY:

2. Work out the volume of the jelly packet. You may use a calculator. Remember to write the unit of measurement.

	% response 2009 ('05) year 4	year 8
correct given measurements		27 (31)
appropriate units given		18 (26)



3. This box holds 10 of these packets of jelly. Write the measurements on the box to show how long, high and wide it would be.

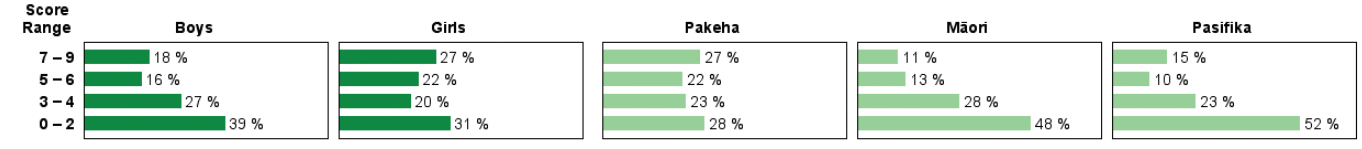
	% response 2009 ('05) year 4	year 8
Height and width:		
same as height/length measurements for one jelly packet		32 (38)
appropriate units given		59 (64)
Length: ten times width given for jelly packet		37 (45)
appropriate units given		62 (66)

4. Work out the volume of this big box. You may use a calculator. Remember to write the unit of measurement.

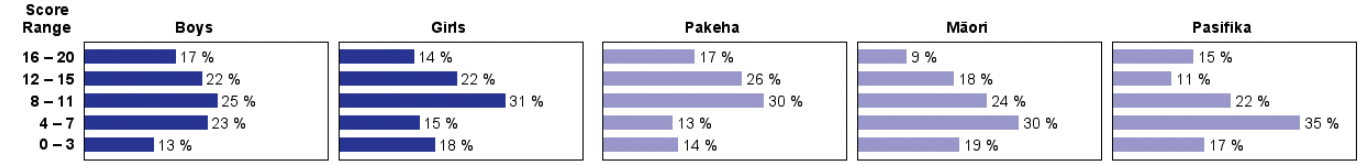
		% response 2009 ('05) year 4	year 8
correct given measurements *(or ten times volume listed for first box)*			27 (28)
Y4 Total Score:	7–9	22 (24)	
	5–6	19 (24)	
	3–4	24 (24)	
	0–2	35 (28)	
Y8 Total Score:	16–20		15 (16)
	12–15		23 (29)
	8–11		28 (28)
	4–7		21 (17)
	0–3		13 (10)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Many students measured to an adjacent cm or half cm measurement, often resulting in choices of 85mm or 8.5cm for height. At both year levels, students scored slightly lower in 2009 than in 2005. Only about one quarter of year 8 students correctly calculated volumes using a calculator. Year 4 girls scored significantly higher than boys – the only task for which this was true.

Trend Task: How Much Could It Hold?

Approach:	Station
Year:	4 & 8
Focus:	Capacity estimation
Resources:	4 containers: milk bottle, yoghurt pottle, juice packet, medicine container; answer booklet

Questions / instructions:

Here are four containers.

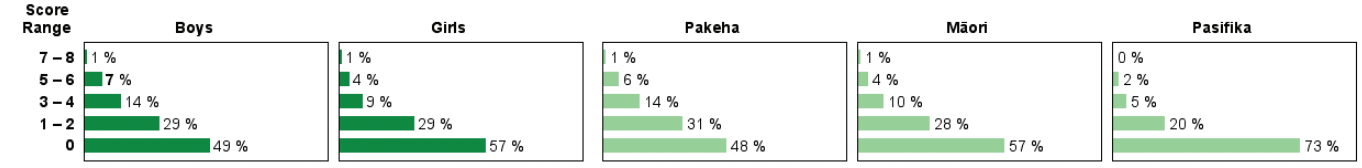
Write down how much each container holds using litres (L) or millilitres (ml).

	% response 2009 ('05) year 4	year 8
1. How many mls of milk do you think the bottle could hold?		
✓ 800 – 1200 ml	22 (24)	48 (53)
1201 – 2000 ml	6 (5)	7 (6)
more than 2 litres	10 (8)	0 (2)
500 to less than 800 ml	6 (2)	11 (6)
less than 500 ml	42 (46)	24 (28)
2. How much yoghurt do you think the pottle could hold?		
✓ 120–180 ml	2 (1)	17 (16)
181–300 ml	5 (3)	16 (21)
more than 300 ml	18 (17)	6 (7)
75–119 ml	7 (6)	14 (14)
less than 75 ml	42 (52)	26 (27)

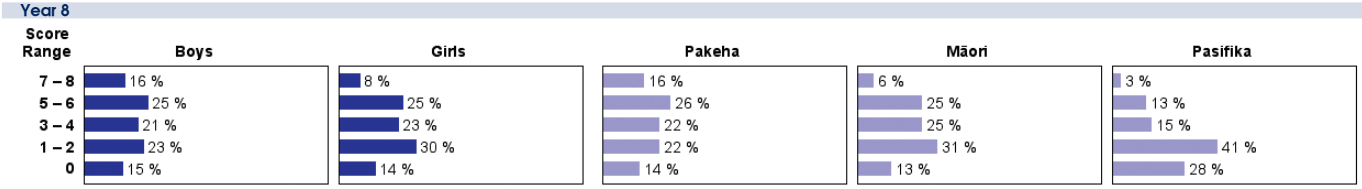
	% response 2009 ('05) year 4	year 8
3. How much juice do you think the packet *[juice box]* could hold?		
✓ 200–300 ml	9 (7)	40 (46)
301–500 ml	7 (4)	12 (12)
more than 500 ml	13 (16)	5 (6)
125–199 ml	2 (2)	6 (6)
less than 125ml	46 (51)	22 (21)
4. How much medicine do you think the container could hold?		
✓ 40–60ml	10 (7)	26 (24)
61–100ml	6 (5)	15 (18)
more than 100ml	15 (15)	9 (13)
25–39ml	3 (4)	8 (8)
less than 25ml	38 (47)	19 (21)
Total Score: 7–8	1 (1)	12 (15)
5–6	5 (4)	25 (26)
3–4	12 (8)	22 (24)
1–2	29 (31)	26 (18)
0	53 (56)	15 (17)

Subgroup Analyses:

Year 4



Year 8



Commentary:

The volume estimates on this task were handled poorly, with about half of year 4 students and one quarter of year 8 students estimating more than double or less than half of the actual capacity of the containers. At both levels, students performed very similarly in 2005 and 2009.

Trend Task: Which Unit?

Approach:	Independent
Focus:	Units of measurement
Resources:	Answer booklet

Year: 4 & 8

Units provided for Year 4

tonne (t)	kilogram (kg)
gram (g)	millimetre (mm)
centimetre (cm)	metre (m)
kilometre (km)	

Units provided for Year 8

tonne (t)	kilogram (kg)
gram (g)	millimetre (mm)
centimetre (cm)	metre (m)
kilometre (km)	square centimetres (cm^2)
square metres (m^2)	square kilometres (km^2)
hectare (h)	

Questions / instructions:

Which unit of measurement would you use to measure each of these?

		% response 2008 ('04) year 4	year 8
1. The length of a piece of ribbon.			
	✓✓ centimetre	52 (50)	74 (80)
	✓ millimetre	14 (15)	9 (10)
	✓ metre	18 (17)	7 (6)
2. The weight of a big truck.	✓✓ tonne	53 (48)	81 (86)
	✓ kilogram	24 (24)	9 (9)
3. The amount of butter needed for a cake.			
	✓✓ gram	53 (58)	84 (84)
	✓ kilogram	22 (17)	8 (11)
4. Carpet for your bedroom floor.			
	✓✓ (Y8) square metre		57 (54)
	✓ metre	46 (48)	16 (23)
5. The distance between Auckland and Taupo.	✓ kilometre	62 (62)	82 (88)
6. The length of a football field.	✓ metre	41 (41)	55 (59)

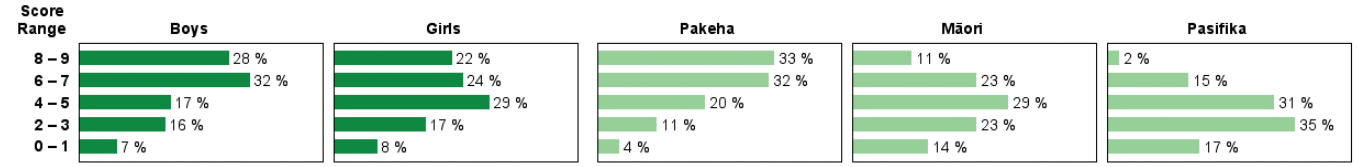
YEAR 8 ONLY:

		% response 2008 ('04) year 4	year 8
7. The thickness of a nail.	✓✓ millimetre		68 (70)
	✓ centimetre		10 (9)
8. The area of a farm.	✓✓ hectare		58 (57)
	✓ square metre		19 (24)

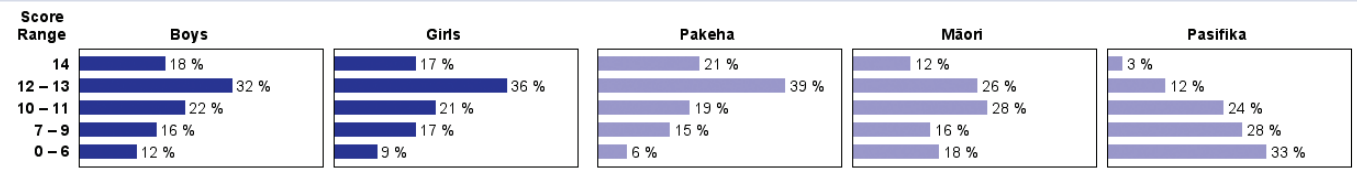
Y4 Total Score:	8–9	25 (24)	
	6–7	28 (30)	
	4–5	23 (20)	
	2–3	17 (18)	
	0–1	7 (8)	
Y8 Total Score:	14		18 (17)
	12–13		34 (36)
	10–11		21 (26)
	7–9		16 (14)
	0–6		11 (7)

Subgroup Analyses:

Year 4



Year 8



Commentary:

At both year levels, performance was very similar in 2005 and 2009. Māori and Pasifika year 4 students scored much lower, on average, than the year 4 Pakeha students, and the performance difference between year 8 Pakeha and Pasifika students was very large.

Trend Task: Toyota Camry

Approach:	Independent	Year:	4 & 8
Focus:	Measurement sense		
Resources:	Answer booklet		

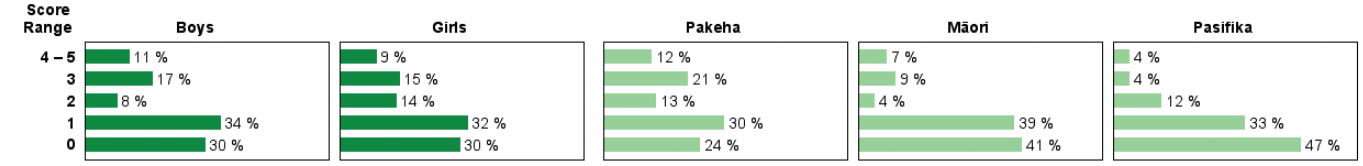
Questions / instructions:

Here is a picture of a real car.

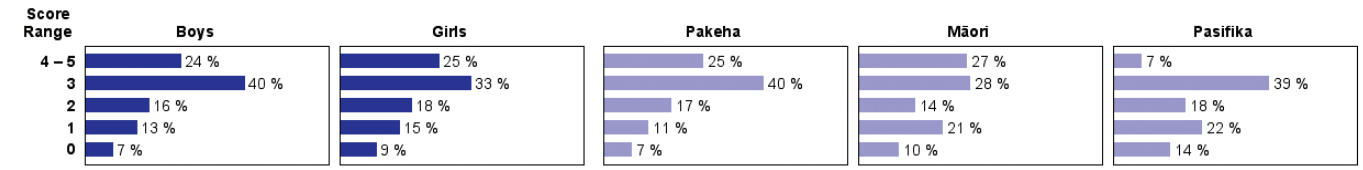
		% response 2009 ('05) year 4	year 8
1. About how long do you think the real car is?	4 – 5.5m *(with units)*	13 (13)	29 (31)
	4 – 5.5m *(without units)*	1 (0)	0 (0)
2. About how high do you think the real car is?	1 – 2m *(with units)*	32 (38)	71 (69)
	1 – 2m *(without units)*	3 (3)	1 (4)
3. About how heavy do you think the real car is?			
Circle your answer.	**A** 10 kg		
	B 100 kg		
	C 1000 kg	57 (47)	70 (68)
	D 10 000 kg		
Total Score:	4–5	10 (9)	24 (24)
	3	16 (17)	37 (36)
	2	11 (17)	17 (18)
	1	33 (26)	14 (16)
	0	30 (31)	8 (6)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students at both year levels scored lower in estimating the car's length than its height or weight, but this may be because of a narrower range of acceptable answers. There was no meaningful change in performance from 2005 to 2009.

Trend Task: Shopping List (Y4 & Y8)

NEMP Access Task

Approach:	Station
Focus:	Money computations
Resources:	Picture, calculator, answer booklet

Year: 4 & 8

Questions / instructions:

You have an advertisement from a shop that tells you the prices of some stationery.

Here is a shopping list. Work out how much this stationery will cost. You can use a calculator if you want to.

