NATIONAL EDUCATION MONITORING PROJECT

Science

Assessment Results 2007

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

SCIENCE ASSESSMENT RESULTS 2007

NEMP Report 44

NEMP
National Education Monitoring Project
NEW ZEALAND

Science

Assessment Results

2007

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NATIONAL EDUCATION MONITORING REPORT 44

MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

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Note that reports are published the year after the research is undertaken i.e. reports for 2008 will not be available until 2009.

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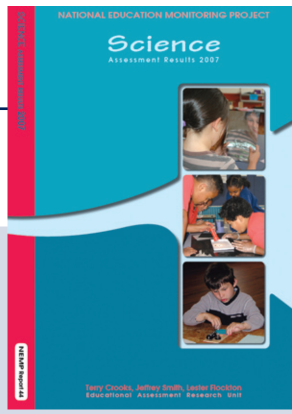

NATIONAL EDUCATION MONITORING REPORT 44

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- members of the Project's Science Advisory Panel
- principals and children of the schools where tasks were trialled
- principals, staff and Board of Trustee members of the 248 schools included in the 2007 sample
- the 2877 children who participated in the assessments and their parents
- the 96 teachers who administered the assessments to the children
- the 44 senior tertiary students who assisted with the marking process
- the 170 teachers who assisted with the marking of tasks early in 2008.

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 other physical products. Many of the responses are recorded on videotape for subsequent analysis.

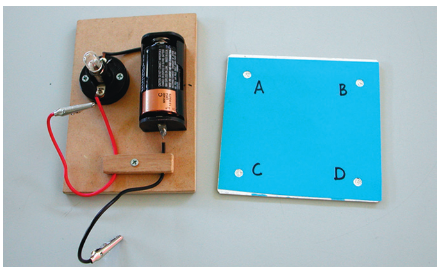
The use of many tasks with both year 4 and year 8 students allows comparisons of the performance of year 4 and 8 students in 2007. Because some tasks have been used twice, in 2003 and again in 2007, trends in performance across the four-year period can also be analysed and reported.

ASSESSING SCIENCE

In 2007, the first year of the fourth cycle of national monitoring, three areas were assessed: science, art, and the use of graphs, tables and maps. This report presents details and results of the assessments in science.

The aims of a science education include the development of knowledge and understanding, skills of scientific investigation, and attitudes on which such investigation depends. A framework for science education and its assessment is presented in **Chapter 2.** This framework highlights the four main content strands of the science curriculum (the living world, physical world, material world, and planet Earth and beyond) and also indicates important scientific approaches, skills and attitudes.

Most students responded with considerable enthusiasm to tasks involving hands-on experimentation, as individuals or as teams. Their enthusiasm for tasks exploring knowledge and understanding of scientific phenomena and concepts was lower on average, but varied considerably depending on the particular task.



LIVING WORLD

Chapter 3 examines achievement relating to the living world curriculum strand.

Averaged across 249 task components used with both year 4 and year 8 students, 10% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made useful progress between year 4 and year 8 in the skills assessed by the tasks. Not surprisingly, students at both levels were less successful in providing explanations for living world phenomena than in demonstrating their knowledge of the phenomena or their ability to classify and identify observable features of specific phenomena. Year 8 students generally were substantially better than year 4 students at offering explanations, but the advantage was smaller on components focused on identification, classification and knowledge.

Nine trend tasks involving a total of 94 components were administered to year 4 students in both the 2003 and 2007 assessments. Averaged across these components, 1% fewer students succeeded in 2007 than in 2003. This difference is not important. Ten trend tasks involving 114 task components were administered to year 8 students in both assessments. Averaged across these components, 1% fewer students succeeded in 2007 than 2003. This difference clearly is not important.

PHYSICAL WORLD

Chapter 4 examines achievement relating to the physical world curriculum strand.

Averaged across 69 task components used with both year 4 and year 8 students, 13% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made quite substantial progress between year 4 and year 8 in the skills assessed by the tasks. The largest gains generally occurred for task components requiring explanations of physical world phenomena, and the lowest gains for task components requiring accurate experimentation, observation and reporting.

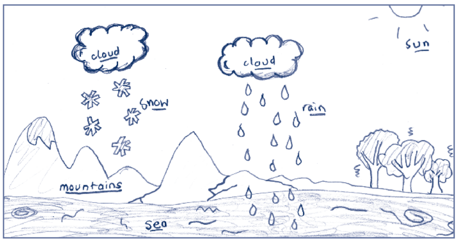
Seven trend tasks involving a total of 40 components were administered to year 4 students in both the 2003 and 2007 assessments. Averaged across these components, 3% fewer students succeeded in 2007 than in 2003. This is a small but noteworthy difference, especially because there was an identical (3%) decline in performance between 1999 and 2003. The same seven trend tasks were administered to year 8 students in both assessments. Averaged across the 40 components, 1% fewer students succeeded in 2007 than 2003. This difference is not important, although it matches a similar 1% decline between 1999 and 2003.

MATERIAL WORLD

Chapter 5 reports achievement relating to the material world curriculum strand.

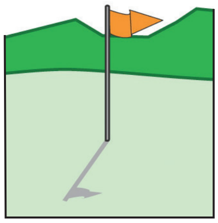
Averaged across 101 task components used with both year 4 and year 8 students, 14% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made quite substantial progress between year 4 and year 8 in the skills assessed by the tasks. The largest gains generally occurred for task components requiring explanations of material world phenomena, and the lowest gains for task components requiring accurate experimentation, observation and reporting.

Six trend tasks involving a total of 60 components were administered to year 4 students in both the 2003 and 2007 assessments. Averaged across these components, 3% fewer students succeeded in 2007 than in 2003. Considered alongside the 2% decline between 1999 and 2003, this small difference becomes noteworthy. The same six trend tasks were administered to year 8 students in both assessments. Averaged across the 60 components, the same percentage of students succeeded in 2007 as in 2003.



PLANET EARTH AND BEYOND

Chapter 6 examines achievement relating to the planet Earth and beyond curriculum strand.



Averaged across 133 task components used with both year 4 and year 8 students, 11% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made useful progress between year 4 and year 8 in the skills assessed by the tasks.

Four trend tasks involving a total of 46 components were administered to year 4 students in both the 2003 and 2007 assessments. Averaged across the 46 components, 2% fewer students succeeded in 2007 than in 2003. This is a very small difference. Between 1999 and 2003 there had been no change. Six trend tasks involving 60 task components were administered to year 8 students in both assessments. Averaged across these components, 2% fewer students succeeded in 2007 than in 2003. This is a very small difference. Between 1999 and 2003 there had been a 3% increase for this strand.

SURVEY

Chapter 7 presents the results of the science surveys, which sought information from students about their curriculum preferences and their perceptions of their achievement and potential in science. Students were also asked about their involvement in science-related activities within school and beyond.

Students were asked to indicate their first three preferences from a list of six class science activities. Two activities ("doing things like experiments" and "going on field trips") were strong first preferences at both year levels, with year 4 regarding both similarly and year 8 strongly favouring experiments.

Year 4 students were generally very positive about doing science at school. Almost two thirds chose the highest rating for the first question (about liking to do science at school), and 71% would like to do more science at school. Over half wanted to keep learning about science when they grew up, and about a quarter thought they would make good scientists when they grew up. The year 4 students were less confident that they learned a lot of science at school, with 24% saying that they learned "heaps" and only 12% saying that their class did really good things in science "heaps". The proportion of students who felt they had very limited opportunities to learn science has increased over the last eight years: 16% said that they learned "very little" in science at school (compared to 8% in 1999), 15% said they "never" did really good things in science at school (compared to 5% in 1999), and there were increased percentages saying that they "never" did the following things in science at school: experiments with science equipment, experiments with everyday things, research or projects, and visits to science activities. These responses suggest that much science in school is bookwork, with practical work, field trips, visits and experiments less common. In a question introduced for the first time in the 2007 survey, it is a concern that 32% of year 4 students marked "don't know" in response to "How good does your teacher think that you are at doing science".

Compared to year 4 students, year 8 students were less inclined to use the most positive categories. This pattern has been common in national monitoring surveys. Older students can be expected to be more discerning and critical, as well as more realistic about their own abilities. However, trends across time paralleled those already mentioned for year 4 students. Almost half of the year 8 students would like more science at school. The percentage of year 8 students particularly enjoying science at school dropped from 37% to 24% over eight years, while the percentage with a negative view increased from 15% to 37%. Sixteen percent (compared to 8% in 1999) indicated that their class "never" did really good things in science. There were similar increases in the percentages indicating that they "never" did experiments with everyday things or with science equipment. Only 5% indicated that they thought they would be a good scientist when they grew up, while 38% said that they "didn't know" how good their teacher thought they were at doing science.

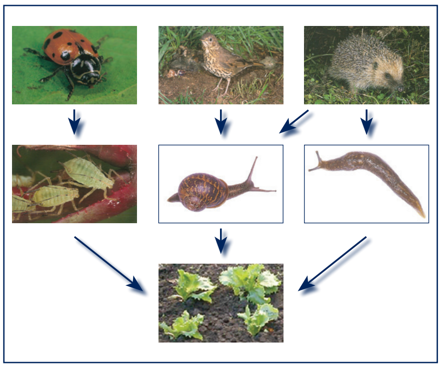
PERFORMANCE OF SUBGROUPS

School type (full primary, intermediate, or year 7 to 13 high school), school size, community size and geographic zone were not important factors predicting achievement on the science tasks. This was also true in the 2003, 1999 and 1995 science assessments.

There were statistically significant differences in the performance of students from low, medium and high decile schools on 67% of the tasks at year 4 level (compared to 65% in 2003, 54% in 1999, and 54% in 1995). At year 8 level there were statistically significant differences on 74% of the tasks (compared to 65% in 2003, 63% in 1999, and 56% in 1995). Over the 12 years from 1995 to 2007, there has been a modest increase in disparities of achievement among students from schools at different decile levels.

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 0.04 (boys averaged 0.04 standard deviations higher than girls). The advantage for year 4 boys has



decreased slightly since 1999, from mean effect sizes of 0.08 in 2003 and 0.15 in 1999. Year 8 boys also averaged slightly higher than girls, with a mean effect size of 0.09 (exactly the same as in 2003, and slightly lower than the mean effect size of 0.14 in 1999).

Pakeha students averaged moderately higher than Māori students, with mean effect sizes of 0.30 for year 4 students and 0.37 for year 8 students. These mean effect sizes are identical at both year levels to the 2003 results, and very slightly higher than the corresponding figures in 1999 (0.27 for year 4 students, 0.34 for year 8 students).

Pakeha students averaged substantially higher than Pasifika students, with mean effect sizes of 0.58 for year 4 students and 0.59 for year 8 students. At both year levels, these show very little change from the corresponding results in 2003 and 1999 (0.57 in 2003 and 0.56 in 1999 for year 4 students, and 0.62 in 2003 and 0.55 in 1999 for year 8 students).

A noteworthy feature of the results for Māori and Pasifika students is that they performed most similarly to Pakeha students on tasks that involved practical work (tasks emphasising accurate experimentation, observation and reporting) and tasks that used the team approach. Because a high proportion of these tasks were in the physical world strand (Chapter 4), the smallest mean effect sizes were for this area. In contrast, tasks in the living world strand (Chapter 3) and planet Earth and beyond strand (Chapter 6) predominantly involved knowledge and had the largest gaps in performance between Pakeha students and their Māori or Pasifika counterparts.

Compared to students for whom the predominant language at home was English, students from homes where other languages predominated performed moderately less well at both year levels (both the year 4 and year 8 mean effect sizes were 0.25). These are lower than the corresponding mean effect sizes in 2003 (0.37 for year 4 students and 0.31 for year 8 students). Comparative figures are not available from the assessments in 1999.

SUMMARY OF PERFORMANCE TRENDS

An indication of overall trends in performance across the four-year period between 2003 and 2007 can be obtained by looking at the patterns of change across the trend tasks for all four of the curriculum strands. Averaged across 240 components of the year 4 trend tasks, 2% fewer students succeeded in 2007 than in 2003. Averaged across 274 components of the year 8 trend tasks, 1% fewer students succeeded in 2007 than in 2003.

The 2003 science report reported trends between 1999 and 2003, with an average decline over that four-year period of 1% on year 4 trend task components, and a gain of 2% on year 8 trend task components.

The 1999 science report reported trends between 1995 and 1999, with an average gain over that four-year period of 1% on year 4 trend task components, but no change on year 8 trend task components.

Taken together, these three sets of trend results suggest little change in science performance overall, for either year 4 or year 8 students, for the 12 year period from 1995 to 2007. However, a more detailed look suggests some concern for year 4 students. In the two assessment cycles since 1999, the performance of year 4 students on trend tasks has dropped twice by 3% in the physical world strand, by 2% and then 3% in the material world strand, and by an average of 1% per cycle in the other two strands. The significant declines for year 4 students in the physical and material world strands, which on average included tasks that were very popular with students, may be related to the evidence from the 2007 science survey that year 4 students were sensing a lack of science activities at school, and particularly a lack of "really good things" such as experiments and research/projects. This may reflect, in particular, diminished time spent on science related to the physical and material worlds.

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 2007 assessments. Detailed information about the sample of students and schools is available in the Appendix.

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 main national samples of 1440 year 4 children and 1440 year 8 children represent about 2.5% 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 1440 students selected in the main sample at each year level are divided into three groups of 480 students, comprising four students from each of 120 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.

	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: *numeracy skills* Social Studies Information Skills: *library, research*		
4	2010 (2006) (2002) (1998)	Language: *writing, listening, viewing* Health and Physical Education		

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 slavishly 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 video or computer also allows the use of richer stimulus material, and standardises the presentation of those tasks.

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 2007 assessments, 75% of year 4 students indicated that they particularly enjoyed the tasks. The range across the 117 tasks was from 99% down to 48%. As usual, year 8 students were more demanding. On average, 60% of them indicated that they particularly enjoyed the tasks, with a range across 149 tasks from 95% down to 32%. One task was more disliked than liked, by year 8 students only (a table interpretation task involving New Zealand travelling times).

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, on video, 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 2007, about 45% of the students' work came in that form, on a total of about 3500 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 2007, 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 and Independent*
  Four students worked collaboratively, supervised by a teacher, on some tasks. This was recorded on videotape. The students then worked individually on some paper-and-pencil tasks.
- *Art-making*
  Four students, supervised by a teacher, worked individually on two art-making tasks. For one task, their clay sculptures were recorded on videotape together with an interview about the sculpture.

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 96 teachers served as teacher administrators in 2007, or about 0.5% 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 13 years is 1232 different teachers, 68 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 2007 tasks, employed five hours per day for about five weeks.

The tasks that require higher levels of professional judgement are marked by teachers, selected from throughout New Zealand. In 2007, 170 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"), 67% to 92% of the teachers who marked student work in 2008 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
  – less than 25 year-4 students
  – 25 to 60 year-4 students
  – more than 60 year-4 students
  YEAR 8 SCHOOLS
  – less 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 2010. The cost is about $2.7 million per year, less than one tenth of a percent of the budget allocation for primary and secondary 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.

Reviews by International Scholars

In June 1996, three scholars from the United States and England, with distinguished international reputations in the field of educational assessment, accepted an invitation from the Project directors to visit the Project. They conducted a thorough review of the progress of the Project, with particular attention to the procedures and tasks used in 1995 and the results emerging. At the end of their review, they prepared a report which concluded as follows:

> *The National Education Monitoring Project is well conceived and admirably implemented. Decisions about design, task development, scoring and reporting have been made thoughtfully. The work is of exceptionally high quality and displays considerable originality. We believe that the project has considerable potential for advancing the understanding of and public debate about the educational achievement of New Zealand students. It may also serve as a model for national and/or state monitoring in other countries.*
>
> *(Professors Paul Black, Michael Kane & Robert Linn, 1996)*

A further review was conducted late in 1998 by another distinguished panel (Professors Elliot Eisner, Caroline Gipps and Wynne Harlen). Amid very helpful suggestions for further refinements and investigations, they commented that:

> *We want to acknowledge publicly that the overall design of NEMP is very well thought through… The vast majority of tasks are well designed, engaging to students and consistent with good assessment principles in making clear to students what is expected of them.*

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 Science



Science – a Universal Discipline

Science is an active process, drawing upon and contributing to a growing and changing body of knowledge. It is a universal discipline that involves using knowledge, understandings, skills and imagination to tackle problems and to investigate objects and events of the real world. A science education encourages students to have enquiring minds and to make sense of the actions and interactions of the biological and physical features of their environment.

Science and the National Curriculum

Science education represents part of a balanced curriculum for all New Zealand school students. The science curriculum is organised into four major areas of learning which are intended to help students make sense of the living world, the physical world, the material world, and planet Earth and beyond. Since science is both a process of enquiry and a body of knowledge, the curriculum also requires that students are helped to develop scientific ideas, skills and attitudes, and "acquire an understanding of the nature of science and its relationship to technology".

Within the major areas of content, the aims of a science education include the development of knowledge and understanding, skills of scientific investigation, and attitudes on which such investigation depends. Science is promoted as an activity that is carried out by people as part of their everyday life. Students are to be helped to "explore issues and to make responsible and considered decisions about the use of science and technology in the environment".

Framework for National Monitoring Assessment of Students' Knowledge, Skills and Attitudes in Science

NEMP task frameworks are developed by the Project's curriculum advisory panels. They have two key purposes: to provide a valuable guideline structure for the development and selection of tasks, and to bring into focus important dimensions of the learning domain that should be included in valid analyses of students' knowledge, skills and attitudes.

The frameworks are organising tools that interrelate main ideas, processes and attitudes with reference to important learning outcomes. They 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.

The science framework has a central organising theme supported by three interrelated aspects. The central organising theme, "Science in everyday contexts", sets the broad context for tasks and is consistent with the aims of New Zealand's official science curriculum:

> *Learning in science is fundamental to understanding the world in which we live and work. It helps people to clarify ideas, to ask questions, to test explanations through measurement and observation, and to use their findings to establish the worth of an idea.*
> *(Science in the New Zealand Curriculum, 1993)*

The **content aspect** highlights four categories of subject matter for a science education.

The **approaches aspect** lists the kinds of scientific skills and attitudes that students could be expected to demonstrate in these subject matter areas. These overlap with skills and attitudes required in other learning areas.

The **motivation aspect** of the framework directs attention to the importance of having information about students' science interests, attitudes, confidence and involvement, both within and beyond the school setting. Educational research and practice confirm the impact of student motivation on achievement and learning outcomes.

SCIENCE ASSESSMENT FRAMEWORK

CENTRAL ORGANISING THEME
Science in everyday contexts

CONTENT ASPECT

Living World

- **classification**
  whales are mammals
- **form and function**
  whales' lungs take in oxygen
- **growth and change/life cycles**
  whales have live young
- **interdependence**
  plankton and whales are part of the same food chain

Material World

- **properties**
  wax is soft and smooth
- **changes and reactions**
  when heated, wax melts and burns
- **uses**
  wax is the fuel in candles
- **chemicals in the environment**
  petrol and diesel engines emit pollutants

Physical World

- **explaining phenomena**
  objects make shadows by blocking off light
- **patterns and relationships**
  the closer the light source the bigger the shadow
- **explaining the use of physical phenomena in technological products**
  solar powered calculators work best if there is enough light

Planet Earth and Beyond

- **geological history**
  ice ages had an effect on life and landscape
- **natural processes**
  erosion by rivers, weather systems
- **solar system**
  Earth's rotation causes day and night
- **guardianship of Earth**
  clearing the bush can harm wild life and increase erosion

NATURE OF SCIENCE

What science is and how you do it

(examples italicised)

APPROACHES ASPECT

Essential Skills for Science

- using information and knowledge
- communicating: talking, writing, explaining
- enquiring, asking questions, investigating
- analysing, solving problems
- using equipment, tools and procedures
- scientific thinking: considering and arguing evidence

Essential Attitudes for Science

- **scientific attitudes**
  open-mindedness, seeking and respecting evidence, persistence, honesty
- **habits of mind**
  disposition to ask questions about the world around us and to undertake some exploration to answer the questions and draw conclusions
- **ethical and cultural awareness**
  accepting that the use of science should recognise and value people's different perspectives, and recognising that the use of science has consequences

MOTIVATION ASPECT

Participation
Initiating scientific activities, choosing to take part, using scientific ways of working in everyday contexts.