YEAR 4:

Shopping List
1 fibre tip pen
1 refillable clear book
1 craft punch
1 packet of crayons

		% response 2009 ('05) year 4
1. This stationery will cost:	$12.96	28 (35)
	$11.96 – $12.95 or $12.97 – $13.96	36 (31)
2. You have $20 to buy this stationery. How much change would you get?		
	$20.00 minus answer to question 1	37 (29)
	within $1.00 of $20.00 minus answer to question 1	22 (16)
Y4 Total Score:	4	9 (9)
	3	26 (19)
	2	30 (35)
	1	11 (13)
	0	24 (24)

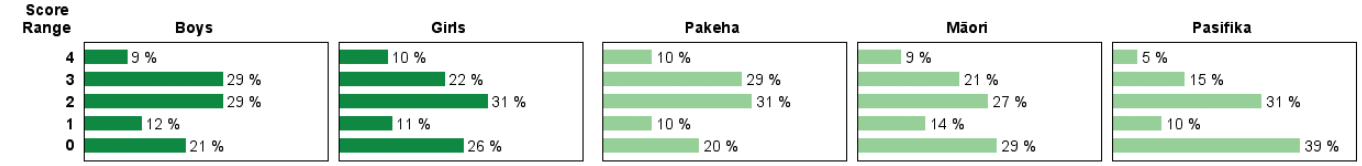
YEAR 8:

Shopping List
2 fibre tip pens
1 refillable clear book
1 craft punch
2 packets of crayons

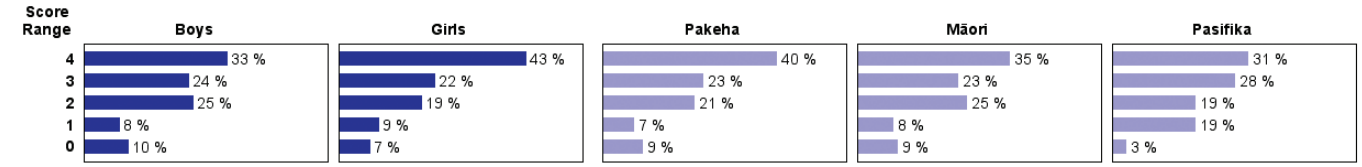
		% response 2009 ('05) year 8
1. This stationery will cost:	$17.44	47 (54)
	$16.44 – $17.43 or $17.45 – $18.44	22 (19)
2. You have $20 to buy this stationery. How much change would you get?		
	$20.00 minus answer to question 1	70 (75)
	within $1.00 of $20.00 minus answer to question 1	18 (15)
Y8 Total Score:	4	38 (46)
	3	23 (18)
	2	22 (24)
	1	8 (6)
	0	9 (6)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Quite a lot of year 8 students forgot to double the cost of the pens and crayons, and computational errors were reasonably common at both year levels. There was no meaningful change of performance from 2005 to 2009. Māori students performed similarly to Pakeha students, as did year 8 Pasifika students.

Trend Task: Playing with Perimeter

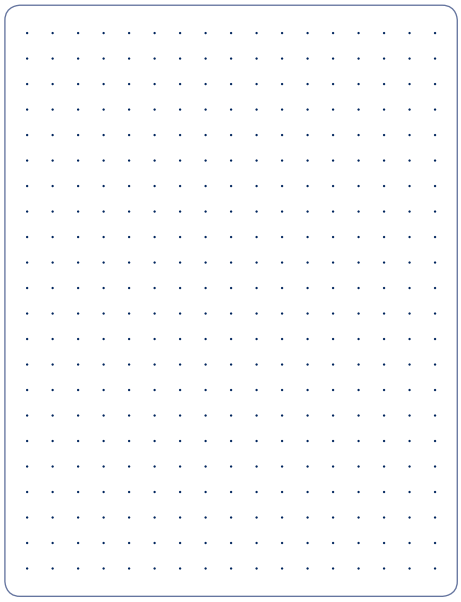
Approach:	Independent	Year:	8
Focus:	Perimeter and area		
Resources:	Ruler, answer booklet		

Questions / instructions:

Shapes with the same perimeter can have different areas.

1. Draw **3** rectangles that have perimeters of 24 cm.

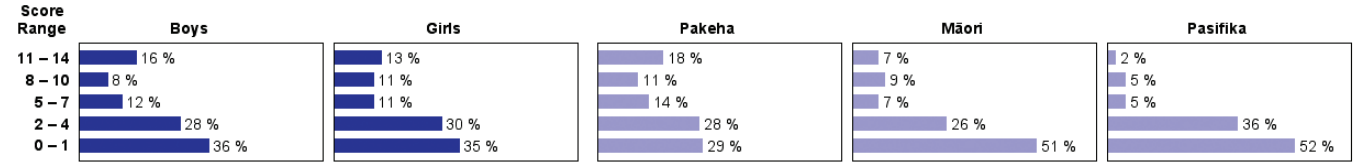
   Write the area in the middle of each rectangle.



		% response 2009 ('05) year 8
First Rectangle:		
Drew:	rectangle	79 (81)
Perimeter:	24 cm	43 (39)
Correct area given:	with units *(cm²)*	14 (15)
	correct area given, no units/cms ONLY	11 (14)
Second Rectangle:		
Drew:	rectangle	51 (55)
Perimeter:	24 cm	31 (34)
Correct area given:	with units *(cm²)*	13 (18)
	correct area given, no units/cms ONLY	8 (10)
Third Rectangle:		
Drew:	rectangle	47 (46)
Perimeter:	24 cm	29 (29)
Correct area given:	with units *(cm²)*	12 (16)
	correct area given, no units/cms ONLY	6 (9)
Overall:		
	drew three rectangles, all with 24 cm perimeters, all with different areas	20 (21)
	drew three rectangles, all with 24 cm perimeters, two or more with same areas	1 (2)
Total Score:	11–14	14 (19)
	8–10	10 (10)
	5–7	12 (6)
	2–4	28 (30)
	0–1	36 (35)

Subgroup Analyses:

Year 8



Commentary:

Many year 8 students were not skilled in calculating the perimeters or areas of rectangles. There was little change in performance from 2005 to 2009. About half of Māori and Pasifika students and 29% of Pakeha students had virtually no success with this task.

Trend Task: Measuring Up

NEMP Access Task

Approach:	Independent
Focus:	Measurement sense
Resources:	Answer booklet

Year: 8

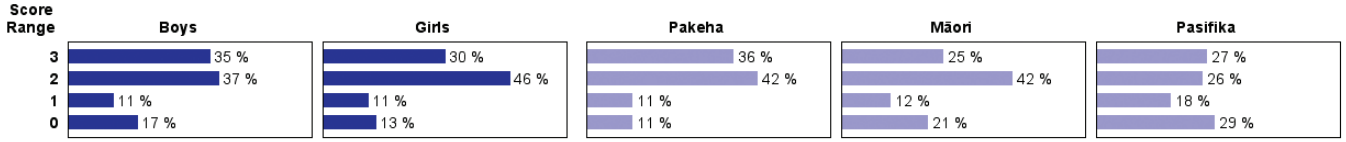
Questions / instructions:

Some 9 year old children measured their heights.
This picture shows what they thought their heights were.

		% response 2009 ('05) year 8
1. John has made a mistake in measuring his height. What is wrong?		
units incorrect *(should be cm)* OR should have decimal point		78 (72)
2. Sarah has made a mistake in measuring her height. What is wrong?		
units incorrect *(should be m)* OR should NOT have decimal point		74 (66)
3. Coralie has made a mistake in measuring her height. What is wrong?		
measurement is incorrect/not that tall *(e.g. teacher is taller, but still probably less than 185 cm)*		39 (29)
Total Score:	3	33 (26)
	2	41 (38)
	1	11 (13)
	0	15 (23)

Subgroup Analyses:

Year 8



Commentary:

Most students had good corrections for at least two of the three errors. Performance was higher in 2009 than in 2005.

Trend Task: Hot and Cold

NEMP Access Task

Approach:	Independent
Focus:	Temperature changes
Resources:	Answer booklet

Year: 8

Questions / instructions:

1. On May 19th, it was 10˚C in Alexandra. That night it fell 14˚C. On the 20th May, it rose 8˚C from the night-time temperature.

   What temperature did it get to on the 20th May? 4˚C

Answer: _____ °C

	% response 2009 ('05) year 8
	59 (61)

2. In Auckland, it was 10˚C but at Mt Cook it was – 7˚C.

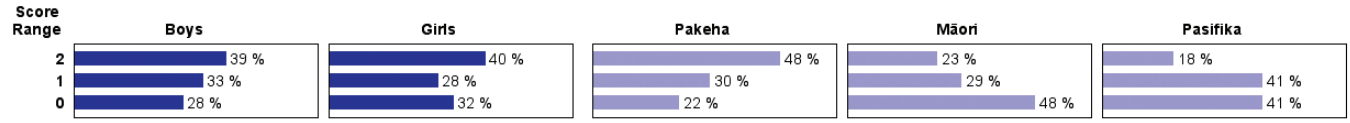
   What is the temperature difference between Auckland and Mt Cook? 17˚C

Answer: _____ °C

		% response 2009 ('05) year 8
		51 (56)
Total Score:	2	40 (43)
	1	30 (30)
	0	30 (27)

Subgroup Analyses:

Year 8



Commentary:

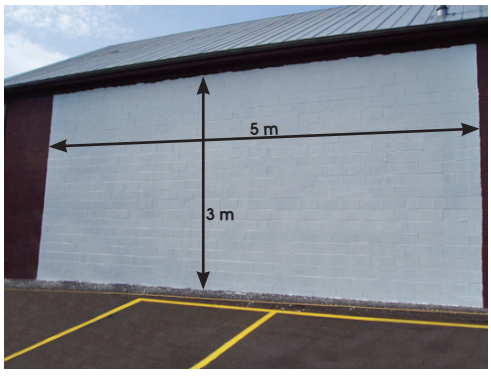
With the temperature scales available, more than half of the students managed each computation. Performance was very similar in 2005 and 2009. On average, Pakeha students scored higher than Māori or Pasifika students.

Trend Task: Wall Paint

Approach:	Independent
Focus:	Measuring area
Resources:	Answer booklet

Year: 8

Questions / instructions:



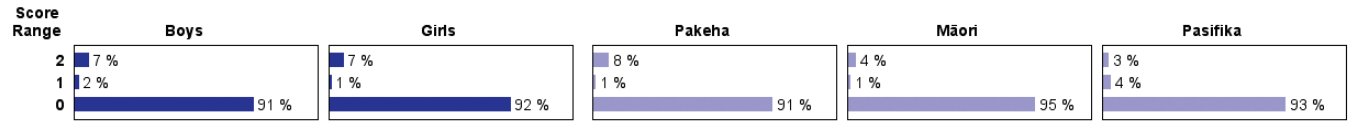
Look carefully at the picture. One litre of paint is needed to paint this wall.

1. If the wall was 10m by 6m, how much paint would you need?

		% response 2009 ('05) year 8
4 litres *(appropriate units)*		7 (9)
4 *(no units given)*		1 (1)
2 litres *(appropriate units)*		59 (54)
2 *(no units given)*		1 (2)
Total Score:	2	7 (9)
	1	1 (1)
	0	92 (90)

Subgroup Analyses:

Year 8



Commentary:

Remarkably few of the year 8 students realised that, with both dimensions doubled, the amount of paint required would increase by four times. All subgroups performed similarly poorly.

Task: Estimates

Approach:	Team
Year:	4 & 8
Focus:	Measurement sense; selecting and using devices; number strategy; estimation
Resources:	2 cards, 2 calculators, 2 x 250ml marked cups, 2 pair answer sheets, 2 stopwatches, 2 story books, 2 balls

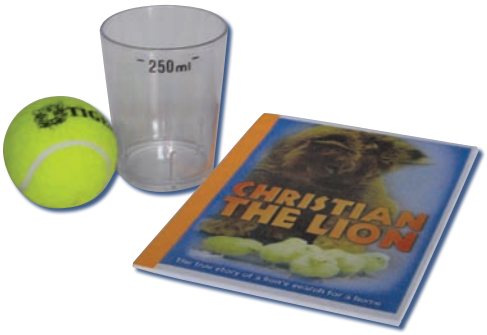
Questions / instructions:

In this activity you will be working in pairs to estimate the measurements of three different things. You don't need to try to work out the exact measurement, just a good estimate. You can only work in this room to do this activity. [Student 1] and [Student 2] can work together, [Student 3] and [Student 4] can work together. Here are some things to help you work out your estimates.

Hand each pair a calculator and stopwatch.

With your partner talk about how to do each estimate then write down how you would do it on the answer sheet. After that have a go at using your idea to estimate the measurement.

Hand each pair an answer sheet, a card, a ball, a 250 ml marked cup and a story book.



[Card showed three problems, same as table below.
Year 4 book: Mock-up of book constructed with pages 1 – 31 plus cover only. Bourke, A. & Rendell, J. (2009). *Christian The Lion*, London.: Red Fox, Random House.

Year 8 book: Johnston, P. (2007). *Dead Dan's Dee*. Dunedin, N.Z.: Longacre Press, Random House.]

Problem	A Way to Estimate This	Estimate
The time it would take one of you to bounce a ball 100 times.		
The number of words in the story book.		
The amount one of you would drink in a week		

Here are the three things to estimate and your answer sheet. You have up to 15 minutes to work on this activity.

Allow up to 15 minutes. Remind students when five minutes is left.

Bring students back to the team table.

Now it is time to report back. [Student 1] and [Student 2] can report back first then [Student 3] and [Student 4].

Let's start with –

The time it would take one of you to bounce a ball 100 times.

1. What did you do to estimate this answer?
2. What was your estimate?

		% responses y4	% responses y8
STUDENTS 1 & 2:			
Students did estimate:	yes	39	79
Estimation method:			
	attempted to bounce ball by some fraction of 100 and measured time taken, then multiplied by appropriate ratio for 100 bounces	14	70
Validity: *(time measured × 100 ÷ number of bounces measured)*	estimate was in the likely range *(40 - 120 secs)*	60	73
STUDENTS 3 & 4:			
Students did estimate:	yes	36	73
Estimation method:			
	attempted to bounce ball by some fraction of 100 and measured time taken, then multiplied by appropriate ratio for 100 bounces	15	66
Validity: *(time measured × 100 ÷ number of bounces measured)*	estimate was in the likely range *(40 - 120 secs)*	55	80

The number of words in the story book.

3. What did you do to estimate this answer?
4. What was your estimate?

		% responses y4	% responses y8
STUDENTS 1 & 2:			
Estimation method:			
Figured out words per page by working out words per line, then multiplying by number of lines:	counted number of lines and number of words per line and multiplying	3	21
	counting words on a whole page	32	53
Used estimate of words on a page and multiplied by number of pages:	yes, and considered part pages *(Y4 = 27/28 pages, Y8 = 153 pages)*	5	4
	yes, but treated all pages the same *(Y4 = 31 pages, Y8 = 162/170 pages)*	17	40
	yes, counted pages but distinction between part and whole pages unclear	14	39
Validity:	estimated total was in the likely range *(Y4 = 3000 – 5500 words / Y8 = 30 000 – 55 000)*	20	63

	% responses y4	% responses y8
STUDENTS 3 & 4:		
Estimation method:		
Figured out words per page by working out words per line, then multiplying by number of lines:		
counted number of lines and number of words per line and multiplying	4	28
counting words on a whole page	31	44
Used estimate of words on a page and multiplied by number of pages:		
yes, and considered part pages *(Y4 = 27/28 pages, Y8 = 153 pages)*	3	5
yes, but treated all pages the same *(Y4 = 31 pages, Y8 = 162/170 pages)*	23	36
yes, counted pages but distinction between part and whole pages unclear	14	45
Validity: estimated total was in the likely range *(Y4 = 3000 – 5500 words / Y8 = 30 000 – 55 000)*	21	56

The amount one of you would drink in a week.

5. What did you do to estimate this answer?
6. What was your estimate?

STUDENTS 1 & 2:			
Students did estimate:			
yes, as number of cups/glasses		36	58
yes, as ml or litres		14	26
Multiplied by seven:	yes	40	85
	no, took weeks as 5 days	2	3
Validity: estimated total in the range of 7L - 18L *(28 - 72 cups)*		23	57
STUDENTS 3 & 4:			
Students did estimate:			
yes, as number of cups/glasses		33	63
yes, as ml or litres		15	22
Multiplied by seven:	yes	39	81
	no, took weeks as 5 days	5	2
Validity: estimated total in the range of 7L - 18L *(28 - 72 cups)*		26	80

7. Are any of your estimates similar?
8. Why is that so?

		% responses y4	% responses y8
Discussion:	strong	2	6
	moderate	19	50
	weak	79	44
9. What things do you think you did well in this activity?	not marked here	•	•
10. If you did this activity again, what would you do differently?	not marked here	•	•

PROMPT (Year 4 only): Does anyone else want to say anything?

Total Score:	21–30	5	40
	16–20	11	38
	11–15	15	13
	6–10	32	4
	0–5	37	5

Commentary:

This team task has been released immediately because it appears that the task could be improved if more highly structured. The general approach appears to be worthwhile, but many teams recorded insufficient information to allow full evaluation of their efforts. Because it is a team task, the usual subgroup graphs are not possible.

Task: On Sale

Approach:	Independent
Focus:	Calculating percentage
Resources:	Answer booklet

Year: 8

Questions / instructions:

A toyshop is having a sale.

Write down how much is taken off the old price.Then write down the new sale price.

Example: Car 10% off $7.00 

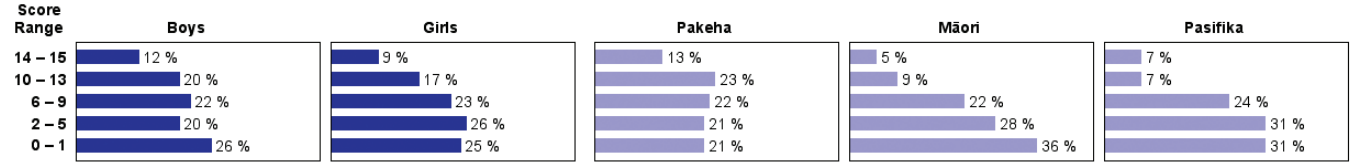
Savings: 70 cents
Sale price: $6.30

[NOTE: When scoring results for the sale price, the student's answer for savings was used, whether it was correct or not.]

		% responses y8
1. Action figure 10% off $17.50		
	**Savings:** $1.75	27
	1.75 / 175 cents	2
	Sale price: correct sale price *(e.g. $17.50 - $1.75 = $15.75)*	51
2. Lego 20% off $15.00		
	**Savings:** $3.00	33
	3.00 / 300 cents	0
	Sale price: correct sale price *(e.g. $15.00 - $3.00 = $12.00)*	58
3. Soft toy 25% off $20.00		
	**Savings:** $5.00	46
	5.00 / 500 cents	1
	Sale price: correct sale price *(e.g. $20.00 - $5.00 = $15.00)*	63
4. Sport set 50% off $25.00		
	**Savings:** $12.50	53
	12.50 / 1250 cents	5
	Sale price: correct sale price *(e.g. $25.00 - $12.50 = $12.50)*	64
5. Dress up 12.5% off $24.00		
	**Savings:** $3.00	15
	3.00 / 300 cents	0
	Sale price: correct sale price *(e.g. $24.00 - $3.00 = $21.00)*	40
	Total Score: 14–15	10
	10–13	19
	6–9	22
	2–5	24
	0–1	25

Subgroup Analyses:

Year 8



Commentary:

About half of the year 8 students had very limited success (5 or fewer marks out of 15) on this task.

LINK TASK: 27

Approach:	One to one
Year:	4 & 8
Focus:	Measurement sense & accuracy/estimation

Total score:	% responses y4	% responses y8
10–11	6	26
8–9	11	20
5–7	19	24
2–4	23	17
0–1	41	13

LINK TASK: 28

Approach:	One to one
Year:	4 & 8
Focus:	Measurement sense

Total score:	% responses y4	% responses y8
8–9	9	32
6–7	26	39
4–5	25	19
0–3	40	10

LINK TASK: 29

Approach:	One to one
Year:	4 & 8
Focus:	Money addition & subtraction; calculating percentage

Total score:	% responses y4	% responses y8
8	10	48
6–7	21	37
4–5	28	11
2–3	32	4
0–1	9	0

LINK TASK: 30

Approach:	Station
Year:	4 & 8
Focus:	Showing & telling time

Total score:	% responses y4	% responses y8
10–11	4	25
8–9	11	35
6–7	16	24
4–5	39	13
0–3	30	3

LINK TASK: 31

Approach:	Independent
Year:	4 & 8
Focus:	Money additions & comparisons

Total score:	% responses y4	% responses y8
7	12	55
5–6	29	28
3–4	23	11
1–2	16	4
0	20	2

LINK TASK: 32

Approach:	Independent
Year:	4 & 8
Focus:	Money place value

Total score:	% responses y4	% responses y8
11	6	47
9–10	12	30
7–8	14	13
4–6	28	8
0–3	40	2

LINK TASK: 33

Approach:	Station
Year:	4 & 8
Focus:	Measurement sense

		% responses y4	% responses y8
Y4 Total Score:	5–7	15	
	4	24	
	3	26	
	2	19	
	0–1	16	
Y8 Total Score:	5		21
	4		18
	3		13
	2		26
	0–1		22

LINK TASK: 34

Approach:	Station
Year:	4
Focus:	Fractions of an area

Total score:	% responses y4	% responses y8
3	53	
2	27	
1	15	
0	5	

LINK TASK: 35

Approach:	Station
Year:	8
Focus:	Fractions of an area

Total score:	% responses y4	% responses y8
4		47
3		23
2		20
1		6
0		4

LINK TASK: 36

Approach:	Station
Year:	8
Focus:	Perimeter and area

Total score:	% responses y4	% responses y8
4		12
3		11
2		14
1		13
0		50

LINK TASK: 37

Approach:	Independent
Year:	8
Focus:	Time and money; showing strategy

Total score:	% responses y4	% responses y8
2		42
1		31
0		27

LINK TASK: 38

Approach:	Independent
Year:	8
Focus:	Proportion and problem solving

Total score:	% responses y4	% responses y8
5–6		21
3–4		34
1–2		30
0		15

5 Geometry

Overview: Year 8 students performed substantially better than year 4 students on mathematics tasks involving geometry, with an average of 21% more year 8 than year 4 students succeeding on the same geometry task components. On average, there was a slight increase in geometry task performance between 2005 and 2009 for year 4 students, but no change for year 8 students.

The assessments included 13 tasks investigating students' understandings, processes and skills in the area of mathematics called geometry. Geometry is concerned with geometrical relations in two and three dimensions, and their occurrence in the environment. It also involves recognition of the geometrical properties of everyday objects and the use of geometric models as aids to solving problems.

Seven of the tasks are trend tasks (fully described with data for both 2005 and 2009), one is a long-term trend task (with data from 1997 and 2009), and five are link tasks (to be used agan in 2010, so only partially described here). Trend tasks are presented first, then the link tasks.

Averaged across 15 task components administered to both year 4 and year 8 students, 21% more year 8 than year 4 students succeeded with these components. Year 8 students performed better on all except one component (an easy one on which there was no difference).

Overall, there was no meaningful change in performance for year 4 or year 8 students between 2005 and 2009. Averaged across 17 trend task components attempted by year 4 students in both years, 2% more students succeeded in 2009 than in 2005, but the small number of tasks and components mean that this change should not be regarded as meaningful. Gains occurred on eight components, with no change on two and decreases on seven. At year 8 level, the same percentage of students succeeded in 2009 as in 2005, with gains on 15 of the 41 components, no change on three, and decreases on 23.

One task, *Shape Lines* (p63), had been used previously in the 1997 assessments, so gave a little information on long-term trends for year 8 students. A small decline in capability to identify cross sections of three-dimensional objects was evident, with, on average, 6% fewer year 8 students succeeding with each of the four components of this task.

Many students were able to identify the symmetry lines of two-dimensional shapes, and year 8 students had good success with drawing the nets of some three-dimensional objects. Students had less success with visualising the internal structure and cross sections of three-dimensional objects and with following instructions involving angle measurements expressed in fractions of complete turns or in degrees.

Approach:	One to one
Focus:	Understanding rotation and angles
Resources:	Person with torch, board, recording book
Year:	4 & 8

Questions / instructions:

Hand student the model figure and board.

This person is playing spotlight with his torch at night. Put the person in the centre, facing the tree.

		% response 2009 ('05) year 4	year 8
1. Turn the person clockwise, a quarter turn. What is it facing?	cat	58 (64)	89 (89)
Turn the person back so that it is facing the tree again.			
2. Now turn the person clockwise, a one-third turn. What is it facing?	rabbit	19 (22)	38 (40)
Turn the person back so that it is facing the tree again.			
3. Now turn the person anticlockwise, a half turn. What is it facing?	sunglasses	61 (64)	87 (87)
Turn the person back so that it is facing the tree again.			
4. Now turn the person anticlockwise, a three-quarters turn. What is it facing?	cat	30 (28)	60 (66)
Turn the person back so that it is facing the tree again.			

YEAR 4 ONLY:

		% response 2009 ('05) year 4	year 8
5. Now turn the person $\frac{1}{12}$ to the right. What is it facing?	boy	27 (23)	
Turn the person back so that it is facing the tree again.			
6. What directions could you give me if I wanted to turn the person to face the chair?	appropriate directions given *(e.g. 1/4 turn anticlockwise/left; 3/4 turn clockwise/right; 90° clockwise/left; 270° anticlockwise/right)*	43 (46)	

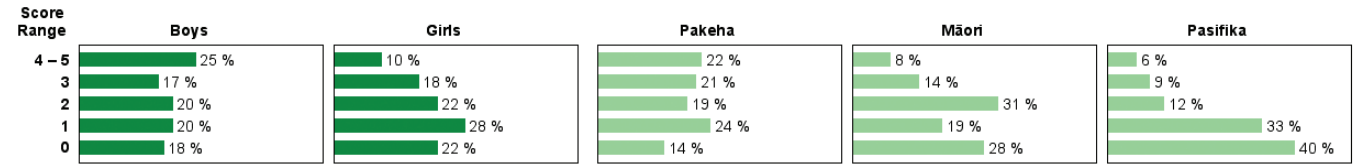
YEAR 8 ONLY:

		% response 2009 ('05) year 4	year 8
5. Now turn the person 90° to the left. What is it facing?	chair		59 (60)
Turn the person back so that it is facing the tree again.			
6. Now turn the person 360° to the left. What is it facing?	tree		77 (77)
Turn the person back so that it is facing the tree again.			
7. Now turn the person 30° to the right. What is it facing?	boy		43 (46)
Turn the person back so that it is facing the tree again.			
8. Now turn the person 270° to the right. What is it facing?	chair		36 (30)
Turn the person back so that it is facing the tree again.			
9. What directions could you give me if I wanted to turn the person to face the shoe?	appropriate directions *(e.g. 120° to the left, 240° to the right; one third turn to the left, two-thirds turn to the right)*		31 (32)

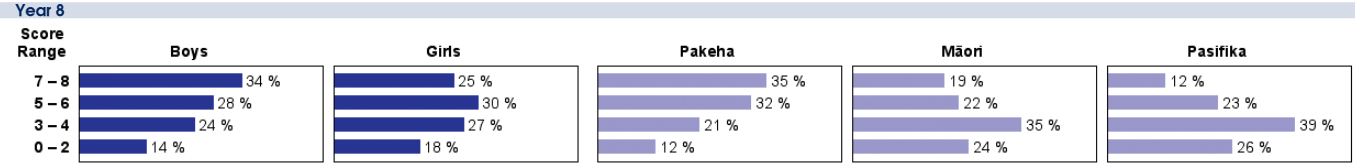
		% response 2009 ('05) year 4	year 8
Y4 Total Score:	4–5	17 (16)	
	3	18 (22)	
	2	21 (24)	
	1	24 (19)	
	0	20 (19)	
Y8 Total Score:	7–8		29 (28)
	5–6		29 (34)
	3–4		26 (24)
	0–2		16 (14)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students were less successful with turns other than $\frac{1}{4}$ (or 90 degrees), or $\frac{1}{2}$. Performance was very similar in 2005 and 2009. Year 4 boys scored significantly higher than girls, and Pasifika students at both year levels scored substantially lower, on average, than Pakeha students.

Trend Task: Cheeses

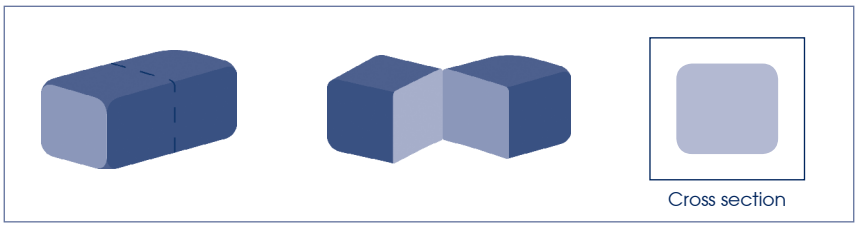
NEMP Access Task

Approach:	Independent
Focus:	Identifying shapes of cross sections
Resources:	Answer booklet

Year: 4 & 8

Questions / instructions:

The cheese has been cut through with one straight cut. The cut made a square shaped cross section.

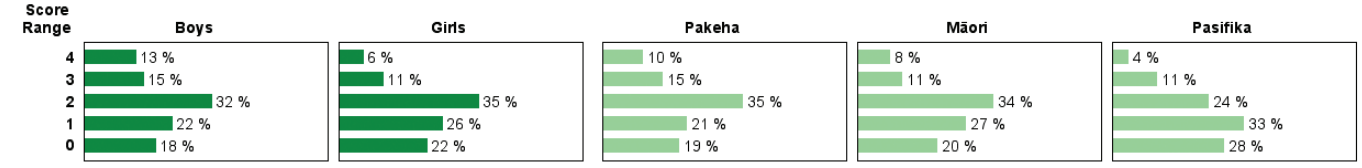


Look at the pictures. They show the places where the different cheeses have been cut.
Draw the cross section for each cheese.