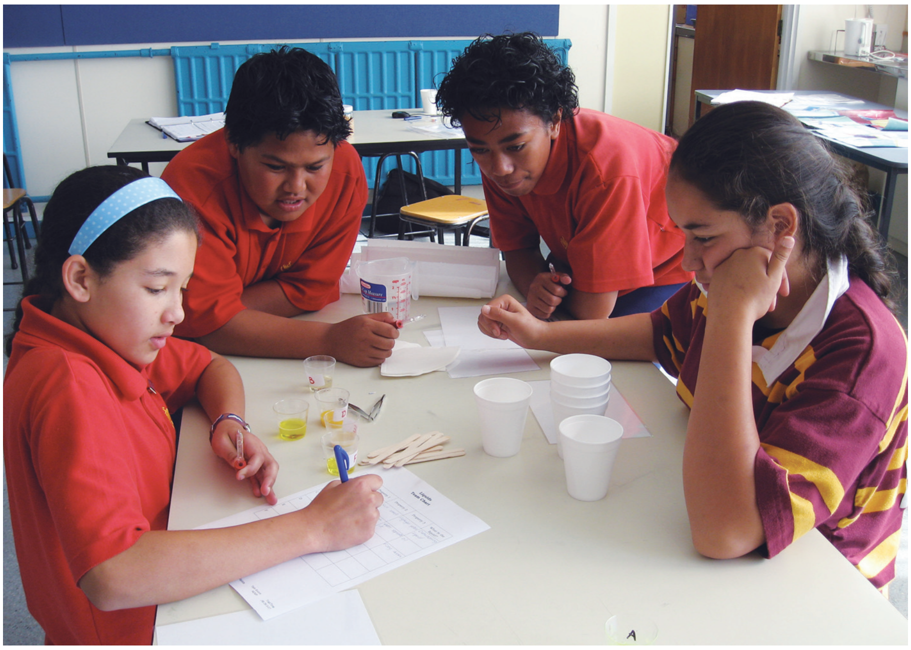
Interest
Displaying curiosity, awe, enthusiasm

The Choice of Science Tasks for National Monitoring

The choice of science 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 dimensions of a science education, and 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 science tasks need to be sufficiently portable, economical, safe and within the handling capabilities of students. Visual items need to depict images and contexts that 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 Science Assessment Tasks

Sixty-six science tasks were administered, using three different approaches. Thirty-nine tasks were administered in one-to-one interview settings, where students used materials and visual information. Nine tasks were presented in team situations involving small groups of students working together. Eighteen tasks were attempted in a stations arrangement, where each student worked independently on a series of paper-and-pencil tasks, many of which included the use of hands-on materials or visual information.

Fifty-five of the 66 tasks were the same or substantially the same for both year 4 and 8, while 11 tasks were unique to year 8.

Trend Tasks

Twenty-nine of the tasks in this report were previously used in identical form in the 2003 assessments. These were called "link tasks" in the 2003 report, but were not described in detail to avoid any distortions in 2007 results that might have occurred if the tasks had been widely available for use in schools since 2003. 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 2003 assessments.

Link Tasks

To allow comparisons of performance between the 2007 and 2011 assessments, 29 of the tasks used for the first time in 2007 have been designated link tasks. Student performance data on these tasks are presented in this report, but the tasks are described only in general terms because they will be used again in 2011.

National Monitoring Science Survey

Additional to the assessment tasks, students completed a questionnaire that investigated their interests, attitudes and involvement in science activity.

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 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, and can be purchased in a kit from the New Zealand Council for Educational Research (P.O. Box 3237, Wellington 6000, New Zealand).

Teachers are also encouraged to use the NEMP web site (http://nemp.otago.ac.nz) to view video clips and listen to audio material associated with some of the tasks.

How to Read 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.

Students did this task in a one-to-one setting with a teacher. See page 8 for descriptions of all four approaches used.

What this task was aiming to evaluate.

The resources used in this task.

ABOUT THE TASK

Trend Task: Mystery Card

Approach: One to one **Year:** 4 & 8
Focus: Exploring closed and open circuits
Resources: Circuit with bulb, battery, mystery card, recording book, pencil

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

Questions / instructions:

In this activity, you will be using this electric circuit to work out where the electricity goes between the circles on this mystery card.

Give student the circuit.

First, touch the clips together on the circuit to make sure that the bulb lights up.

Give student mystery card.

Now have a try at touching different circles on the mystery card with the clips to see what happens.

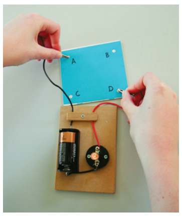
Allow time.

Now touch Circle A with one clip. At the same time, touch Circle B with the other clip.

	% response 2007 ('03) year 4	year 8
1. What's happening to the bulb? bulb lights up	99 (99)	99 (100)

Now touch A with one clip, at the same time touch C with the other clip.

	% response 2007 ('03) year 4	year 8
2. What's happening to the bulb? bulb doesn't light up	98 (99)	99 (99)



Now touch A with one clip, at the same time touch D with the other clip.

	% response 2007 ('03) year 4	year 8
3. What's happening to the bulb? bulb lights up	82 (84)	75 (94)
4. Why do you think the bulb didn't light up when A and C were touched?		
Give student recording book and pencil.		
Quality of explanation: *(A and C not connected, so circuit not complete, so electricity can't flow to light up bulb)*		
clear, detailed explanation	0 (2)	7 (4)
partial explanation	10 (15)	31 (34)
5. Draw what you think is inside the mystery card. **Allow time.**		
A connected to B *(directly or via D)*	54 (60)	76 (82)
A connected to D *(directly or via B)*	47 (56)	60 (79)
A not connected to C *(directly or indirectly)*	81 (88)	86 (88)
6. Use your diagram to explain why the bulb lights up when some circles are touched but not with other circles.		
Explanation:		
clear, convincing explanation, using diagram *(explains lighting up AND not lighting up)*	5 (7)	17 (24)
partial explanation, using diagram *(explains at least one of lighting up OR not lighting up)*	21 (25)	38 (38)
Total score: 4–5	5 (11)	28 (34)
3	30 (40)	32 (40)
2	20 (12)	17 (10)
0–1	45 (37)	23 (16)

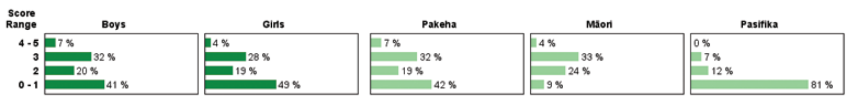
- In 2007, 54% of year 4 students drew A as being connected to B inside the mystery card.
- In 2003, 60% of year 4 students drew A as being connected to B inside the mystery card.
- In 2007, 76% of year 8 students drew A as being connected to B inside the mystery card.
- In 2003, 82% of year 8 students drew A as being connected to B inside the mystery card.

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.

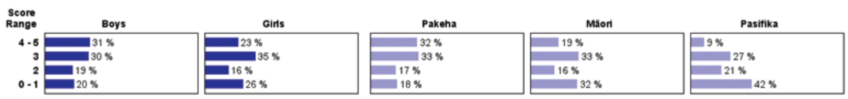
PERFORMANCE PATTERNS

Subgroup Analyses:

Year 4



Year 8



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

Commentary:

This task was very popular but there were some problems with the mystery card for year 8 students in 2007 (the A to D link did not reliably produce the intended result). Performance dropped markedly for year 4 students between 2003 and 2007, but similar judgements are not justified for year 8 students. Performance patterns for subgroups are typical, except for the strong performance of year 4 Māori students.

Comments that assist with interpreting the results.

3 Living World

The 2007 science assessments included 23 assessment tasks related to the living world strand of the science curriculum.

Twenty-one tasks were identical for year 4 and year 8 students. Nine of these are trend tasks (fully described with data for both 2003 and 2007), two are released tasks (fully described with data for 2007 only) and ten are link tasks (to be used again in 2011 so only partially described here). One trend task and one released task were attempted only by year 8 students.

The task details and results for trend tasks are presented in the first section, followed by the task details and results for released tasks. The third section contains a little task information and the results for the link tasks. Within these sections, tasks used with both year 4 and year 8 students are presented first, followed by tasks used only with year 8 students.

Comparing Results for Year 4 and Year 8 Students

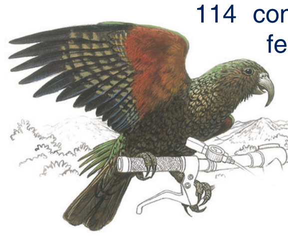
Averaged across 249 task components used with both year 4 and year 8 students, 10% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made useful progress between year 4 and year 8 in the skills assessed by the tasks. Not surprisingly, students at both levels were less successful in providing explanations for living world phenomena than in demonstrating their knowledge of the phenomena or their ability to classify and identify observable features of living world phenomena. Year 8 students generally were substantially better than year 4 students at offering explanations for phenomena, but the advantage was smaller on components focused on identification, classification and knowledge.

Boys and girls performed very similarly at both year levels. Pakeha students scored statistically significantly higher than Māori students on 55% of year 4 tasks and 71% of year 8 tasks. Pakeha students scored statistically significantly higher than Pasifika students on all year 4 tasks and 86% of year 8 tasks. Students whose predominant language at home was English scored statistically significantly higher than other students on 50% of year 4 tasks and 48% of year 8 tasks.

Trend Results: Comparing 2003 and 2007 Results

Nine trend tasks involving a total of 94 components were administered to year 4 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 43 components, more 2003 than 2007 students succeeded on 44 components, and there was no difference on seven components. Averaged across the 94 components, 1% fewer students succeeded in 2007 than in 2003. This difference is not important.

Ten trend tasks involving 114 task components were administered to year 8 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 44 components, more 2003 than 2007 students succeeded on 61 components, and there was no difference on nine components. Averaged across the 114 components, 1% fewer students succeeded in 2007 than 2003. This difference clearly is not important.



Approach: One to one | **Year:** 4 & 8
Focus: Ecosystems
Resources: Computer program on laptop computer

Questions / instructions:

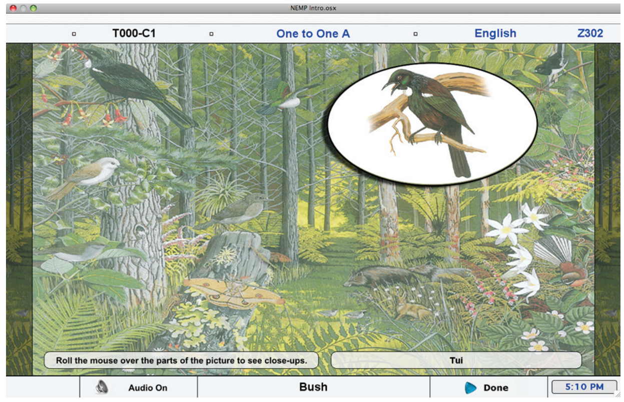
This activity uses the computer.

In this activity you will be thinking about how plants and animals live together in the bush and why plants are important to people.

In the bush there are lots of different animals and plants. You can click on the different parts of the bush picture to see some of the animals and plants.

Try doing that now.

Click the *Bush* button.
[No voiceover; audio of bird song and bush sounds only. Plants and animals enlarge as mouse is rolled over.]



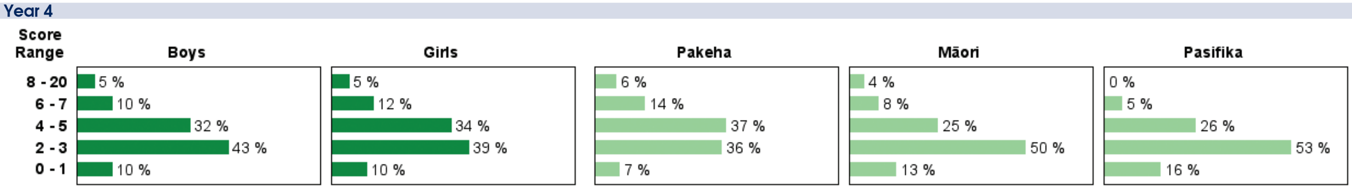
[Illustrations: Forestry Insights, (resource pack for teachers), (1992). *Plants and Animals in Plantation Forests.* Auckland: FITEC. Illustrations now online at: http://www.insights.co.nz. Sighted 27 May 2008.]