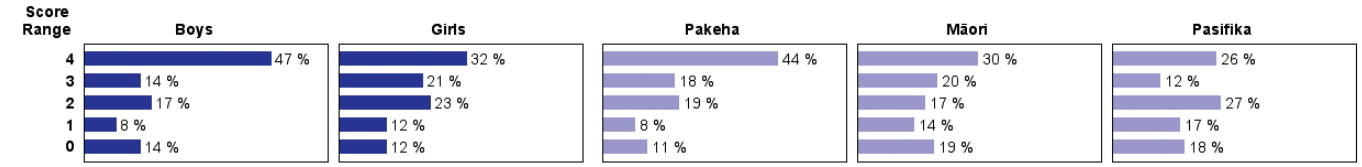
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1. 	**Drew:** circle	77 (68)	85 (80)
2. 	**Drew:** rectangle	18 (7)	47 (46)
	✗ triangle	40 (43)	27 (18)
3. 	**Drew:** triangle	55 (51)	77 (71)
4. 	**Drew:** rectangle	18 (10)	52 (54)
	✗ curved shape *(semicircle, circle, etc)*	50 (49)	29 (23)
Total Score:	4	9 (2)	40 (40)
	3	14 (11)	17 (18)
	2	33 (35)	20 (12)
	1	24 (24)	10 (13)
	0	20 (28)	13 (17)

Subgroup Analyses:

Year 4



Year 8



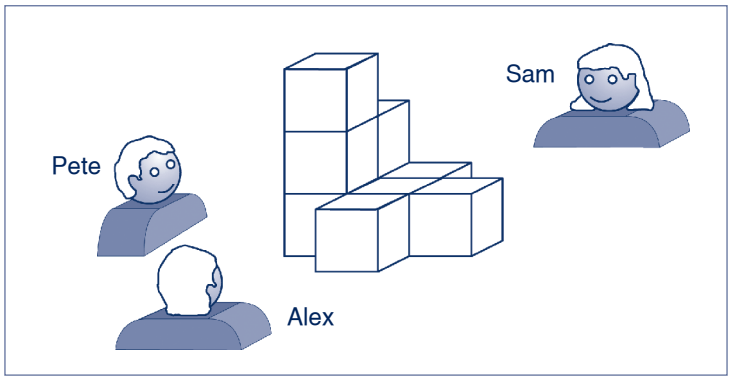
Commentary:

The second and fourth shapes caused greater visualisation problems than the other two, with many students seeing the surface rather than the cross section. Year 4 students scored a little higher in 2009 than in 2005, but there was little change for year 8 students. Year 4 Pakeha and Māori students performed similarly.

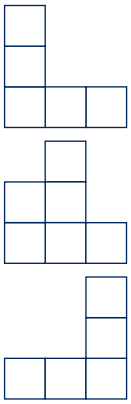
NEMP Access Task

Approach:	Independent
Focus:	Visualising and representing
Resources:	Answer booklet
Year:	4 & 8

Questions / instructions:



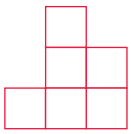
1. Below are views of this building from different sides. Who would see these views?



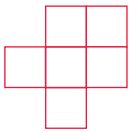
	% response 2009 ('05) year 4	year 8
Alex	53 (54)	84 (86)
Pete	52 (54)	84 (86)
Sam	57 (61)	82 (85)

YEAR 8 ONLY:

2. Draw what you would see if you were standing on the opposite side to Pete.



3. Draw the view you would see if you looked down on it from a helicopter.

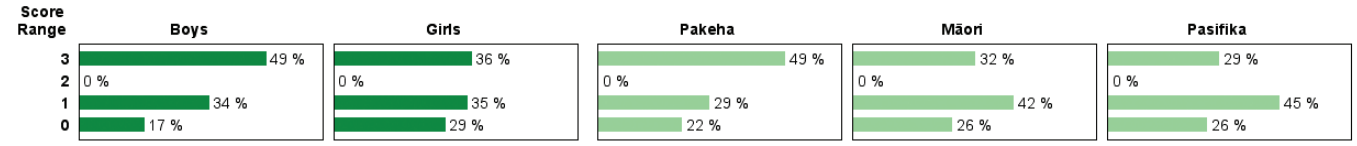


(or any rotation of this shape)

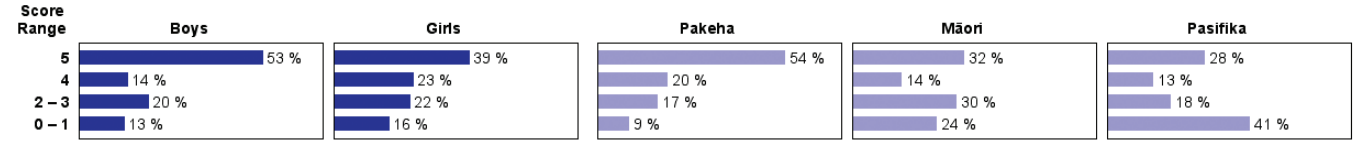
		% response 2009 ('05) year 4	year 8
			63 (58)
			63 (64)
Y4 Total Score:	3	43 (43)	
	2	0 (1)	
	1	34 (37)	
	0	23 (19)	
Y8 Total Score:	5		47 (46)
	4		18 (21)
	2–3		20 (20)
	0–1		15 (13)

Subgroup Analyses:

Year 4



Year 8



Commentary:

About 20% fewer year 8 students were able to draw a view than to identify one. Performance was very similar in 2005 and 2009. Year 8 Māori students and Pasifika students were, on average, substantially less successful than Pakeha students. Year 4 boys scored significantly higher than girls.

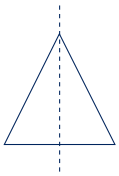
Trend Task: Mirror Image

NEMP Access Task

Approach:	Independent
Focus:	Finding symmetry
Resources:	Ruler, answer booklet
Year:	4 & 8

Questions / instructions:

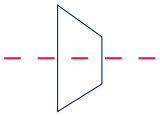
The dotted line shows where the shape could be folded exactly in half.



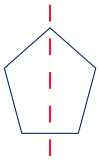
	% response 2009 ('05) year 4	year 8

1. Draw dotted lines on these shapes to show where they could be folded exactly in half. You may use a ruler.

86 (80) | 95 (98)



80 (69) | 97 (94)

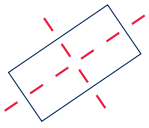


97 (97) | 97 (100)

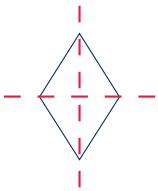
93 (93) | 95 (97)

YEAR 8 ONLY:

2. These shapes can be folded in half in more than one way. Draw dotted lines on each shape to show **two** ways that it could be folded exactly in half. You may use a ruler.

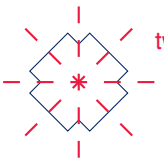


both lines given	91 (93)
one line given	3 (3)
two correct plus at least one incorrect	0 (1)
one correct and one incorrect	3 (2)

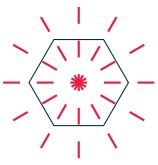


both lines given	93 (94)
one line given	4 (3)
two correct plus at least one incorrect	1 (2)
one correct and one incorrect	0 (0)

3. Draw dotted lines on these shapes to show **all** the ways that they could be folded exactly in half. You may use a ruler.

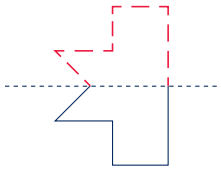


	% response 2009 ('05) year 4	year 8
all correct lines given		61 (70)
two to three correct lines given		31 (27)
one correct line given		3 (2)
all correct plus at least one incorrect		1 (0)
some correct lines and at least one incorrect		0 (1)



all correct lines given		34 (41)
two to five correct lines given		60 (56)
one correct line given		3 (2)
all correct plus at least one incorrect		1 (0)
some correct lines and at least one incorrect		0 (0)

4. Draw the other half of this shape so the dotted line is where the shape could be folded exactly in half. You may use a ruler.

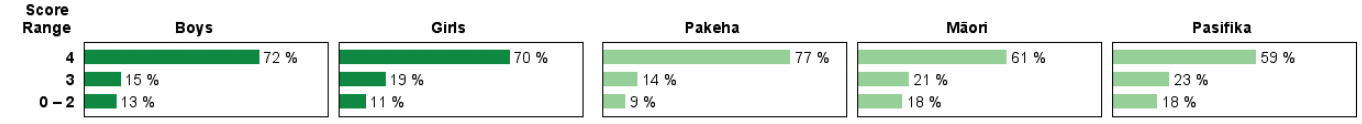


correct as shown		88 (94)
partially correct *(one or more lines correctly drawn)*		6 (3)

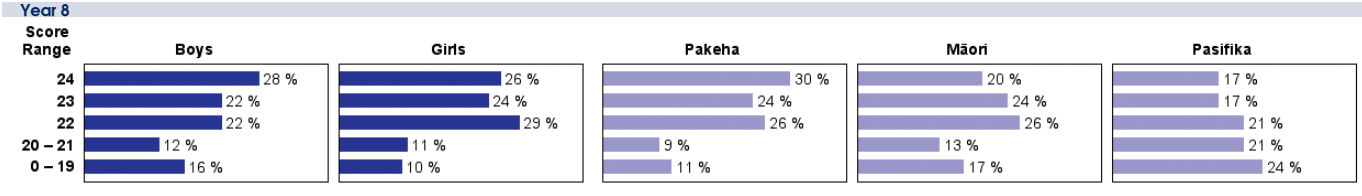
Y4 Total Score:	4	71 (62)
	3	17 (21)
	0–2	12 (17)
Y8 Total Score:	24	27 (33)
	23	23 (28)
	22	25 (24)
	20–21	11 (9)
	0–19	14 (6)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Performance levels were high, for both year 4 and year 8 students, where there were only one or two lines of symmetry, but dropped markedly for year 8 students where there were four to six lines of symmetry. Year 4 students scored slightly higher in 2009 than in 2005, while year 8 students scored slightly lower.

Task: Shape Lines

Approach:	One to one	Year:	8
Focus:	Cross sections		
Resources:	5 geometric solids, shape board, recording book		

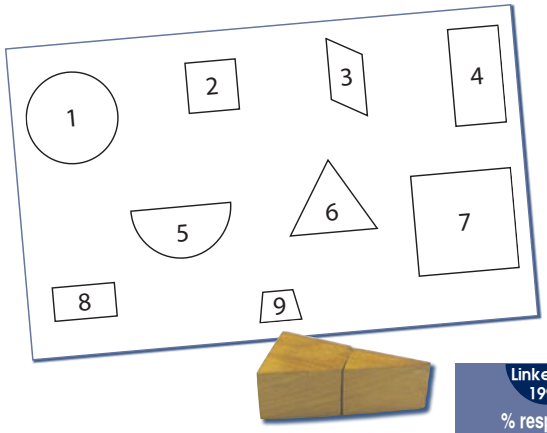
Questions / instructions:

In this activity I am going to show you some solid shapes with lines drawn on them. Here is an example.

Show student the cube and point to the line around the cube.

Imagine that I am going to cut through this shape on this line. I want you to think about what the face of the shape would look like after the cut was made. Here is an example.

Place the *Shape Lines* board in front of the student. Hold the two pieces of the wedge shape together and show them to the student.



Here is a shape that has already been cut through the line. The line went around here.

Point along cut.

1. What would the shape of the face, where it was cut, look like? not marked

This board shows a range of different shapes and sizes.

2. Which shape on this board would match the face on the solid shape after it was cut? not marked

If student doesn't point to the small rectangle (8), say: 'It would be a rectangle or oblong shape like this one'. *(Point.)*

Open two pieces and show the student the shape of the cut face.

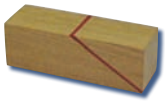
Now try and match the shapes for these solid objects if they were cut.

Show the cube *[same cube as before]*.

Imagine that I cut on this line.

3. Which shape on the board would match the cut face of this solid? shape 6

Show the rectangular solid.



4. Which shape would match the cut face of this solid? shape 4

Show the pyramid.

5. Which shape would match the cut face of this solid? shape 2

Show the cylinder.

6. Which shape would match the cut face of this solid? shape 7

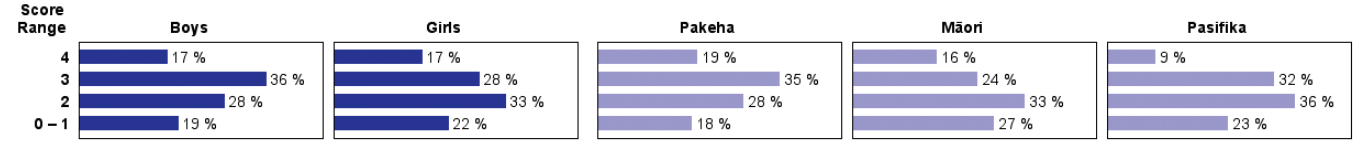
Total Score:

	Linked to 1997 % response 2009 ('97) year 8
4	17 (25)
3	32 (38)
2	30 (21)
0–1	21 (16)

Linked to 1997 % response 2009 ('97) year 8	
• (•)	Q1
• (•)	Q2
90 (93)	Q3
55 (68)	Q4
75 (79)	Q5
23 (28)	Q6

Subgroup Analyses:

Year 8



Commentary:

This task explored trends between 1997 and 2009. A small decline in performance over the 12-year period is evident. Māori and Pasifika students performed quite similarly to Pakeha students.

Trend Task: Sketching Nets

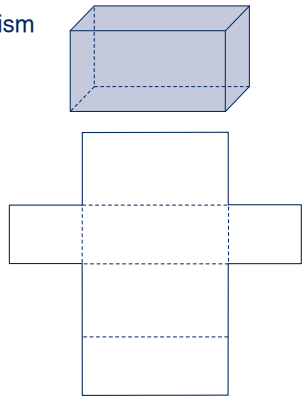
NEMP Access Task

Approach:	Independent	Year:	8
Focus:	Sketching nets for 3D solids		
Resources:	Answer booklet		

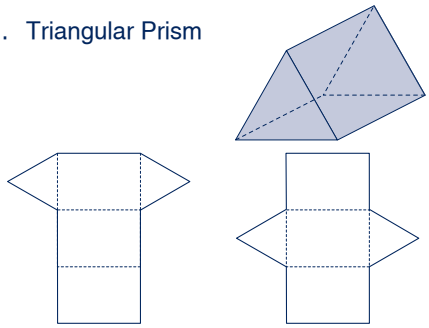
Questions / instructions:

Sketch a net for each solid. The first one has been done for you.

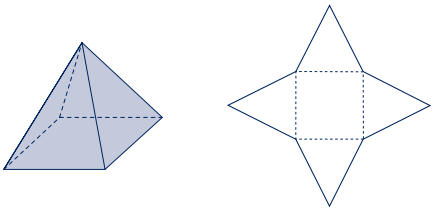
Rectangular Prism



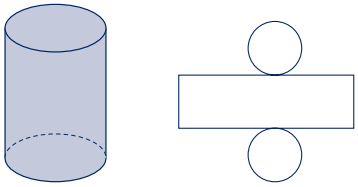
1. Triangular Prism



2. Square-Based Pyramid



3. Cylinder



		% response 2009 ('05) year 8
Triangles:	two	84 (81)
	one	1 (5)
	none or more than two	15 (14)
Rectangles:	three	70 (72)
	one or two	14 (15)
	none or more than three	16 (13)
Sketch will fold into appropriate 3-D shape (solid):	yes	70 (71)

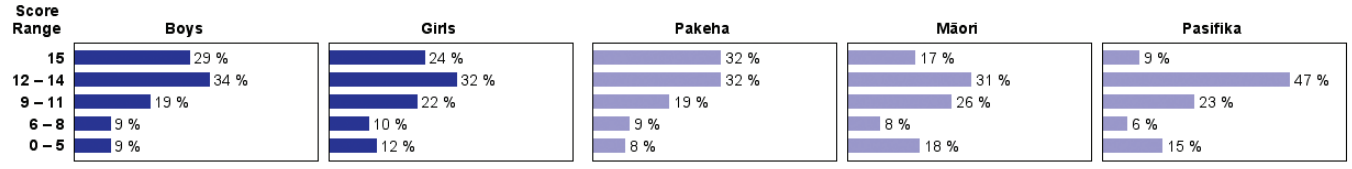
		% response 2009 ('05) year 8
Triangles:	four	89 (87)
	one to three	3 (2)
	none or more than four	8 (11)
Squares:	one	86 (82)
	more than one square	1 (0)
	none	13 (18)
Sketch will fold into appropriate 3-D shape (solid):	yes	84 (80)

		% response 2009 ('05) year 8
Circles:	two	69 (66)
	one	3 (5)
	none or more than two circles	28 (29)
Rectangles:	one	53 (52)
	more than one	9 (7)
	none	38 (41)
Sketch will fold into appropriate 3-D shape (solid):	yes	33 (38)

		% response 2009 ('05) year 8
Total Score:	15	26 (34)
	12–14	34 (26)
	9–11	20 (18)
	6–8	9 (7)
	0–5	11 (15)

Subgroup Analyses:

Year 8



Commentary:

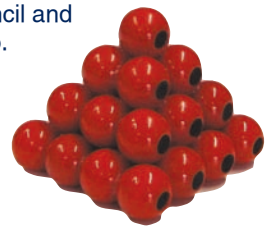
More than two thirds of students successfully sketched nets for the triangular prism and square-based pyramid, but only one third managed the cylinder successfully. Performance was very similar in 2005 and 2009.

Trend Task: Pyramid

Approach:	One to one	Year:	8
Focus:	Patterns/spatial relationships		
Resources:	Ball pyramid, recording book		

Questions / instructions:

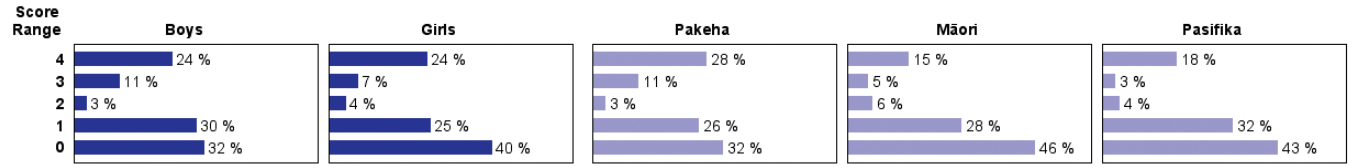
Have a look at this pyramid made of balls. You can pick it up if you want to. You can use pencil and paper if you need to.



		% response 2009 ('05) year 8
1. How many balls make up the pyramid?	30	54 (63)
2. How many balls are hidden in the middle?	1	25 (25)
3. If another layer is added to the bottom of the pyramid, how many more balls would be needed to make the new layer?	25	37 (41)
4. Describe how you got that answer.		
clear explanation with 5 × 5 calculation		32 (27)
clear explanation of thinking process		3 (9)
some explanation but not clear		4 (5)
Total Score:	4	24 (24)
	3	9 (11)
	2	3 (5)
	1	28 (29)
	0	36 (31)

Subgroup Analyses:

Year 8



Commentary:

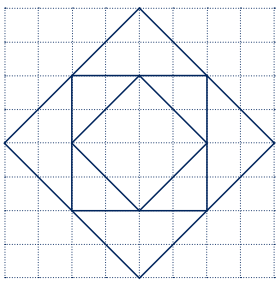
The instruction for question 2 was interpreted in various ways by students so the results for that question were not included in the total score. Performance was similar in 2005 and 2009.

Trend Task: Bigger

Approach:	Independent	Year:	8
Focus:	Enlargement		
Resources:	Ruler		

Questions / instructions:

Here is a design made on squared paper.

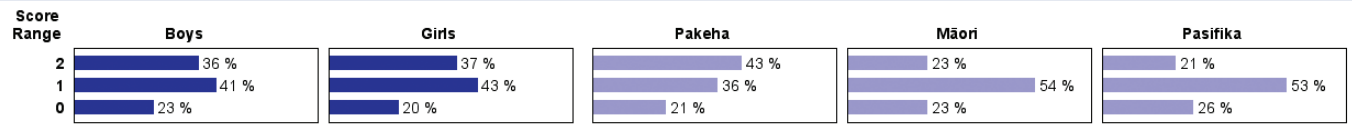


Original size

		% response 2009 ('05) year 8
1. Make the design with lines **twice** as long as the original *[grid paper supplied]*.		
shape was reproduced		78 (83)
all lengths were doubled *(all three squares)*		37 (33)
Total Score:	2	37 (33)
	1	41 (51)
	0	22 (16)

Subgroup Analyses:

Year 8



Commentary:

Most students reproduced the shape, but only 37% doubled its size accurately. Performance was very similar in 2005 and 2009.

		% responses y4	% responses y8
LINK TASK:	**39**		
Approach:	Station		
Year:	4 & 8		
Focus:	Transformation; symmetry		
Total score:	11	22	45
	9–10	20	11
	7–8	17	24
	5–6	17	6
	0–4	24	14
LINK TASK:	**40**		
Approach:	One to one		
Year:	4		
Focus:	Shape and space; transformation; position and orientation; generalising and being precise		
Total score:	5–6	18	
	4	19	
	3	15	
	2	31	
	0–1	17	
LINK TASK:	**41**		
Approach:	One to one		
Year:	8		
Focus:	Shape and space; transformation; position and orientation; generalising and being precise		
Total score:	7–8		32
	5–6		23
	3–4		30
	0–2		15
LINK TASK:	**42**		
Approach:	Station		
Year:	8		
Focus:	Position; coordinates		
Total score:	12		24
	8–11		17
	5–7		17
	2–4		13
	0–1		29
LINK TASK:	**43**		
Approach:	Station		
Year:	8		
Focus:	Angle estimation		
Total score:	8		8
	6–7		32
	4–5		23
	2–3		20
	0–1		17

6 Statistics

Overview: Year 8 students performed moderately better than year 4 students on statistics tasks, with an average of 12% more year 8 than year 4 students succeeding on the same statistics task components. On average, there was a small increase in statistics task performance between 2005 and 2009 for year 4 students, but no change for year 8 students. Because of the small number of tasks involved, these trends should be interpreted cautiously. Major parts of the knowledge and skills normally included in year 4 and year 8 statistics were not assessed in this report, being covered instead in NEMP reports on *Graphs, Tables and Maps.*

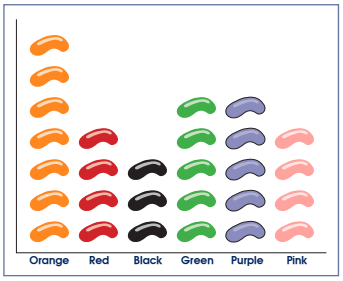
The assessments included six tasks investigating students' understandings, processes and skills in statistics. Statistics is concerned with the collection, organisation and analysis of data, and the estimation of probabilities and use of probabilities for prediction. Readers should note that much of what is usually taught and assessed in this area is covered in separate NEMP reports on using *Graphs, Tables and Maps*: most recently Report 46 on the 2007 assessments.

Four of the six tasks are trend tasks (fully described with data for both 2005 and 2009) and the remaining two are link tasks (to be used again in 2010, so only partially described here). Trend tasks are presented first, followed by link tasks.

Averaged across seven components of the one task administered to both year 4 and year 8 students, 12% more year 8 than year 4 students succeeded with these components. Year 8 students performed better on all seven components. Because only one task was involved, the magnitude of this gain should be interpreted cautiously.

Year 4 students improved markedly on one trend task between 2005 and 2009, with little change on the other trend task. Averaged across 16 components of the two tasks, 5% more students succeeded in 2009 than in 2005, but this arose from an 8% gain on one task and a 1% gain on the other. Gains occurred on 14 of the 16 components, with no change on the other two.

There was no meaningful change between 2005 and 2009 for year 8 students. Averaged across the 20 components of three trend tasks, 0.5% more students succeeded in 2009 than in 2005, with gains on nine components, no change on four, and losses on seven.



Students generally performed well on tasks related to recording or directly interpreting data, but much less well in applying probability-related ideas to data.

Trend Task: Travelling to School

NEMP Access Task

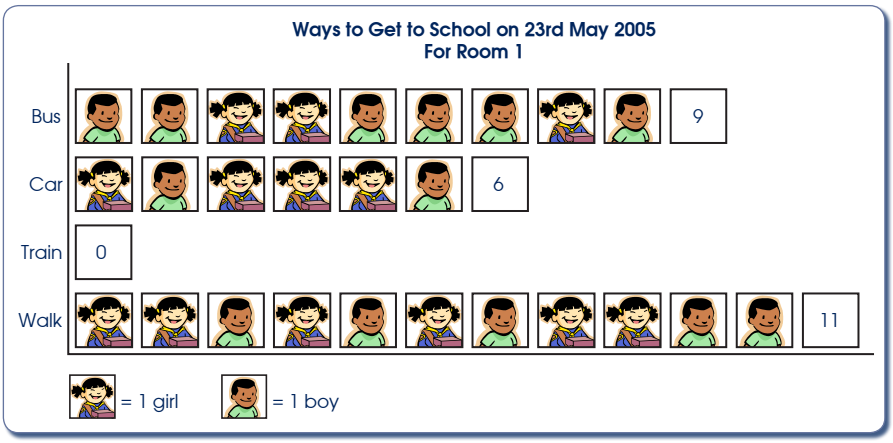
Approach:	One to one
Focus:	Interpret graphs; prediction
Resources:	Graph

Year: 4 & 8

Questions / instructions:

Hand student graph.

Look carefully at this graph.

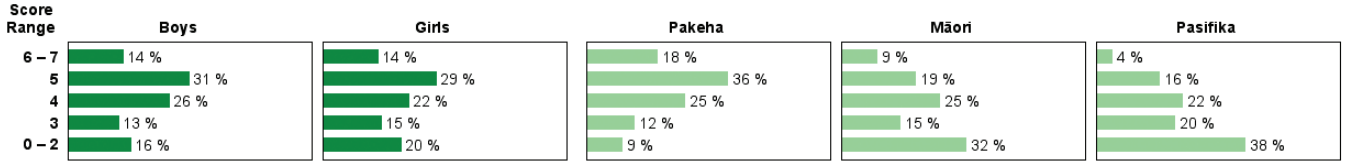


		% response 2009 ('05) year 4	% response 2009 ('05) year 8
1. How many children walk to school?	11	93 (88)	99 (99)
2. How many more children come by bus than by car?	3	62 (62)	89 (91)
3. This graph is for the 23rd of May. Would the graph look the same every day?	no	90 (89)	95 (92)
4. Why do you think that? **Explanation:**			
understanding of variation *(e.g. some children might stay home because sick; some children might want to be driven if it is raining)*		51 (49)	79 (72)
some understanding of variation but unclear		26 (31)	15 (20)
5. What does the row with 'Train' tell you about how these children go to school?			
nobody took the train that day		5 (3)	6 (5)
nobody catches/uses the train		46 (62)	59 (64)
no trains in area/train doesn't stop there/train too expensive, etc.		17 (16)	23 (19)

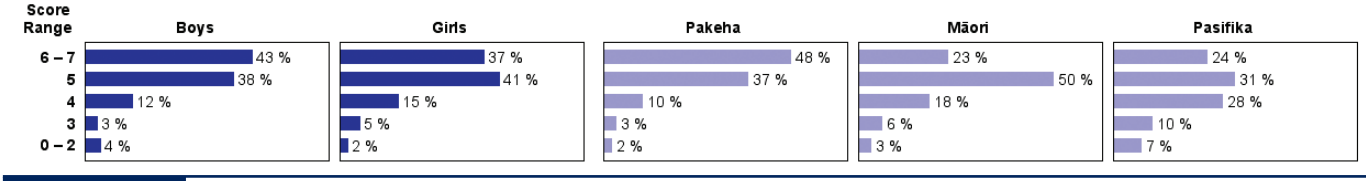
		% response 2009 ('05) year 4	% response 2009 ('05) year 8
6. Tom was not at school on that day. How do you think he normally gets to school?			
no way to tell/can't know		2 (1)	11 (12)
walk		26 (25)	32 (31)
bus		21 (19)	17 (16)
car		27 (40)	17 (19)
train		16 (8)	15 (11)
any other response *(incl. "don't know")*		8 (7)	8 (11)
7. Why do you think that? **Explanation:**			
sound explanation for "not able to tell"		1 (1)	7 (9)
reasonable argument for specific choice based on graph		27 (17)	46 (41)
Total Score:	6–7	14 (10)	41 (34)
	5	30 (28)	39 (40)
	4	24 (26)	13 (20)
	3	14 (18)	4 (3)
	0–2	18 (18)	3 (3)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Most students were good at direct interpretation of the graph for the day, but far fewer understood day-to-day variability in travel methods. There was no meaningful change in performance from 2005 to 2009. Year 4 Māori and Pasifika students and year 8 Pasifika students scored substantially lower than their Pakeha counterparts.

Trend Task: Counting Cars

Approach:	Station
Focus:	Tallying and interpreting data
Resources:	Computer program on laptop computer, answer booklet
Year:	4

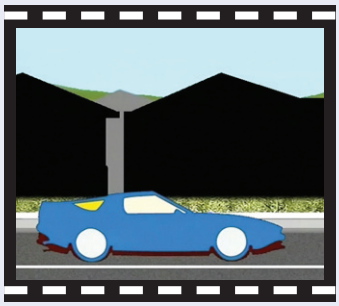
Questions / instructions:

This activity uses the computer.

[Simple animation with cars passing through screen one at a time, each taking five seconds to pass through.]

VOICEOVER INSTRUCTIONS:

You have been asked to make a tally chart that shows the number of different coloured cars that pass your school gate. Use the chart in your answer book to keep a tally of how many cars pass your school. Do not try to do any of the other questions while you are filling in the tally chart. You will have time to do these later. Click the start button to begin.