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. What are some of the ways that plants help the animals? *PROMPT: Can you think of any more ways?*		
food	80 (79)	91 (94)
shelter *(from cold, rain)* / provide homes	50 (45)	71 (65)
camouflage/hiding from predators	30 (22)	41 (32)
shade *(from sun)*	3 (7)	3 (10)
oxygen *(through photosynthesis)*	17 (16)	21 (22)
2. What are some of the ways that animals help the plants? *PROMPT: Can you think of any more ways?*		
seed dispersion	6 (9)	19 (22)
pollination	7 (5)	11 (22)
fertilise the ground	9 (8)	23 (17)
reduce competing plants	2 (3)	6 (2)
eat pests	5 (8)	13 (11)

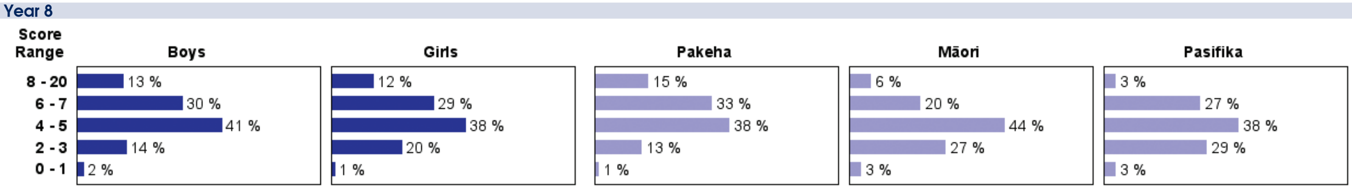
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
3. Try to explain to me **why** plants are important to people.		
food	43 (58)	55 (56)
shade	7 (2)	6 (8)
beauty	39 (40)	37 (46)
building materials	12 (5)	17 (20)
fuel	5 (1)	7 (6)
prevent erosion	1 (0)	1 (0)
shelter	2 (6)	11 (9)
medicines	7 (3)	18 (10)
oxygen	36 (42)	61 (58)
ingredients in human-made products other than medicines *(e.g. paper)*	10 (7)	17 (18)
Total score: 8–20	5 (1)	13 (12)
6–7	11 (9)	29 (36)
4–5	33 (39)	39 (35)
2–3	41 (44)	17 (15)
0–1	10 (7)	2 (2)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students were much more aware of ways that plants help animals than vice versa. Performance patterns on this task were typical of the patterns for many other science tasks: boys and girls performed similarly, while Pakeha students performed moderately better, on average, than Māori students and substantially better, on average, than Pasifika students. There was a wide range of performance for all subgroups.

Trend Task: Cheetahs

Approach: One to one

Year: 4 & 8

Focus: Identify physical features that assist survival

Resources: Video recording on laptop computer

[Discovery Channel (1997). *Discovery Channel – The Ultimate Guide: Big Cats* [video]. United States: Ilc Entertainment]

DESCRIPTION:
No soundtrack; video of cheetah at rest then pursuing and catching its prey. Some sequences in slow motion; telescoped closeups of various body parts with graphic enhancements to highlight movement and function.

Questions / instructions:

This activity uses the computer.

You are going to watch a video of a cheetah. The video shows how different parts of the cheetah help it to hunt.

Click the *Cheetahs* button. No sound on video. When the video has finished, give student the picture.

Look carefully at the picture and think about the video. Tell me the parts of the body that help it to hunt. As you tell me the different parts of its body, I'll write them down.

Now I'll read out the things you have said, and if you want to change any of them you can tell me.

Make any changes offered by the student.

Now tell me how each of these parts of its body helps the cheetah to hunt.

[Grosnick, M.W. (photo.), Theodorou, R., (2001); *Animals in Danger:* Cheetah; Oxford: Heinemann Library]

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Eyes: body part mentioned and value for hunting adequately explained	38 (36)	40 (49)
body part mentioned but value for hunting not adequately explained	23 (30)	15 (32)
body part not mentioned	39 (34)	45 (19)
Ears: body part mentioned and value for hunting adequately explained	34 (42)	34 (44)
body part mentioned but value for hunting not adequately explained	17 (22)	11 (25)
body part not mentioned	49 (36)	55 (31)
Nose: body part mentioned and value for hunting adequately explained	24 (25)	20 (40)
body part mentioned but value for hunting not adequately explained	13 (19)	8 (15)
body part not mentioned	63 (56)	72 (45)
Brain/nerves: body part mentioned and value for hunting adequately explained	2 (3)	2 (1)
body part mentioned but value for hunting not adequately explained	1 (3)	1 (1)
body part not mentioned	97 (94)	97 (98)

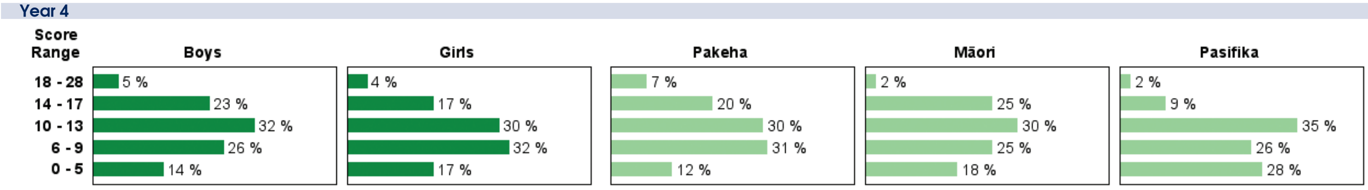
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Muscles: body part mentioned and value for hunting adequately explained	2 (7)	7 (9)
body part mentioned but value for hunting not adequately explained	1 (2)	3 (3)
body part not mentioned	97 (91)	90 (88)
Legs: body part mentioned and value for hunting adequately explained	47 (52)	54 (52)
body part mentioned but value for hunting not adequately explained	29 (30)	20 (30)
body part not mentioned	24 (18)	26 (18)
Spine: body part mentioned and value for hunting adequately explained	54 (39)	80 (79)
body part mentioned but value for hunting not adequately explained	24 (26)	11 (5)
body part not mentioned	22 (35)	9 (16)
Pads on paws: *(traction/grip/cushioning)* body part mentioned and value for hunting adequately explained	18 (8)	46 (21)
body part mentioned but value for hunting not adequately explained	17 (5)	14 (11)
body part not mentioned	65 (87)	40 (68)

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Tail: *(for steering/balance)*		
body part mentioned and value for hunting adequately explained	8 (9)	18 (27)
body part mentioned but value for hunting not adequately explained	14 (14)	5 (7)
body part not mentioned	78 (77)	77 (66)
Claws: *(for gripping/tearing)*		
body part mentioned and value for hunting adequately explained	44 (61)	56 (65)
body part mentioned but value for hunting not adequately explained	14 (13)	11 (12)
body part not mentioned	42 (26)	33 (23)
Jaws/teeth:		
body part mentioned and value for hunting adequately explained	33 (51)	48 (56)
body part mentioned but value for hunting not adequately explained	21 (25)	13 (20)
body part not mentioned	46 (24)	39 (24)
Colour/texture: *(camouflage)*		
body part mentioned and value for hunting adequately explained	17 (25)	28 (39)
body part mentioned but value for hunting not adequately explained	4 (3)	1 (2)
body part not mentioned	79 (72)	71 (59)

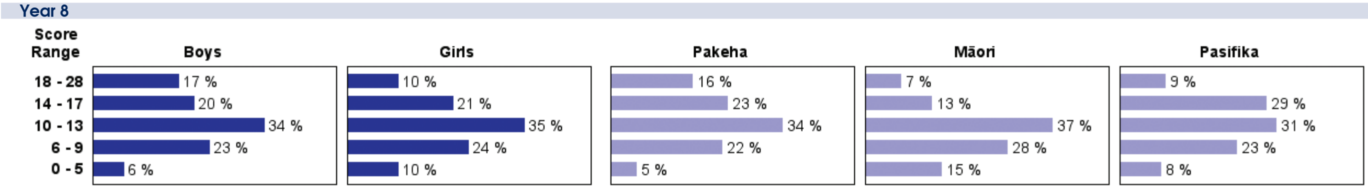
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Overall, mentions:		
detection/tracking/guidance aspects *(at least one: eyes, ears, nose, brain)*	60 (60)	55 (73)
locomotion aspects *(at least one: legs, muscles, spine)*	81 (83)	93 (90)
weapons aspects *(at least one: jaws, teeth, claws)*	57 (76)	63 (80)
camouflage aspects *(at least one: colour, texture)*	20 (28)	29 (42)
Total score: 18–28	5 (10)	14 (23)
14–17	20 (24)	21 (35)
10–13	31 (30)	34 (29)
6–9	29 (28)	23 (10)
0–5	15 (8)	8 (3)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Year 4 and year 8 students performed quite similarly and, at both year levels, performance dropped markedly between 2003 and 2007. Year 8 boys performed noticeably better than girls. Year 4 Māori students and year 8 Pasifika students performed quite similarly to their Pakeha counterparts.

Trend Task: Endangered Animals

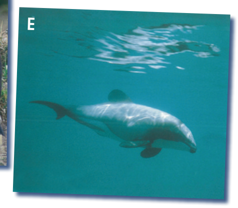
Approach:	One to one	**Year:**	4 & 8
Focus:	Identifying reasons for animals being endangered and suggesting ways and reasons to help them		
Resources:	5 pictures (A,B,C,D,E)		

Questions / instructions:

This activity is about endangered animals. Animals are endangered if there are very few of them left in the world.

Show pictures.

Have a look at these pictures of some endangered animals. There is a kiwi, a panda, a tiger, a yellow-eyed penguin and a Hector's dolphin.



[Illustrations sourced from:
A: Substituted resource in lieu of copyright.
B: Substituted resource in lieu of copyright: *giantpanda1.jpg* Retrieved from: *http://www.bensonassoc.com/pct/ppics.html* Christine, P. (30 May 2008.)
C: Shah, A. (photo.), Pye, W. (1999). *What is an Endangered Animal?*; Auckland: Wendy Pye Publishing.
D: Earl, G. (photo.), Pye, W. (1999). *What is an Endangered Animal?*; Auckland: Wendy Pye Publishing.
E: Todd, B., Dawson, S., Monteath, C. (photo.); Jones, J. (1993). *Hector's Dolphin*; Auckland: Heinemann.]

1. What can cause an animal to become endangered?

PROMPTS: *Can you explain that more? Can you think of any other reasons?*

	% response 2007 ('03) year 4	year 8
hunting/killing/fishing by people	71 (68)	81 (78)
predation by other animals	53 (41)	63 (54)
loss of or change in habitat	19 (16)	39 (35)
reduced availability of needed/ preferred food	21 (20)	33 (23)
natural disaster *(e.g. fire)*	2 (4)	4 (4)
fishing lines/nets or traps *(unintended/accidental)*	11 (7)	14 (14)
disease	5 (5)	6 (7)
pollution	13 (4)	32 (24)
people breaking laws/regulations	6 (10)	21 (21)
breeding restrictions	5 (5)	8 (10)

2. What do you think people could do to stop these animals from dying out?

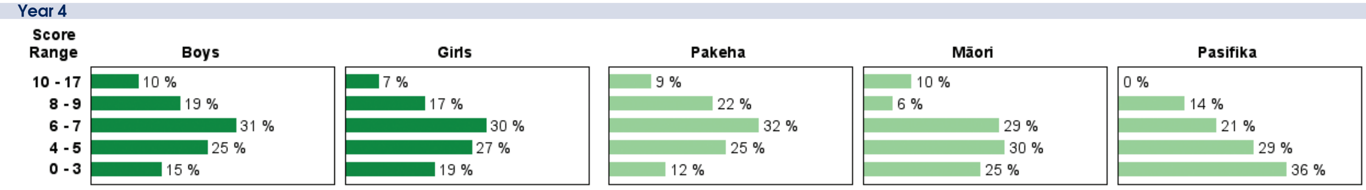
	% response 2007 ('03) year 4	year 8
Valid ideas:		
two or more, well explained	13 (9)	25 (23)
two or more, but little explanation	31 (27)	41 (40)
one, well explained	16 (19)	15 (17)
one but little explanation	33 (34)	18 (18)
any other response	7 (11)	1 (2)

3. Do you think people should try and save endangered animals?
4. Why do you think that?

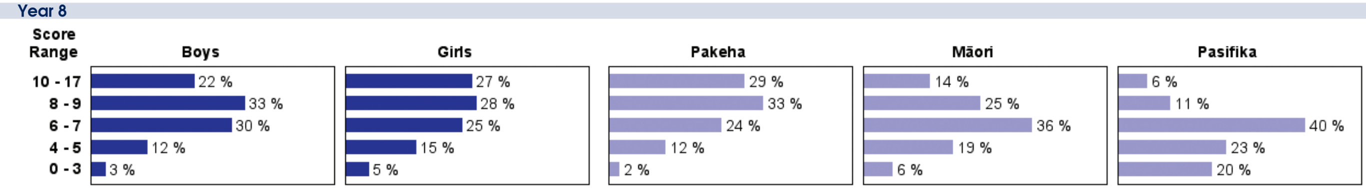
	% response 2007 ('03) year 4	year 8
Strength of agreement and argument:		
yes, strongly stated and well argued	17 (21)	30 (32)
yes, strongly stated but not well argued	51 (49)	47 (41)
yes, moderately stated/argued	28 (26)	21 (23)
no	4 (4)	2 (4)
Total score: 10–17	9 (6)	25 (20)
8–9	18 (14)	30 (27)
6–7	30 (29)	27 (31)
4–5	26 (33)	14 (13)
0–3	17 (18)	4 (9)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students were much more aware of human or animal predation than effects of habitat changes. There was a particularly large performance difference between year 8 Pakeha and Pasifika students.

Trend Task:

NEMP Access Task

Kiwi and Kea

Approach: One to one

Year: 4 & 8

Focus: Adaptation differences between two New Zealand birds

Resources: Picture A (kiwi), picture B (kea)

Questions / instructions:

In this activity you will be looking at two New Zealand birds. Look at the pictures of the kiwi and the kea.

Hand out pictures.

[Illustrations sourced from: Gunson, D. (illus.) Crowe, A. (2001). *Which New Zealand Bird?*. Auckland: Penguin Books NZ.]

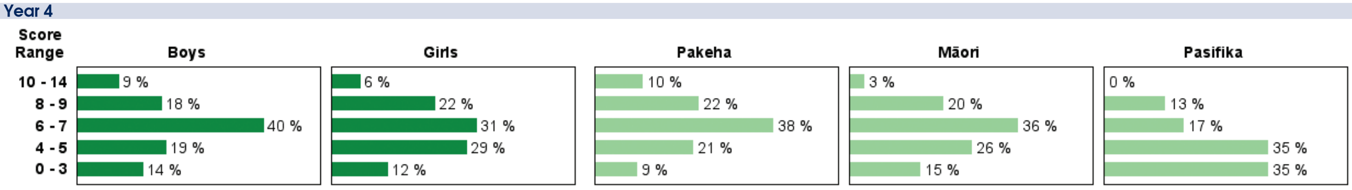
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Tell me how their feathers are different.		
different colours	59 (62)	47 (55)
different textures	37 (33)	40 (46)
different sizes/shapes	45 (46)	68 (74)
2. What does the kiwi use its feathers for?		
weather protection *(warmth, keeping dry)*	66 (61)	79 (76)
camouflage	19 (24)	24 (30)
3. What does the kea use its feathers for?		
weather protection *(warmth, keeping dry)*	37 (30)	48 (42)
camouflage	9 (8)	15 (23)
flight	76 (82)	77 (76)

Now look at the beaks of the two birds.
Allow time.

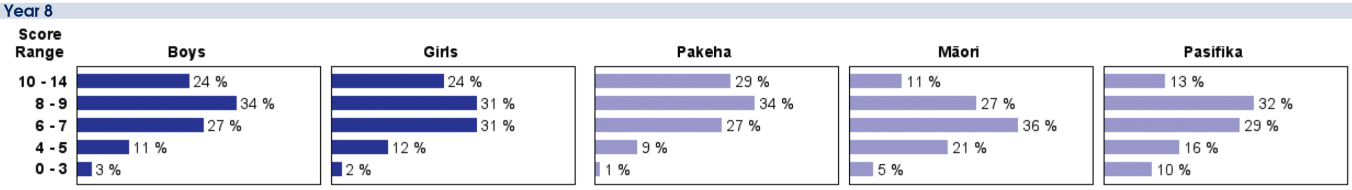
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
4. What kind of food would the kiwi's beak help it to get?		
5. How could the kiwi's beak help it to get that kind of food?		
listed types of food or locations of food <u>that the kiwi's beak is particularly suitable to get</u>	53 (48)	76 (72)
explained accurately why the kiwi's beak is particularly suitable for some types of food	62 (61)	76 (83)
6. What kind of food would the kea's beak help it to get?		
7. How could the kea's beak help it to get that kind of food?		
listed types of food or locations of food <u>that the kea's beak is particularly suitable to get</u>	14 (16)	29 (30)
explained accurately why the kea's beak is particularly suitable for some types of food	29 (31)	47 (42)
Look at the feet of the two birds. **Allow time.**		
8. Why are the kiwi's and kea's feet different from each other?		
kiwi's feet good for walking/ balancing on ground	52 (61)	83 (87)
kea's feet good for holding onto perches/branches	59 (59)	82 (86)
Total score: 10–14	8 (8)	24 (17)
8–9	20 (23)	33 (53)
6–7	35 (25)	29 (25)
4–5	24 (31)	12 (3)
0–3	13 (13)	2 (2)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task showed strong progress from year 4 to year 8. There was a particularly large performance difference between year 4 Pakeha and Pasifika students.

Trend Task: Guess What!

NEMP Access Task

Approach:	One to one
Focus:	Asking questions
Resources:	Chart, rules card, 3 cards, question counter with clothes peg, counters

Year: 4 & 8

Questions / instructions:

Give student chart.

We are going to play a question game called "Guess What!" In this game you will need to try to ask good questions. I have three cards with names of things that are on this chart. You are going to ask me questions to work out which things are on my cards. Here are the rules for the game.

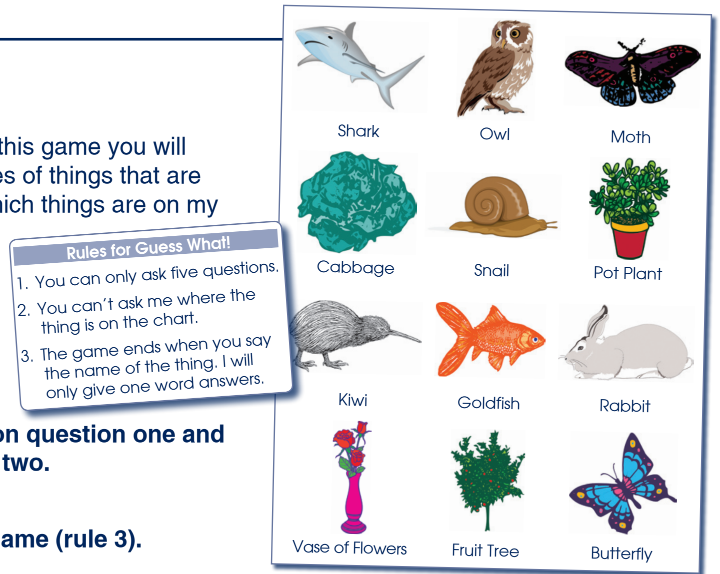
Show and read rules card.

You can put the counters on the things that you think are **not** the answer. I'll move the peg each time you ask a question.

Hand out chart and counters. Place question counter in front of student. Take one card at a time – in the numbered order beginning at 1, then 2 then 3. Start with clothes peg on question one and move to question two when they are ready to ask question two.

"What is your first question?"

Children can guess a thing at any stage but this ends the game (rule 3).



% response 2007 ('03)

Card 1. Goldfish:		year 4	year 8
first question certain to eliminate at least four of the things		23 (25)	43 (47)
Number of questions used:	1	6 (5)	2 (0)
	2	15 (12)	11 (14)
	3	21 (17)	22 (17)
	4	21 (25)	32 (38)
	5	37 (41)	33 (31)
Got the correct answer:		79 (79)	85 (82)

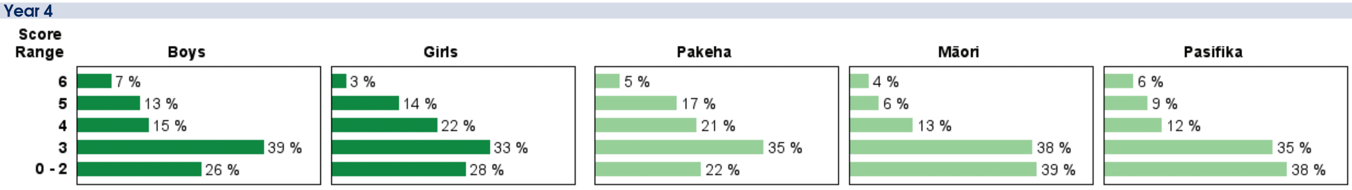
Card 2. Fruit tree:		year 4	year 8
first question certain to eliminate at least four of the things		28 (34)	47 (56)
Number of questions used:	1	3 (1)	0 (0)
	2	6 (6)	8 (7)
	3	18 (19)	29 (26)
	4	23 (26)	26 (31)
	5	50 (48)	37 (36)
Got the correct answer:		73 (67)	83 (85)

% response 2007 ('03)