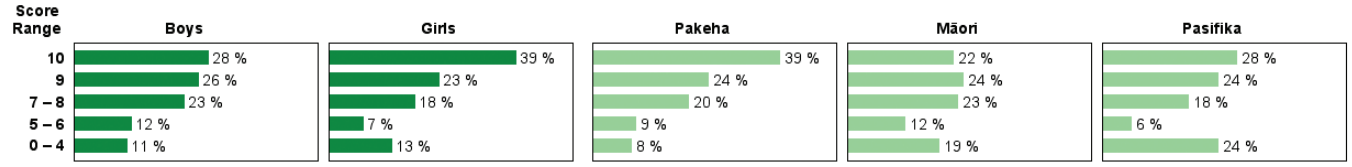
1. Tally Chart

Red Cars	White Cars	Yellow Cars	Blue Cars	Other Colours
𝍸 I	𝍸 III	𝍸	𝍸	III

		% response 2009 ('05) year 4
Tally method:	conventional groups of 5	68 (51)
	sticks only	20 (31)
Tally for:	Red cars – 6	81 (74)
	White cars – 8	78 (69)
	Yellow cars – 4	79 (77)
	Blue cars – 5	83 (76)
	Other cars – 3	84 (76)
2. How many blue cars went past the school?	5	81 (74)
3. Which colour car was the most common?	white	82 (76)
4. How many cars went past the school altogether?	26	60 (55)
5. Which colour car is most likely to come next?	not marked	• (•)
Total Score:	10	34 (24)
	9	24 (26)
	7–8	21 (16)
	5–6	9 (13)
	0–4	12 (21)

Subgroup Analyses:

Year 4



Commentary:

Most year 4 students were successful at tallying and interpreting this information. There was a quite marked improvement from 2005 to 2009.

Trend Task: Tossing a Die

NEMP Access Task

Approach:	One to one
Focus:	Use probabilities for prediction
Resources:	1 die, recording book

Year: 8

Questions / instructions:

Table 1. Predictions	
Number on Die	How many times each number might come up in 30 tosses
1	
2	
3	
4	
5	
6	

Imagine you threw a die 30 times.

1. Fill in the table to show how many times you think each number would come up *[Table 1]*.

   Allow time.

   Predictions:

	% response 2009 ('05) year 8
✓ varied for each number but no number was given more than 10	49 (56)
prediction for each number was 5	42 (35)
any other response	9 (9)

2. Why do you think those numbers are reasonable?

   Explanation:

✓ showed a clear understanding of variation in probability	3 (3)
showed expectation of an even distribution from throws	38 (34)

3. If someone put down that 12 out of the 30 would be sixes, would that be unusual or surprising? yes — 81 (70)

4. Why do you say that?

   Explanation:

✓ showed a clear understanding of variation in probability, but indicated 12 out of 30 would be unusually high	3 (3)
showed a clear understanding of variation in probability, and thought 12 out of 30 was a reasonable possibility	4 (2)
showed an expectation that the distribution would be even	13 (8)

Table 2. Actual Amounts		
Number on Die	How many times each number came up in 30 tosses	
	Tally	Amount
1		
2		
3		
4		
5		
6		

5. Throw this die 30 times. Use this tally chart to record how often the numbers come up *[Table 2]*.

   Allow time. Count the 30 throws for the student but don't tally for them.

   Used tally system:

	% response 2009 ('05) year 8
yes, including clusters of five	79 (73)
yes, not including clusters of five	18 (22)
Tallies totalled 30:	76 (76)

6. Why do you think there are differences between your predictions and what you actually got?

   Explanation:

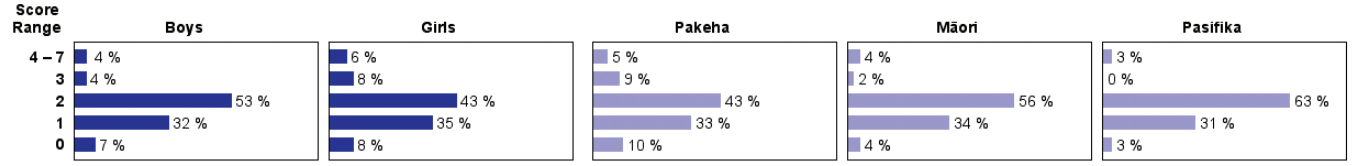
   (extent to which the explanation showed understanding of appropriate variation in probability)

strong	1 (1)
moderate	21 (23)
weak or no explanation	78 (76)

Total Score:	
4–7	5 (4)
3	6 (9)
2	48 (49)
1	33 (21)
0	8 (17)

Subgroup Analyses:

Year 8



Commentary:

The total score centred on understanding of randomness and probability, and few year 8 students performed well. All subgroups performed similarly.

NEMP Access Task

Approach:	One to one
Focus:	Understanding randomness and probability
Resources:	2 graphs

Year: 8

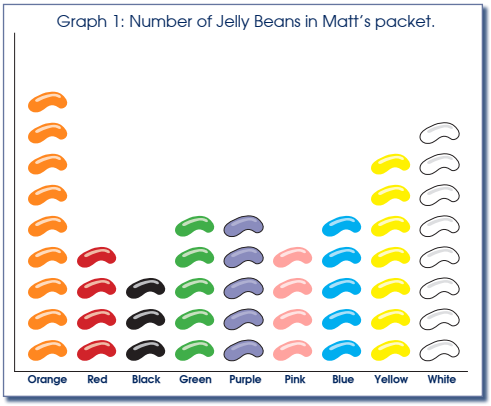
Questions / instructions:

Matt likes black jelly beans the best. But he thinks that there are always fewer black ones than the other colours. He wants to write to the makers asking them to put more black ones in. Matt's teacher told him he should have some data or information to support what he is saying.

1. What do you think Matt should do to get some data or information to go with his letter?

	% response 2009 ('05) year 8
Data on frequency of jelly beans in packets:	
use several packets of jelly beans to tally/graph proportion of black ones	35 (35)
use single packet of jelly beans to tally/graph proportion of black ones	24 (31)
Data on proportion of people who particularly like black jelly beans:	
presented good ideas for a survey	13 (10)
mentioned issue without elaboration	11 (10)

Show student graph 1.



This graph shows the jelly beans in one packet.

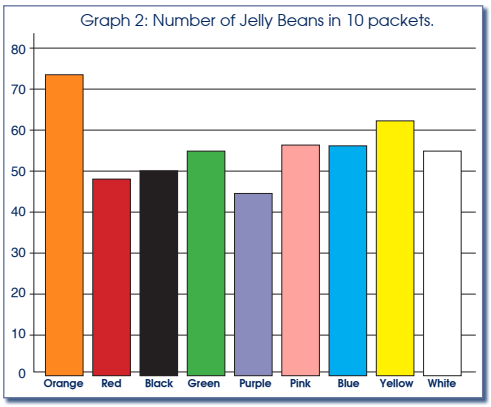
2. Do you think that this would be enough information to convince the makers that there should be more black jelly beans in each packet?

	% response 2009 ('05) year 8
✓ no	48 (54)
yes	48 (39)

3. Why do you think that?

	% response 2009 ('05) year 8
Support for "yes":	
black lowest on graph	36 (32)
Support for "no":	
only one fewer black than red or pink	10 (9)
should sample more than one packet to judge proportion of black	27 (34)
graph does not give information about people's preference for different colours	7 (10)

Show student graph 2.



This graph shows the jelly beans in ten packets.

4. Do you think that Matt should write to the jelly bean makers?

	% response 2009 ('05) year 8
✓ no	71 (68)
yes	24 (23)

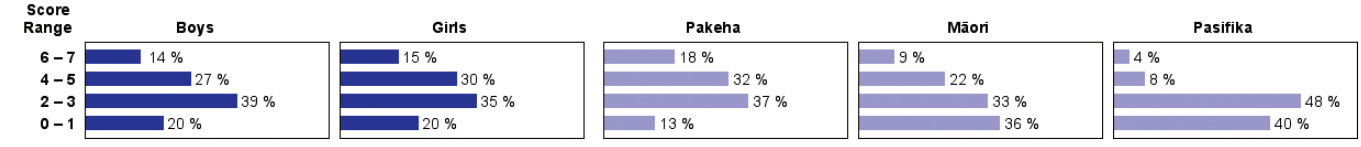
5. Why do you say that?

	% response 2009 ('05) year 8
Support for "no":	
black is not lowest on graph	61 (59)
Support for "yes":	
black is not high/highest on graph	7 (4)
lots of people have black as their favourite	2 (2)

Total Score:	% response 2009 ('05) year 8
6–7	15 (10)
4–5	28 (34)
2–3	37 (43)
0–1	20 (13)

Subgroup Analyses:

Year 8



Commentary:

This task involved interpreting data, taking into account randomness and probability. Performance was not strong, with 57% scoring fewer than half marks. Pasifika students scored markedly lower than Pakeha and Māori students.

		% responses y4	% responses y8
LINK TASK:	**44**		
Approach:	One to one		
Year:	8		
Focus:	Probabilites for prediction		
Total Score:	12–15		6
	9–11		28
	6–8		41
	3–5		18
	0–2		7
LINK TASK:	**45**		
Approach:	Station		
Year:	8		
Focus:	Use probabilities for prediction		
Total score:	10		22
	8–9		11
	6–7		28
	3–5		27
	0–2		12

7 Mathematics Survey

Overview: Mathematics is a popular subject, ranking second among 14 subjects for year 4 students and third for year 8 students. Two thirds of year 4 students and one third of year 8 students were very positive about "learning and doing maths" as they got older. A clear majority of students in both years nominated basic facts and tables as very important for learning maths or being very good at maths. There has been a resurgence in attention, since 2005, to learning basic facts and tables in year 4 students' own time, although not back to the level of 2001.

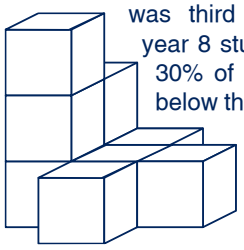
Attitudes and Motivation

Students' attitudes, interests and liking for a subject can have a bearing on their achievement. The mathematics survey sought information from students about their curriculum preferences and perceptions of their own achievement. The questions were the same for year 4 and year 8 students. The survey was administered to the students in an independent session (four students working individually on tasks, supported by a teacher). The questions were read to year 4 students, and also to individual year 8 students who requested this help. Writing help was available if requested.

Mathematics Survey

The survey included 11 items which asked students to record a rating response by circling their choice, one item which asked them to select three preferences from a list, one item which asked them to nominate up to six activities, and two items which invited them to write comments.

In the social studies survey, also administered during the 2009 assessments, students were asked to select their three favourite school subjects from a list of 14 subjects. Full details are in the social studies report, but it is appropriate to summarise here how mathematics fared. Mathematics was second in popularity of the 14 subjects among year 4 students, chosen by 44% of them. Physical education and sport was slightly higher, at 53%, with a large gap below mathematics to the next subject at 32%. Mathematics was third in popularity for year 8 students, chosen by 30% of students, but well below the 71% for physical education and sport, and 45% for technology.



MATHS ACTIVITIES STUDENTS LIKE DOING AT SCHOOL:
[• = question not asked in that year

	year 4 2009 ('05) ['01']	year 8 2009 ('05) ['01]
doing maths work sheets	49 (44) [41]	41 (35) [33]
work in my maths book	46 (36) [40]	30 (27) [22]
maths problems and puzzles	43 (41) [39]	57 (58) [60]
maths tests	36 (30) [30]	14 (10) [16]
using a calculator	35 (28) [29]	35 (33) [27]
using equipment	27 (37) [35]	42 (44) [43]
maths competitions	21 (24) [22]	26 (23) [25]
explaining my maths ideas	14 (9) [•]	8 (12) [•]
using maths textbooks	11 (16) [14]	20 (21) [17]

Students were presented with a list of nine mathematics activities and asked to nominate up to three that they liked doing at school. The responses are shown adjacent and are listed in order by year 4 percentages. Comparative figures are given for 2001 and 2005, but it should be noted that a new choice was added in 2005 so the percentages for 2001 are not strictly comparable.

The most notable changes from year 4 to year 8 are that "maths problems and puzzles" and "using equipment" are substantially more popular at year 8 level, while taking "maths tests" is substantially less popular at year 8 level. Comparing the 2001 and 2009 results, there have been moderate increases at both year levels in the popularity of "doing maths work sheets", "work in my maths book", and "using a calculator", with a modest decline at year 4 level in the popularity of "using equipment".

An open-ended question asked students to nominate what they considered to be some very important things a person needs to learn or do to be good at maths. They were asked to try to think of three things. Their responses were coded into eight categories and the results shown in the table adjacent are percentage totals from the sets of three ideas. If a student listed two or more ideas in the same category (such as learning addition facts and multiplication tables), only one was counted. Basic facts and tables were seen by a clear majority of students in both years to be important (increased at least 10% from 2005), with several other factors given fairly equal but lower importance.

A second open-ended question asked students, *"What are some interesting maths things you do in your own time?"* Their responses were coded into seven categories, and the results shown in the table adjacent are percentage totals, out of those students who responded. Year 4 students placed more emphasis on basic facts and tables, while year 8 students made more diverse choices. The emphasis on basic facts and tables among year 4 students declined dramatically between 2001 and 2005, but increased again by 2009 to midway between the earlier percentages.

IMPORTANT FOR LEARNING AND BEING GOOD AT MATHS:
Factors nominated by students as being very important for learning maths or for being very good at maths.

	year 4 2009 ('05)	year 8 2009 ('05')
basic facts and tables	59 (43)	63 (53)
work skills *(practice, study, revision, homework)*	22 (21)	19 (18)
personal attributes *(good attitudes, concentration, focus, enjoyment)*	17 (18)	20 (23)
classroom behaviours *(seeking help, discussing with others, paying attention)*	16 (24)	15 (15)
intelligence *(thinking, being brainy, being smart, being able to understand)*	16 (17)	17 (15)
maths knowledge *(algebra, money, percentages, use of calculators, etc.)*	14 (14)	29 (23)
skills and abilities in related subjects *(reading, writing)*	7 (7)	4 (7)
problem-solving skills	5 (3)	7 (9)

MATHS ACTIVITIES STUDENTS DO IN THEIR OWN TIME:

	year 4 2009 ('05) ['01']	year 8 2009 ('05) ['01]
basic facts and tables	47 (36) [56]	29 (20) [21]
puzzles, quizzes and games	24 (25) [23]	22 (23) [24]
maths homework	10 (8) [7]	9 (9) [10]
math skills *(excluding basic facts)*	9 (14) [9]	21 (16) [25]
life skills maths *(counting money, banking, calculating animal feed, fencing for paddocks, etc.)*	3 (3) [3]	10 (12) [15]
none	6 (7) [8]	16 (18) [16]
other	9 (16) [8]	3 (14) [12]

Rating Items

Responses to the 11 rating items are presented in separate tables on the following page for year 4 and year 8 students.