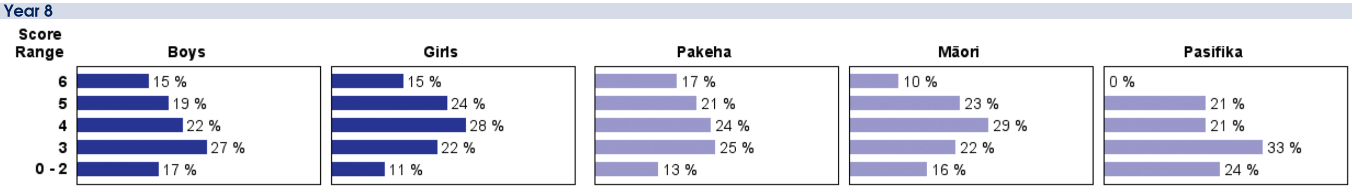
Card 3. Owl:		year 4	year 8
first question certain to eliminate at least four of the things		30 (25)	50 (50)
Number of questions used:	1	2 (3)	1 (1)
	2	14 (10)	15 (16)
	3	27 (25)	31 (33)
	4	25 (21)	26 (28)
	5	32 (41)	27 (22)
Got the correct answer:		82 (80)	87 (90)
Total score:	6	4 (4)	15 (21)
	5	14 (11)	21 (21)
	4	18 (21)	25 (25)
	3	36 (29)	25 (19)
	0–2	27 (35)	14 (14)

Subgroup Analyses:

Year 4



Year 8



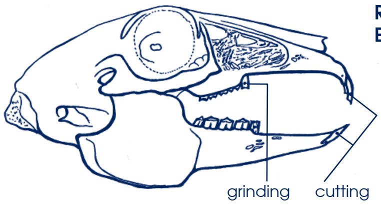
Commentary:

Only about one quarter of year 4 students and half of year 8 students used efficient strategies for asking questions. There was little evidence of change between 2003 and 2007. Year 8 Pakeha and Māori students performed similarly.

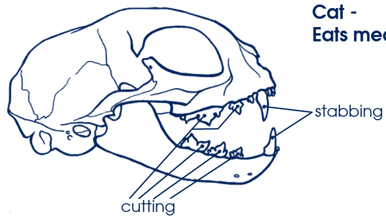
Munchies

Trend Task: NEMP Access Task

Approach: Station
Year: 4 & 8
Focus: Adaptation
Resources: Pictures in workbook



Rabbit - Eats plants.



Cat - Eats meat.

[Illustrations sourced from:
Rabbit, Cat: Wenhan, M. (2001). *200 Science Investigations for Young Students*; London: Paul Chapman Publishing Ltd.
Dinosaur skulls: Creagh, C., Milner, A. (ed.) (1995). *Dinosaurs*; Sydney: Allen & Unwin.]

Questions / instructions:

Look at these dinosaur skulls. Write down what sorts of foods you think these dinosaurs ate - plants, or animals.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. What it eats: plants	69 (81)	88 (89)
How can you tell it eats this?		
Explanation: *(grinding teeth; flat teeth (not sharp); teeth at back of mouth)*		
two or more valid reasons	1 (0)	5 (10)
one valid reason	28 (35)	47 (52)
alternatively explained as looking like rabbit teeth	2 (3)	5 (4)

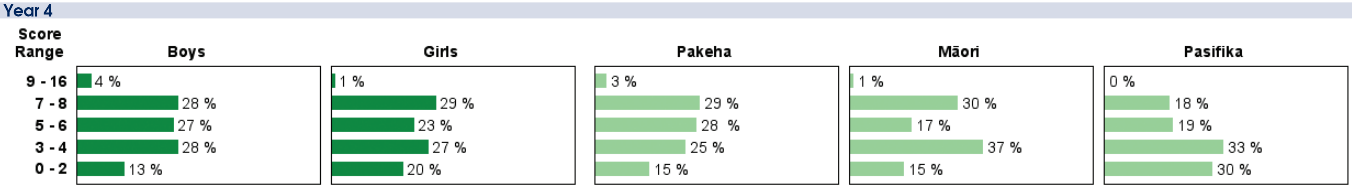
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
2. What it eats: meat	84 (91)	95 (96)
How can you tell it eats this?		
Explanation: *(sharp/jagged/stabbing teeth, mixed sizes; teeth go right to front of mouth)*		
two or more valid reasons	1 (1)	3 (4)
one valid reason	51 (59)	73 (74)
alternatively explained as looking like cat teeth	2 (0)	3 (3)

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
3. What it eats: plants	79 (91)	93 (94)
How can you tell it eats this?		
Explanation: *(grinding teeth; flat teeth (not sharp); teeth at back of mouth)*		
two or more valid reasons	1 (1)	3 (5)
one valid reason	39 (59)	56 (62)
alternatively explained as looking like rabbit teeth	1 (2)	4 (2)

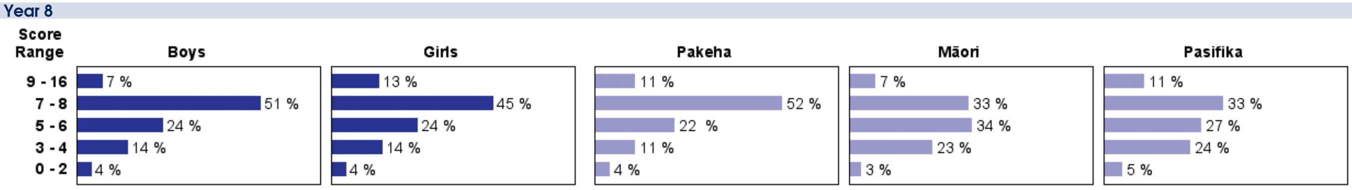
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
4. What it eats: meat	83 (91)	95 (96)
How can you tell it eats this?		
Explanation: *(sharp/jagged/stabbing teeth; mixed sizes; teeth go right to front of mouth)*		
two or more valid reasons	1 (1)	3 (3)
one valid reason	47 (55)	72 (76)
alternatively explained as looking like cat teeth	1 (3)	2 (2)
Total score: 9–16	3 (3)	10 (14)
7–8	28 (41)	48 (54)
5–6	25 (24)	24 (17)
3–4	28 (24)	14 (11)
0–2	16 (8)	4 (4)

Subgroup Analyses:

Year 4



Year 8



Commentary:

There was a moderate decline in performance between 2003 and 2007 for year 4 students, with little change for year 8 students. Year 4 Pakeha and Māori students performed similarly.

Trend Task: Garden Grubs

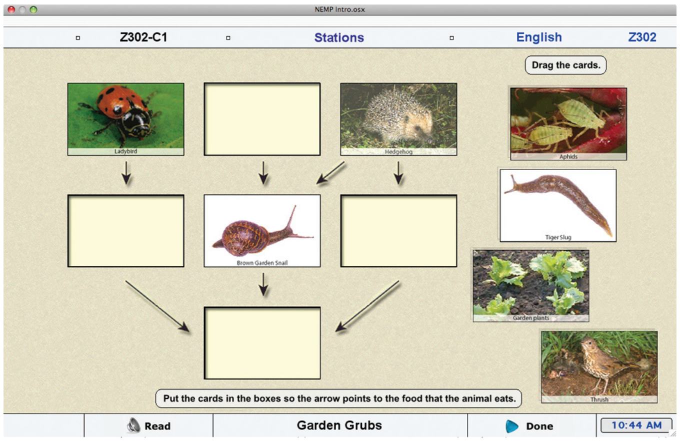
Approach:	Station	Year:	4 & 8
Focus:	Constructing a food web		
Resources:	Computer program on laptop computer		

Questions / instructions:

This activity uses the computer.

Click on the button that says ***Garden Grubs***.

VIDEO VOICEOVER:
Here is the start of a garden food web. In each box put an animal so the arrow points to the food that the animal eats. Use the computer mouse to drag the animals to the box you think they should go in.



	% response 2007 ('03) year 4	year 8
thrush eats snail	76 (81)	91 (96)
ladybird eats aphid	54 (63)	76 (82)
hedgehog eats snail and slug	60 (64)	81 (84)
snail eats plants	68 (69)	83 (87)
Total score: 4	46 (52)	71 (78)
3	0 (0)	0 (0)
2	29 (29)	21 (16)
1	16 (12)	5 (5)
0	9 (7)	3 (1)

Subgroup Analyses:

Year 4

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
4	47 %	44 %	53 %	33 %	26 %
3	1 %	1 %	0 %	1 %	2 %
2	28 %	29 %	27 %	29 %	33 %
1	16 %	15 %	13 %	21 %	24 %
0	8 %	11 %	7 %	16 %	15 %

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
4	71 %	70 %	79 %	53 %	46 %
3	0 %	1 %	0 %	1 %	0 %
2	24 %	18 %	16 %	34 %	32 %
1	2 %	8 %	4 %	6 %	6 %
0	3 %	3 %	1 %	6 %	16 %

Commentary:

Students showed substantial progress between year 4 and year 8, with little change between 2003 and 2007. At year 8 level, there were particularly large performance differences between Pakeha and Māori students, and between Pakeha and Pasifika students.

Trend Task:

Mammals or Fish?

Approach: Station | **Year:** 4 & 8

Focus: Scientific classification

Resources: Computer program on laptop computer

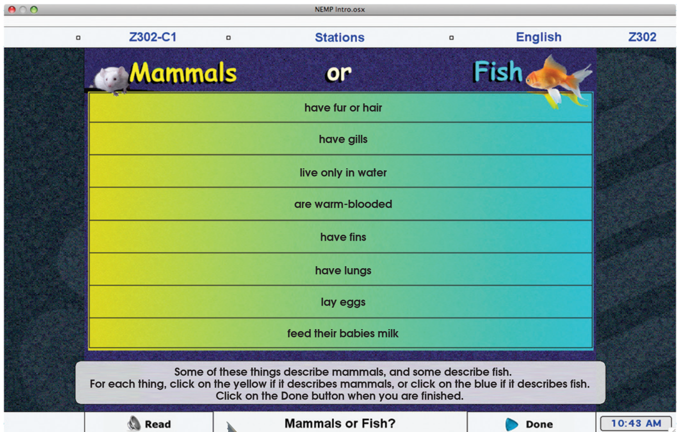
Questions / instructions:

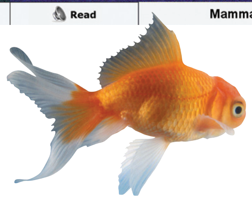
This activity uses the computer.

Click on the button that says ***Mammals or Fish?***

VIDEO VOICEOVER:
Scientists use the words "mammals" and "fish" to make two different groups of animals.

Run the mouse over the statements and I'll read them out. Then drag the ones about mammals to the green side, and the ones about fish to the yellow side. When you've finished, click the "Done" button.





% response 2007 ('03)

		year 4	year 8
Mammals:	have fur or hair	98 (96)	99 (98)
	are warm-blooded	96 (94)	99 (97)
	have lungs	97 (95)	98 (97)
	feed their babies milk	89 (86)	94 (95)
Fish:	have gills	98 (95)	99 (96)
	live only in water	87 (81)	90 (88)
	have fins	59 (58)	82 (76)
	lay eggs	97 (93)	99 (97)
Total score:	8	47 (45)	71 (67)
	7	34 (32)	19 (22)
	6	16 (16)	8 (8)
	0–5	3 (7)	2 (3)

Subgroup Analyses:

Year 4

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
8	42 %	52 %	53 %	39 %	28 %
7	39 %	29 %	33 %	37 %	32 %
6	15 %	16 %	12 %	21 %	28 %
0 - 5	4 %	3 %	2 %	3 %	12 %

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
8	72 %	70 %	75 %	67 %	51 %
7	18 %	20 %	18 %	20 %	24 %
6	8 %	8 %	6 %	12 %	16 %
0 - 5	2 %	2 %	1 %	1 %	8 %

Commentary:

Students performed very well on this task. Because of the high scores, there was limited potential for improvement from year 4 to year 8. Results were very similar at both year levels in 2003 and 2007.

Trend Task: Spiders

Approach:	Station	Year:	4 & 8
Focus:	Asking questions and obtaining information		
Resources:	Video recording on laptop computer		

DESCRIPTION: No soundtrack; video of several types of spiders.

[Delta (2002). *Wildlife Stories The Whole StoryBeetles and Spiders.* [Video]. Los Angeles: Delta Entertainment Coporation]

Questions / instructions:

This activity uses the computer.

On the computer you will be watching a video about spiders.

Click on the button that says ***Spiders***.

1. Write down five questions that would help you to understand more about spiders.

Amount of relevant information that could be expected to be triggered by:

		% response 2007 ('03) year 4	year 8
Question 1:	quite a lot	18 (20)	21 (13)
	some *(e.g. a specific fact)*	67 (65)	72 (82)
Question 2:	quite a lot	14 (16)	17 (17)
	some *(e.g. a specific fact)*	71 (68)	74 (72)
Question 3:	quite a lot	13 (13)	17 (17)
	some *(e.g. a specific fact)*	68 (69)	74 (74)
Question 4:	quite a lot	11 (8)	12 (17)
	some *(e.g. a specific fact)*	64 (70)	74 (72)
Question 5:	quite a lot	10 (8)	14 (14)
	some *(e.g. a specific fact)*	57 (65)	69 (74)

2. Put ticks ✓ beside three of your questions that could get the most interesting answers.

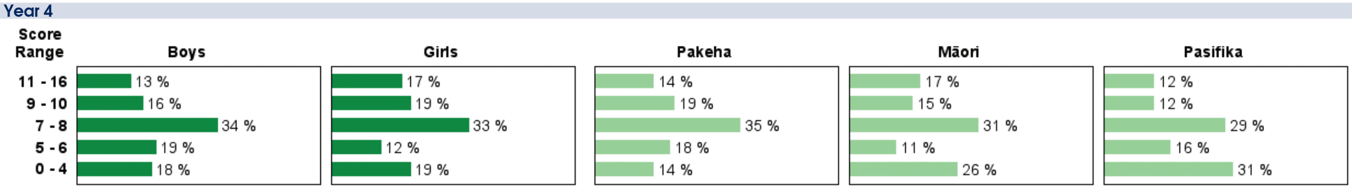
		% response 2007 ('03) year 4	year 8
Overall score for questions chosen:	6	1 (4)	3 (4)
	5	7 (4)	10 (10)
	4	20 (17)	19 (20)
	3	40 (47)	46 (45)
	2	14 (16)	7 (7)
	1	3 (3)	3 (1)
	0	15 (9)	12 (13)

3. You can get answers from books or computers. Where else could you go for answers to your questions?

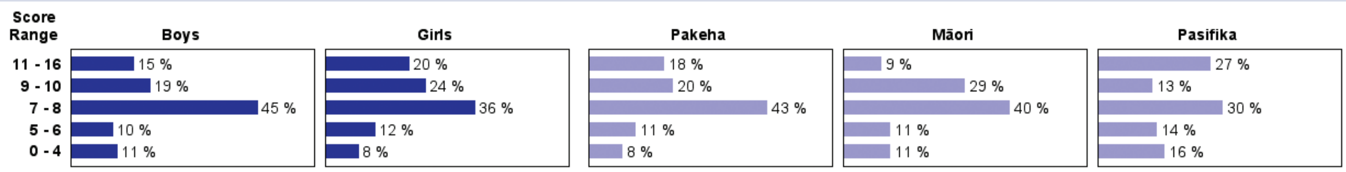
		year 4	year 8
direct observation/experiments with spiders		7 (7)	10 (9)
ask experts *(e.g. scientist, museum)*		46 (41)	46 (45)
ask readily available people *(e.g. parents, siblings, friends, teachers)*		32 (29)	42 (47)
other resource material *(e.g. video, tv, magazines, library)*		33 (37)	36 (42)
Total score:	11–16	15 (14)	17 (20)
	9–10	17 (20)	21 (20)
	7–8	34 (38)	41 (38)
	5–6	16 (15)	11 (15)
	0–4	18 (13)	10 (7)

Subgroup Analyses:

Year 4



Year 8

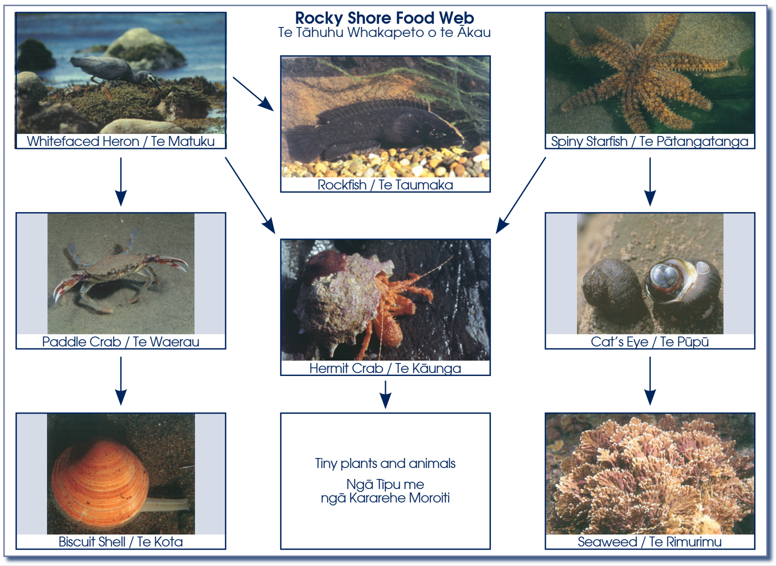


Commentary:

This task showed very similar results for year 4 and year 8 students, and little change between 2003 and 2007. The performance of year 8 Pasifika students varied widely: they achieved the largest percentage in both the highest score band and the lowest score band.

Trend Task: Food Web

Approach: One to one | **Year:** 8
Focus: Understanding food web dynamics
Resources: Food web picture



Illustrations sourced from:

Paddle Crab, Cat's Eye, Sea Biscuit – Enderby, J., Enderby,T. (photo.); Stace, G. (1997). *What's on the Beach?*; Auckland: Penguin Books.

Seaweed – Enderby, J., Enderby,T. (photo.); Stace, G. (1998). *What's on the Rocks?*; Auckland: Penguin Books.

Hermit Crab, Starfish, Heron, Rockfish – Gray, P. (photo.), Gray, P. (1997). *New Zealand Rocky Shore*; Alexandra: Central Otago Education Centre.

Questions / instructions:

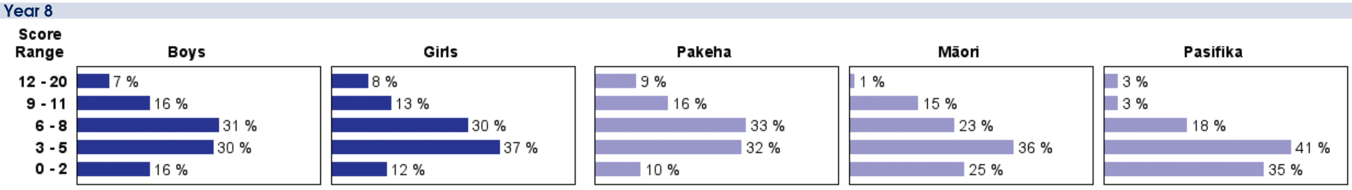
Here is a food web that shows what animals on the rocky shore eat.

	% response 2007 ('03) year 8
1. What eats the seaweed? Cat's Eye	82 (85)
2. What could happen to the other animals if most of the hermit crabs got sick and died?	
less food for whitefaced heron	36 (30)
less food for spiny starfish	37 (32)
more tiny plants and animals	9 (4)
whitefaced heron eat more rockfish	10 (10)
whitefaced heron eat more paddle crab	12 (13)
spiny starfish eat more cat's eye	12 (9)
3. What could happen to the other animals if more whitefaced heron started feeding at the rocky shore?	
less rockfish	41 (40)
less paddle crab	41 (42)
less hermit crab	38 (34)
more biscuit shell	11 (10)
more tiny plants and animals	5 (6)

	% response 2007 ('03) year 8
4. What are some things that the cat's eye does to stop other animals eating it?	
hides in its shell	76 (82)
hides in crevices	6 (6)
camouflages itself	10 (12)
sucks onto rocks	28 (36)
5. What are some things that the paddle crab does to stop other animals eating it?	
hides in crevices	17 (18)
uses pincers	79 (72)
moves away	31 (32)
camouflages itself	23 (32)
Total score: 12–20	7 (6)
9–11	15 (13)
6–8	30 (41)
3–5	34 (29)
0–2	14 (11)

Subgroup Analyses:

Year 8



Commentary:

Only about one quarter of year 8 students showed strong understanding of this food web. There was no evidence of meaningful change between 2003 and 2007.

Task: Bees

Approach:	One to one	Year:	4 & 8
Focus:	Adaptations for habitat		
Resources:	2 pictures, recording book		

Questions / instructions:

Hand student picture 1.

Here is a picture of bees. Bees are very helpful. They make honey.

Smith, P. (photo.) (1994); *Visuals Canterbury.* Lincoln: Natural Sciences Image Library.

	% responses y4	y8
1. What else do bees do that is helpful? not marked	•	•

Hand student picture 2.

This bee is very busy at work in this flower.

Thompson, C. (photo.) (1994); *Visuals Canterbury.* Lincoln: Natural Sciences Image Library.

2. What do you think it is doing?

	y4	y8
Explanation: comprehensive	2	5
quite strong	5	10
has general idea	11	29
no relevant ideas	82	56
Use of the nectar in flowers:		
gathering/getting nectar *(specific)*	27	24
gathering/getting food *(general)*	47	41
eating nectar	3	4
eating something	9	8
no relevant response	14	23
will take nectar/food back to hive	17	17
nectar/food will be used to make honey	40	35

3. What are the features of a bee that help it to live and survive? Tell me as many as you can think of and I'll write them down for you.