The student responses to the rating items showed the pattern found to date in all subjects except technology: year 8 students are less likely to use the most positive rating than year 4 students. In other words, students become more cautious about expressing high enthusiasm and self-confidence over the four additional years of schooling. It is also clear, however, that about 10% more year 8 than year 4 students have distinctly negative views about their own capabilities in mathematics, while 32% more year 8 than year 4 students are negative about "doing maths in their own time". These patterns have stayed quite consistent from the 2001 survey to the 2009 survey. Over the same period, there have been worthwhile reductions, at both year levels, in the percentages of students who said that they didn't know how good their parents thought they were at maths, or how good their teacher thought they were at maths.

There is clear scope for further reduction in the percentage of students who do not know what their teacher thinks about their mathematical capabilities.

YEAR 4 MATHEMATICS 2009 (2005) [2001]

[• = question not asked in that year]

	more	*about the same*	*less*		
1. Would you like to do more, the same or less maths at school?					
	40 (37) [38]	42 (41) [39]	18 (22) [23]		
					
2. How much do you like doing maths at school?					
	55 (50) [51]	31 (34) [30]	10 (10) [10]	4 (6) [9]	
3. How good do you think you are at maths?					
	45 (33) [41]	43 (55) [45]	9 (8) [10]	3 (4) [4]	
					***don't know***
4. How good does your teacher think you are at maths?					
	46 (39) [46]	32 (30) [25]	5 (6) [5]	1 (1) [1]	16 (24) [23]
5. How good does your Mum or Dad think you are at maths?					
	69 (63) [65]	18 (21) [15]	2 (4) [4]	1 (2) [1]	10 (10) [15]
					
6. How much do you like doing maths on your own?					
	49 (50) [53]	27 (26) [23]	13 (14) [14]	11 (10) [10]	
7. How much do you like doing maths with others?					
	62 (59) [55]	26 (25) [27]	8 (7) [9]	4 (7) [9]	
8. How much do you like helping others with their maths?					
	64 (60) [56]	22 (22) [25]	9 (9) [9]	5 (9) [10]	
9. How do you feel about doing things in maths you haven't tried before?					
	45 (47) [47]	31 (31) [28]	16 (14) [15]	8 (8) [10]	
10. How much do you like doing maths in your own time (not at school)?					
	38 (40) [37]	26 (26) [23]	16 (14) [16]	20 (20) [24]	
11. How do you feel about learning or doing maths as you get older?					
	68 (64) [•]	21 (24) [•]	7 (6) [•]	4 (6) [•]	

YEAR 8 MATHEMATICS 2009 (2005) [2001]

[• = question not asked in that year]

	more	*about the same*	*less*		
1. Would you like to do more, the same or less maths at school?					
	15 (14) [13]	65 (59) [59]	20 (27) [28]		
					
2. How much do you like doing maths at school?					
	24 (25) [26]	51 (48) [40]	19 (19) [23]	6 (8) [11]	
3. How good do you think you are at maths?					
	14 (23) [22]	64 (56) [58]	16 (16) [16]	6 (5) [4]	
					***don't know***
4. How good does your teacher think you are at maths?					
	15 (20) [20]	47 (39) [34]	12 (8) [10]	2 (3) [3]	24 (30) [33]
5. How good does your Mum or Dad think you are at maths?					
	29 (31) [35]	44 (43) [32]	11 (10) [7]	2 (2) [1]	14 (14) [25]
					
6. How much do you like doing maths on your own?					
	20 (26) [23]	36 (38) [42]	28 (22) [21]	16 (14) [14]	
7. How much do you like doing maths with others?					
	46 (46) [49]	38 (37) [34]	13 (14) [11]	3 (3) [6]	
8. How much do you like helping others with their maths?					
	30 (33) [30]	44 (38) [40]	20 (21) [20]	6 (8) [10]	
9. How do you feel about doing things in maths you haven't tried before?					
	34 (32) [33]	45 (45) [38]	16 (17) [21]	5 (6) [8]	
10. How much do you like doing maths in your own time (not at school)?					
	9 (11) [9]	23 (22) [22]	31 (31) [33]	37 (36) [36]	
11. How do you feel about learning or doing maths as you get older?					
	34 (32) [•]	47 (50) [•]	14 (14) [•]	5 (4) [•]	

8 Performance of Subgroups

Overview: Community size, school size, school type (for year 8 students) and geographic zone did not seem to be important factors predicting achievement on the mathematics tasks, but students from high decile schools scored higher than students from low decile schools on about 80% of the tasks. Year 4 boys scored slightly higher, on average, than year 4 girls, but performance differences between year 8 boys and girls were typically very small. On average, at both year levels, Pakeha students scored moderately to strongly higher than Māori students and strongly higher than Pasifika students, but on all tasks there was a substantial overlap in the performance of these groups of students. Responses to the *Mathematics Survey* showed a clear tendency for Pasifika students to be more enthusiastic about studying mathematics than their Pakeha counterparts. Compared to the 2005 assessments, the 2009 assessments showed a greater advantage for students who lived in homes where English was the predominant language.

Although national monitoring has been designed primarily to present an overall national picture of student achievement, there is some provision for reporting on performance differences among subgroups of the sample. Eight demographic variables are available for creating subgroups, with students divided into subgroups on each variable, as detailed on page 7 of Chapter 1.

Analyses of the relative performance of subgroups used the total score for each task, created as described in Chapter 1.

SCHOOL VARIABLES

Five of the demographic variables related to the schools the students attended. For these five variables, statistical significance testing was used to explore differences in task performance among the subgroups. Where only two subgroups were compared (for *School Type*), differences in task performance between the two subgroups were checked for statistical significance using t-tests. Where three subgroups were compared, one-way analysis of variance was used to check for statistically significant differences among the three subgroups.

Because the number of students included in each analysis was quite large (approximately 420), the statistical tests were quite sensitive to small differences. To reduce the likelihood of attention being drawn to unimportant differences, the critical level for statistical significance for tasks reporting results for individual students was set at $p = .01$ (so that differences this large or larger among the subgroups would not be expected by chance in more than 1% of cases). For the one task administered to teams of students, $p = .05$ was used as the critical level, to compensate for the smaller numbers of cases in the subgroups.

For the first four of the five school variables, statistically significant differences among the subgroups were found for less than 22% of the tasks at both year levels. For the remaining variable, statistically significant differences were found on more than 80% of the tasks at both levels. In the detailed report below, all differences mentioned are statistically significant (to save space, the words “statistically significant” are omitted).

School Type

Results were compared for year 8 students attending full primary schools, intermediate or middle schools, or year 7 to 13 high schools.

In comparing students attending full primary and intermediate (or middle) schools, there were no differences on any of the 88 tasks, nor on any questions of the *Mathematics Survey*. In comparing students attending intermediate (or middle) schools to those attending year 7 to 13 high schools, there were no differences on questions of the *Mathematics Survey*, but there was a difference on one of the 88 tasks: students attending year 7 to 13 high schools scored higher on *Pointless* (p35).

Community Size

Results were compared for students living in communities containing over 100,000 people (main centres), communities containing 10,000 to 100,000 people (provincial cities), and communities containing less than 10,000 people (rural areas).

For year 4 students, there were differences among the three subgroups on five of the 61 tasks. Students from main centres scored highest on *Number Facts (Multiplication)* (p14), *Quick Way* (p16) and *Division Facts* (p18), while students from provincial cities scored lowest on *Jumpers* (p13) and *Counting Cars* (p69). There were no differences on questions of the *Mathematics Survey*.

For year 8 students, there were differences among the three subgroups on four of the 88 tasks. Students from main centres scored highest on *Addition Y8* (p34) and *Link Task 22* (p42), while students from provincial cities scored lowest on *Link Tasks 20 and 26* (p42). There were no differences on questions of the *Mathematics Survey*.

School Size

Results were compared from students in larger, medium-size, and small schools (exact definitions were given on page 7 of Chapter 1 (p5).

For year 4 students, there were differences among the three subgroups on seven of the 61 tasks. Students attending small schools scored lowest on *Link Task 11* (p41). Students attending large schools scored highest on the remaining six tasks, while students attending small schools scored lowest. These six tasks were *Number Facts (Multiplication)* (p14), *Quick Way* (p16), *Division Facts* (p18), *Less Than* (p39), *Link Task 22* (p42) and *Link Task 33* (p57). There were no differences on questions of the *Mathematics Survey*.

For year 8 students there were differences among the three subgroups on five of the 88 tasks. Students from small schools scored lowest on *Subtraction Facts* (p21), *Link Task 26* (p42), *Measuring Up* (p52) and *Hot and Cold* (p53), while students from medium-sized schools scored highest and students from large schools lowest on *Link Task 4* (p40). There were no differences on questions of the *Mathematics Survey*.

Zone

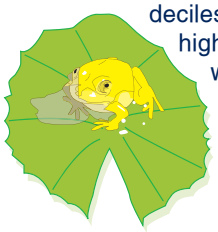
Results were compared for students from Auckland, the rest of the North Island, and the South Island.

For year 4 students, there were differences among the three subgroups on 13 of the 61 tasks. Because of the number of tasks involved, they are not listed here. Students from Auckland scored clearly highest on six tasks, students from the rest of the North Island clearly lowest on five tasks and students from the South Island highest on two tasks. There were no differences on questions of the *Mathematics Survey*.

For year 8 students, there were differences among the three subgroups on 18 of the 88 tasks. Because of the number of tasks involved, they are not listed here. Students from the South Island scored highest on 11 tasks, students from Auckland highest on three tasks and lowest on one task, and students from the rest of the North Island lowest on three tasks. There were no differences on questions of the *Mathematics Survey*.

Socio-Economic Index

Schools are categorised by the Ministry of Education based on census data for the census mesh blocks where children attending the schools live. The SES index takes into account household income levels and categories of employment. The SES index uses 10 subdivisions, each containing 10% of schools (deciles 1 to 10). For our purposes, the bottom three deciles (1-3) formed the low SES group, the middle four deciles (4-7) formed the medium SES group, and the top three deciles (8-10) formed the high SES group. Results were compared for students attending schools in each of these three SES groups.



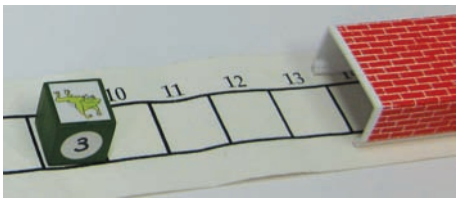
For year 4 students, there were differences among the three subgroups on 52 of the 61 tasks. Because of the number of tasks involved, they are not listed here. In each case, performance was lowest for students attending low decile schools. Students attending high decile schools performed better than students attending medium decile schools on all but four tasks, but these differences were often smaller than those between low and medium decile schools. There were also differences on two questions on the *Mathematics Survey* (p75). Students in low decile schools were most positive about how good they thought they were at mathematics (question 3) and how much they liked doing mathematics in their own time (question 10).

For year 8 students, there were differences among the three subgroups on 73 of the 88 tasks. Because of the number of tasks involved, the specific tasks are not listed here. In each case, performance was lowest for students attending low decile schools. Students attending high decile schools performed better than students attending medium decile schools on all but eight tasks, but these differences were often smaller than those between low and medium decile schools. There were also differences on two questions of the *Mathematics Survey* (p75). Students in medium decile schools judged that their parents were most positive about their mathematical capabilities (question 5), while students in high decile schools were least positive about learning or doing mathematics as they got older (question 11).

STUDENT VARIABLES

Three demographic variables related to the students themselves:

- *Gender:* boys and girls
- *Ethnicity:* Māori, Pasifika and Pakeha (this term was used for all other students)
- *Language used predominantly at home:* English and other.



The analyses reported compare the performances of boys and girls, Pakeha and Māori students, Pakeha and Pasifika students, and students from predominantly English-speaking and non-English-speaking homes.

For each of these three comparisons, differences in task performance between the two subgroups are described using effect sizes and statistical significance.

For each task and each year level, the analyses began with a t-test comparing the performance of the two selected subgroups and checking for statistical significance of the differences. Then the mean score obtained by students in one subgroup was subtracted from the mean score obtained by students in the other subgroup, and the difference in means was divided by the pooled standard deviation of the scores obtained by the two groups of students. This computed effect size describes the magnitude of the difference between the two subgroups in a way that indicates the strength of the difference and is not affected by the sample size. An effect size of +.30, for instance, indicates that students in the first subgroup scored, on average, three tenths of a standard deviation higher than students in the second subgroup.

For each pair of subgroups at each year level, the effect sizes of all available tasks were averaged to produce a mean-effect size for the curriculum area and year level, giving an overall indication of the typical performance difference between the two subgroups.

Gender

Results achieved by male and female students were compared using the effect-size procedures.

For year 4 students, the mean-effect size across the 60 tasks was .14 (boys averaged 0.14 standard deviations higher than girls). This difference is small. There were statistically significant ($p < .01$) differences favouring boys on 11 of the 60 tasks: *Jumpers* (p13), *Number Facts (Multiplication)* (p14), *Population Change* (p22), *Number Line Places* (p37), *Less Than* (p39), *Link Tasks 5, 8* (p40) and *Link Task 23* (p42), *Link Task 30* (p57), *Spotlight* (p59) and *Point of View* (p61). There was a difference favouring girls on one task: *Jelly* (p46). There was also a difference on one question of the *Mathematics Survey* (p75): boys were more inclined than girls to want to do more mathematics at school (question 1).

For year 8 students, the mean-effect size across the 87 tasks was .03 (boys averaged 0.03 standard deviations higher than girls); this is a very small difference. There were statistically significant differences on just four of the 87 tasks, with girls scoring higher on *Bridge* (p32) and *Multiplication* Y8 (p36), while boys scored higher on *Tryathlon* (p33) and *Link Task 43* (p66). There were also differences on two questions of the *Mathematics Survey* (p75). Boys thought that they were better at mathematics (question 3) and also believed that their teacher thought that they were better at mathematics (question 4).

Ethnicity

Results achieved by Māori, Pasifika, and Pakeha (all other) students were compared using effect-size procedures. First, the results for Pakeha students were compared to those for Māori students. Second, the results for Pakeha students were compared to those for Pasifika students.

Pakeha-Māori Comparisons

For year 4 students, the mean-effect size across the 60 tasks was .42 (Pakeha students averaged 0.42 standard deviations higher than Māori students). This is a moderate to large difference. There were statistically significant differences ($p < .01$) on 45 of the 60 tasks. Pakeha students scored higher than Māori students on all 45 tasks. Because of the number of tasks showing differences, they are not listed here. There was also a difference on one question of the *Mathematics Survey* (p75): Māori students were more positive than Pakeha students about doing maths in their own time (question 10).

For year 8 students, the mean-effect size across the 87 tasks was .38 (Pakeha students averaged 0.38 standard deviations higher than Māori students). This is a moderate to large difference. There were statistically significant differences on 58 of the 87 tasks. Pakeha students scored higher than Māori students on all 58 tasks. Because of the number of tasks showing differences, they are not listed here. There were no differences on questions of the *Mathematics Survey*.

Pakeha-Pasifika Comparisons

Readers should note that only 36–51 year 4 or 25–46 year 8 Pasifika students were included in the analysis for each task because of differing numbers of Pasifika students in the three subsamples in each year level, and varying completion of tasks. This is lower than normally preferred for NEMP subgroup analyses, but has been judged adequate for giving a useful indication, through the overall pattern of results, of the Pasifika students' performance. Because of the relatively small numbers of Pasifika students, $p = .05$ has been used here as the critical level for statistical significance.

For year 4 students, the mean-effect size across the 60 tasks was .50 (Pakeha students averaged 0.50 standard deviations higher than Pasifika students). This is a large difference. There were statistically significant differences on 45 of the 60 tasks. Pakeha students scored higher on all 45 tasks. Because of the number of tasks showing differences, they are not listed here. There were also differences on five questions of the *Mathematics Survey* (p75). Pasifika students were more positive than Pakeha students about doing more maths at school (question 1), how much they liked doing maths at school (question 2), helping others with their maths (question 8), doing maths in their own time (question 10), and learning or doing maths as they got older (question 11).

For year 8 students, the mean-effect size across the 87 tasks was .53 (Pakeha students averaged 0.53 standard deviations higher than Pasifika students). This is a large difference. There were statistically significant differences on 64 of the 87 tasks. Pakeha students scored higher on all 64 tasks. Because of the number of tasks showing differences, they are not listed here. There were also differences on two questions of the *Mathematics Survey* (p75): Pasifika students were more positive than Pakeha students about doing more maths at school (question 1) and about doing maths in their own time (question 10).

Home Language

Results achieved by students who reported that English was the predominant language spoken at home were compared, using effect-size procedures, with the results of students who reported predominant use of another language at home (most commonly an Asian or Pasifika language).

For year 4 students, the mean-effect size across the 60 tasks was .20 (students for whom English was the predominant language at home averaged 0.20 standard deviations higher than the other students). This is a small to moderate difference. There were statistically significant differences on 10 of the 60 tasks: *Chocolate Fractions* (p17), *Population Change* (p22), *Work It Out Y4* (p28), *Link Task 6* (p40), *Which Unit?* (p48), *Toyota Camry* (p49), *Link Task 32* (p57), *Spotlight* (p59), *Mirror Image* (p62) and *Travelling to School* (p68). Students for whom English was the predominant language at home performed significantly better on each of these tasks than the students who reported predominant use of another language at home. There were also differences on four questions of the *Mathematics Survey* (p75), with students whose predominant language at home was not English more positive about doing maths at school (question 2), doing maths on their own (question 6), doing maths in their own time (question 10), and learning or doing maths as they got older (question 11).

For year 8 students, the mean-effect size across the 87 tasks was .24 (students for whom English was the predominant language at home averaged 0.24 standard deviations higher than the other students). This is a moderate difference. There were statistically significant differences on 19 of the 87 tasks, with students for whom English was the predominant language spoken at home scoring higher on all 19 of these tasks. Because of the number of tasks, they are not listed here. There were also differences on four questions of the *Mathematics Survey* (p75), with students whose predominant language at home was not English more inclined to want to do more maths at school (question 1) and more positive about doing maths at school (question 2), doing maths on their own (question 6) and doing maths in their own time (question 10).

Summary, with Comparisons to Previous Mathematics Assessments

Community size, school size, school type (full primary, intermediate, or Year 7 to 13 high school) and geographic zone did not seem to be important factors predicting achievement on the mathematics tasks. The same was true for the 2005, 2001 and 1997 assessments. However, there were statistically significant differences in the performance of students from low, medium and high decile schools on 85% of the tasks at year 4 level (compared to 63% in 2005, 87% in 2001 and 85% in 1997), and 83% of the tasks at year 8 level (compared to 65% in 2005, 76% in 2001 and 77% in 1997).

For the comparisons of boys with girls, Pakeha with Māori, Pakeha with Pasifika students, and students for whom the predominant language at home was English with those for whom it was not, effect sizes were used. Effect size is the difference in mean (average) performance of the two groups, divided by the pooled standard deviation of the scores on the particular task. For this summary, these effect sizes were averaged across all tasks.

Year 4 boys averaged slightly higher than girls, with a mean effect size of 0.14 (a little higher than the mean effect sizes of 0.08 in 2005 and 0.10 in 2001). Year 8 boys averaged very slightly higher than girls, with a mean effect size of 0.03 (in both 2005 and 2001, girls were ahead of boys by an identical margin).

Pakeha students averaged moderately to substantially higher than Māori students, with mean effect sizes of 0.42 for year 4 students (similar to 0.37 in 2005 and 0.46 in 2001) and 0.38 for year 8 students (similar to 0.35 in 2005 and 0.42 in 2001).

Year 4 Pakeha students averaged substantially higher than Pasifika students, with a mean effect size of 0.50 (compared with 0.35 in 2005 and 0.59 in 2001). Year 8 Pakeha students also averaged substantially higher than Pasifika students, with a mean effect size of 0.53 (essentially unchanged from 0.51 in 2005 and 0.53 in 2001). Responses to the *Mathematics Survey* (p75) showed a clear tendency for Pasifika students to be more enthusiastic about studying mathematics than their Pakeha counterparts.

Compared to students for whom the predominant language at home was English, students from homes where other languages predominated averaged moderately lower, with mean effect sizes of 0.20 for year 4 students and 0.24 for year 8 students (compared to 0.10 for both year levels in 2005). Comparative figures are not available for the assessments in 2001. Year 4 and year 8 students whose predominant language at home was not English tended to be more positive about studying mathematics than students whose predominant language at home was English.

Appendix : The Sample of Schools and Students in 2009

Year 4 and Year 8 Samples

In 2009, 2638 children from 228 schools were in the main samples to participate in national monitoring. About half were in year 4, the other half in year 8. At each level, 110 schools were selected randomly from national lists of state, integrated and private schools teaching at that level, with their probability of selection proportional to the number of students enrolled in the level. The process used ensured that each region was fairly represented. Schools with fewer than four students enrolled at the given level were excluded from these main samples, as were special schools and Māori immersion schools (such as Kura Kaupapa Māori).

In late April 2009, the Ministry of Education provided computer files containing lists of eligible schools with year 4 and year 8 students, organised by region and district, including year 4 and year 8 roll numbers drawn from school statistical returns based on enrolments at 1 March 2009.

From these lists, we randomly selected 110 schools with year 4 students and 110 schools with year 8 students. Schools with four students in year 4 or 8 had a less than 1% chance of being selected, while some of the largest intermediate (year 7 and 8) schools had a more than 90% chance of inclusion.

Pairing Small Schools

At the year 8 level, three of the 110 chosen schools in the main sample had fewer than 12 year 8 students. For each of these schools, we identified the nearest small school meeting our criteria to be paired with the first school. Wherever possible, schools with eight to 11 students were paired with schools with four to seven students, and vice versa. However, the travelling distances between the schools were also taken into account.

Similar pairing procedures were followed at the year 4 level. Here, five pairs of very small schools were included in the sample, giving a total of 115 schools.

Contacting Schools

In the middle of May, we attempted to telephone the principals or acting principals of all schools in the year 8 sample. In these calls, we briefly explained the purpose of national monitoring, the safeguards for schools and students, and the practical demands that participation would make on schools and students. We informed the principals about the materials which would be arriving in the school (a copy of a 20-minute NEMP DVD, plus copies for all staff and trustees of the general NEMP brochure and the information booklet for sample schools). We asked the principals to consult with their staff and Board of Trustees and confirm their participation by the middle of June.

A similar procedure was followed at the end of July with the principals of the schools selected in the year 4 samples. They were asked to respond to the invitation within about three weeks.

Response from Schools

Of the 113 schools originally invited to participate at year 8 level, 110 agreed. Of the 115 schools originally invited to participate at year 4 level, 111 agreed. The most common reason for withdrawal was severe space constraints, usually associated with current redevelopment work. The schools who withdrew were replaced by schools with similar characteristics from the same district.

Sampling of Students

Each school sent a list of the names of all year 4 or year 8 students on their roll. Using computer-generated random numbers, we randomly selected the required number of students (12 or four plus eight in a pair of small schools), at the same time clustering them into random groups of four students. The schools were then sent a list of their selected students and invited to inform us if special care would be needed in assessing any of those children (e.g. children with disabilities or limited skills in English).

For the year 8 sample, we received 102 comments about particular students. In 61 cases, we randomly selected replacement students because the children initially selected had left the school between the time the roll was provided and the start of the assessment programme in the school, or were expected to be away or involved in special activities throughout the assessment week. The remaining 41 comments concerned children with special needs. Each such child was discussed with the school and a decision agreed. Eight students were replaced because they were very recent immigrants or overseas students who had extremely limited English-language skills. Nineteen students were replaced because they had disabilities or other problems of such seriousness that it was agreed that the students would be placed at risk if they participated. Participation was agreed upon for the remaining 14 students, but a special note was prepared to give additional guidance to the teachers who would assess them.

For the year 4 sample, we received 146 comments about particular students. Forty-four students originally selected were replaced because they had left the school or were expected to be away throughout the assessment week. Two students were replaced because they were not correctly classified as year 4 students. Thirty-one students were replaced because of their NESB status and very limited English. Fifty-six students were replaced because they had disabilities or other problems of such seriousness the students appeared to be at risk if they participated. Special notes for the assessing teachers were made about 13 children retained in the sample.

Communication with Parents

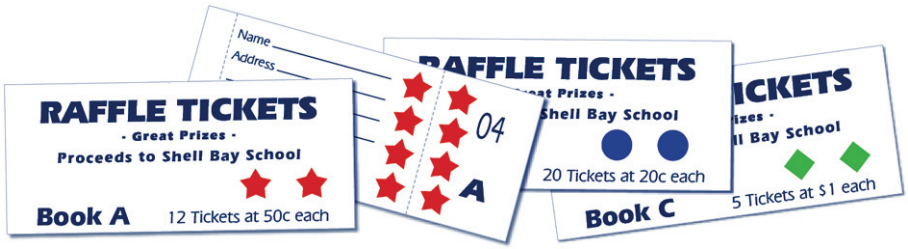
Following these discussions with the school, Project staff prepared letters to all of the parents, including a copy of the NEMP brochure, and asked the schools to address the letters and mail them. Parents were told they could obtain further information from Project staff (using an 0800 number) or their school principal, and advised that they had the right to ask that their child be excluded from the assessment.

At the year 8 level, we received a number of phone calls including several from students or parents wanting more information about what would be involved. Eight students were replaced because they did not want to participate or their parents did not want them to (usually because of concern about missing regular classwork).

At the year 4 level we also received several phone calls from parents. Some wanted details confirmed or explained (notably about reasons for selection). Four children were replaced at their parents' request.

Practical Arrangements with Schools

On the basis of preferences expressed by the schools, we then allocated each school to one of the five assessment weeks available and gave them contact information for the two teachers who would come to the school for a week to conduct the assessments. We also provided information about the assessment schedule and the space and furniture requirements, offering to pay for hire of a nearby facility if the school was too crowded to accommodate the assessment programme. This proved necessary in several cases.



Results of the Sampling Process

As a result of the considerable care taken, and the attractiveness of the assessment arrangements to schools and children, the attrition from the initial sample was quite low. About 3% of selected schools in the main samples did not participate, and less than 4% of the originally sampled children had to be replaced for reasons other than their transfer to another school or planned absence for the assessment week. The main samples can be regarded as very representative of the populations from which they were chosen (all children in New Zealand schools at the two class levels apart from the one to two percent who were in special schools, Māori immersion programmes, or schools with fewer than four year 4 or year 8 children).

Of course, not all the children in the samples actually could be assessed. Two student places in the year 8 sample were not filled because insufficient students were available in small schools. One student at each year level was withdrawn because they had been incorrectly classified as year 4 or year 8. Three year 8 students and two year 4 students left school at short notice and could not be replaced. Four year 8 students and one year 4 students withdrew or were withdrawn by their parents or school too late to be replaced. Twenty-one year 8 students and twenty year 4 students were absent from school throughout the assessment week. Some other students were absent from school for some of their assessment sessions, and a very small percentage of performances were lost because of malfunctions in the video recording process. Some of the students ran out of time to complete the schedules of tasks. Nevertheless, for most of the tasks over 90% of the sampled students were assessed. Given the complexity of the Project, this is a very acceptable level of participation.

Composition of the Sample

Because of the sampling approach used, regions were fairly represented in the sample, in approximate proportion to the number of school children in the regions.

REGION

PERCENTAGES OF STUDENTS FROM EACH REGION:		
REGION	% YEAR 4 SAMPLE	% YEAR 8 SAMPLE
Northland	4.5	3.6
Auckland	33.6	33.6
Waikato	10.0	10.0
Bay of Plenty/Poverty Bay	8.2	8.2
Hawkes Bay	3.6	3.6
Taranaki/Whanganui/Manawatu	7.3	8.2
Wellington/Wairarapa	10.9	10.9
Nelson/Marlborough/West Coast	3.6	3.6
Canterbury	11.8	11.8
Otago/Southland	6.4	6.4

DEMOGRAPHY

DEMOGRAPHIC VARIABLES: PERCENTAGES OF STUDENTS IN EACH CATEGORY			
VARIABLE	CATEGORY	% YEAR 4 SAMPLE	% YEAR 8 SAMPLE
Gender	Male	51	52
	Female	49	48
Ethnicity	Pakeha	67	69
	Māori	22	22
	Pasifika	11	9
Geographic Zone	Greater Auckland	32	33
	Other North Island	46	45
	South Island	22	22
Community Size	< 10,000	16	16
	10,000 – 100,000	28	21
	> 100,000	56	63
School SES Index	Bottom 30%	26	24
	Middle 40%	40	44
	Top 30%	34	32
Main Language at Home	English	84	86
	Other	16	14
Size of School	< 25 y4 students	20	
	25 – 60 y4 students	46	
	> 60 y4 students	34	
	<35 y8 students		20
	35 – 150 y8 students		34
	> 150 y8 students		46
Type of School	Full Primary		34
	Intermediate or Middle		50
	Year 7 to 13 High School		11
	Other *(not analysed)*		5

Mathematics is pervasive. We encounter and use mathematical ideas and processes in our ordinary everyday lives and, in varying degrees of sophistication, it is used in all fields of industry, commerce, the sciences and technology.

In order to fully understand the world around us and exercise effective control over our own affairs, we all need to develop mathematical understandings, skills and attitudes.

National monitoring provides a "snapshot" of what New Zealand children can do at two levels, at the middle and end of primary education (year 4 and year 8).

The main purposes for national monitoring are:

- to meet public accountability and information requirements by identifying and reporting patterns and trends in educational performance
- to provide high quality, detailed information which policy makers, curriculum planners and educators can use to debate and review educational practices and resourcing.

NEMP National Education Monitoring Project

MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
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NEMP Report 52