Record student's ideas. Then point to each feature recorded and ask the following question:

4. How does this feature help the bee to live and survive?

	% responses y4	y8
Mentioned: wings - to move around	82	94
mouth - to eat, bite pests, manipulate wax, get nectar, brush pollen from body:		
two or more uses	2	6
one use	37	46
eyes - to see flowers, detect movement, see predators	42	58
antennae - to smell, touch, locate	21	42
hairs and other features - to capture, transport, remove pollen	10	23
stomach/inside of body - for food, transport of food/nectar	5	3
legs - carry pollen, move on flowers/surfaces	38	46
stinger/sting - protect, discourage predators	56	75
dance behaviours - to communicate directions and distance to nectar sources	2	4

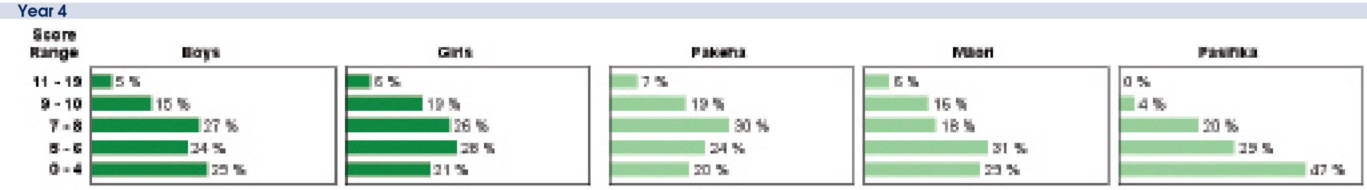
Repeat question 4 until all features on the recording sheet have been discussed.

5. How do bees help fruit growers?

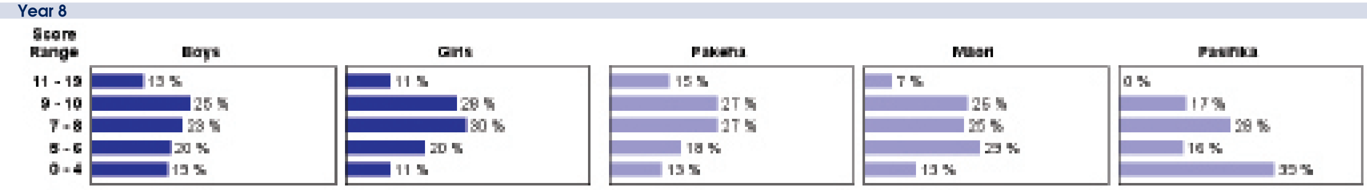
	y4	y8
Explanation: comprehensive	1	4
quite strong	6	10
has general idea	15	18
no relevant ideas	78	68
Total score: 11–19	6	12
9–10	17	27
7–8	26	26
5–6	26	20
0–4	25	15

Subgroup Analyses:

Year 4



Year 8



Commentary:

Most students revealed quite limited understanding of the role of bees in pollination and its importance in horticulture. Pasifika students were distinctly less successful than other students at both year levels.

Task: # School Garden

NEMP Access Task

Approach: One to one
Year: 4 & 8
Focus: Requirements for successful gardens
Resources: Picture

Questions / instructions:

Hand student picture.

Here is a picture of a school garden that was made by teachers and children.

1. Why do you think the teachers and children made this garden at their school?

% responses	y4	y8
not marked	•	•

The garden is growing very well.

2. What might the teachers and children have done to get the plants in their garden to grow so well?

% responses	y4	y8
obtain good seeds/plants	1	1
use good soil *(incl. worms)*	9	20
add compost, fertiliser, etc.	9	32
water regularly and appropriately	71	87
remove weeds or prevent/ suppress weed growth	3	12
position and structure *(sun, wind protected, stakes for plants)*	34	44

Plants in gardens often have to be protected from pests and disease.

3. What garden pests and disease can cause damage to plants?
4. What could the teachers and children do to protect their plants against pests and disease?

% responses	y4	y8
Walking animals on ground: *(rabbits, possums, etc.)*		
mentioned, with appropriate protection ideas	6	8
mentioned	16	16
not mentioned	78	76
Slugs, snails, etc:		
mentioned, with appropriate protection ideas	14	26
mentioned	29	38
not mentioned	57	36
Birds:		
mentioned, with appropriate protection ideas	5	10
mentioned	9	12
not mentioned	86	78
Other flying creatures: *(moths, butterflies, aphids etc.)*		
mentioned, with appropriate protection ideas	6	10
mentioned	19	29
not mentioned	75	61
Diseases: *(e.g. blights, funguses, mildew, rotting)*		
mentioned, with appropriate protection ideas	0	1
mentioned	1	3
not mentioned	99	96
Overall rating for pests, diseases, protection: very good/excellent	0	4
good	10	20
moderate/weak	52	64
no idea	38	12

5. Why do you think this school garden has been built up from the ground?

% responses	y4	y8
To make it easier to look after and protect: *(e.g. people running through the garden)* both	1	3
easier to look after	3	5
protection	28	47
no idea	68	45
to provide greater depth of soil	5	9
to improve drainage	1	2

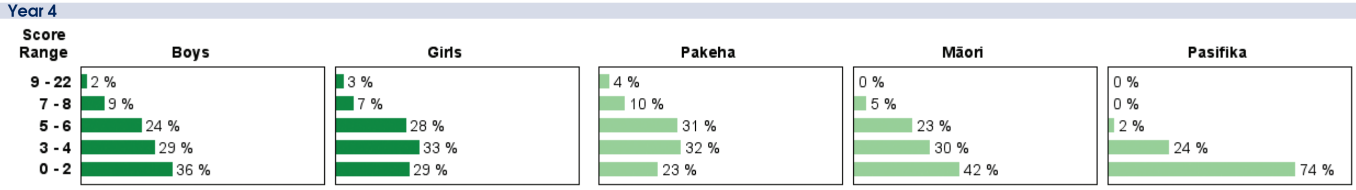
6. Do you have a garden at home?

% responses	y4	y8
yes, specifically child's	3	3
yes	81	75
no	16	22

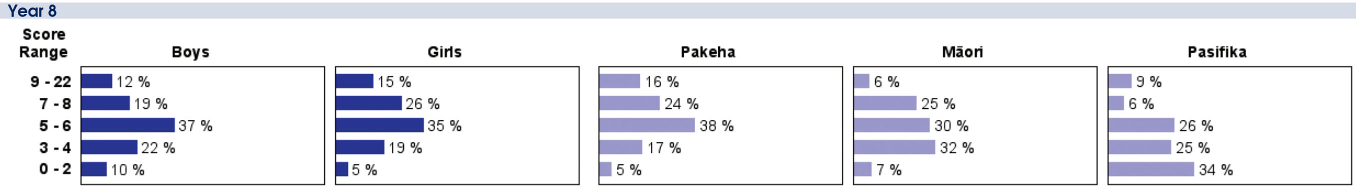
Total score:	y4	y8
9–22	3	13
7–8	8	23
5–6	26	36
3–4	31	20
0–2	32	8

Subgroup Analyses:

Year 4



Year 8



Commentary:

Despite most students indicating that there was a garden at their home, the requirements for successful gardens were not well understood by most students. Pasifika students had particularly low scores at both year levels.

Task: Wasps

Approach:	Team	**Year:**	8
Focus:	Scientific questions and fair testing		
Resources:	2 team answer sheets, question card, video recording on laptop computer *(no sound)*		

Questions / instructions:

This activity uses the computer.

Scientists watch wasps in their natural surroundings then do experiments to find out more about them.
Watch the wasps on the video and think about some good questions you could ask a scientist to investigate.

Click the *Wasps* button.

DESCRIPTION: No soundtrack; video of wasps constructing a nest and cells, laying eggs, larvae, drones hatching, life cycle starting again.

[Video: © NHNZ, *Wild South – Bandits of the Beech Forest.* [video]. (1996). Dunedin: Natural History N.Z. Ltd.
Question card below: Davis, H. (photo.); *http://static.flickr.com/27/59396660_6c0355b9a9_b.jpg.* Retrieved March 2008.]

Hand students team answer sheet 1.

1. Write down three good science questions about wasps that you could ask a scientist to investigate.

Questions proposed:

	% responses y8
question 1 is a question that a scientist might investigate	67
question 2 is a question that a scientist might investigate	81
question 3 is a question that a scientist might investigate	75

Hand students question card.

Here is a question that was asked of a scientist - "Do wasps see in colour?"

[Substituted resource in of copyright: eastern-yellowjacket.jpg Retrieved from: *http://www.entomology.wisc.edu/insectid/insect_info.php?411* University of Wisconsin (28 May 2008.)]

Hand students team answer sheet 2.

2. As a team plan how you could carry out an investigation to find out if wasps can see in different colours.

Elements included in the plan:

	% responses y8
set up tasks involving <u>choice between two or more different colours</u> to fly/move to	68
observe what happens/watch/see	78
replicate with multiple wasps	9
replicate with different arrangements of the colours	7
all other things held the same *(e.g. food, position, equally apart, time span)*	12

Practicality of the idea:

	% responses y8
relatively easy to carry out	33
difficult to carry out/not enough information	35
impossible or highly improbable	19
no relevant idea	13

Total score:	% responses y8
8–10	23
6–7	35
4–5	26
0–3	16

Commentary:

Because this was a team task, no graph of subgroup performance is possible. Many of the year 8 teams of students made quite a good attempt at what was a challenging task in experimental design.

LINK TASK: 1		% responses y4	% responses y8
Approach:	One to one		
Year:	4 & 8		
Focus:	Endangerment and protection		
Total score:	7–12	5	24
	5–6	19	34
	3–4	35	31
	1–2	34	9
	0	7	2

LINK TASK: 2		% responses y4	% responses y8
Approach:	One to one		
Year:	4 & 8		
Focus:	Decay and regeneration		
Total score:	8–13	1	9
	6–7	8	31
	4–5	26	39
	2–3	41	17
	0–1	24	4

LINK TASK: 3		% responses y4	% responses y8
Approach:	One to one		
Year:	4 & 8		
Focus:	Plant features and function		
Total score:	4–11	2	10
	3	3	8
	2	13	22
	1	30	35
	0	52	25

LINK TASK: 4		% responses y4	% responses y8
Approach:	One to one		
Year:	4 & 8		
Focus:	Adaptations of nocturnal animals		
Total score:	19–22	4	14
	17–18	15	39
	15–16	31	28
	13–14	25	12
	0–12	25	7

LINK TASK: 5		% responses y4	% responses y8
Approach:	One to one		
Year:	4 & 8		
Focus:	Growth and change		
Total score:	9–16	3	16
	7–8	10	34
	5–6	30	28
	3–4	37	18
	0–2	20	4

LINK TASK: 6		% responses y4	% responses y8
Approach:	Station		
Year:	4 & 8		
Focus:	Life cycle of an animal		
Total score:	12	3	8
	10–11	29	34
	8–9	21	19
	6–7	33	31
	0–5	14	8

LINK TASK: 7		% responses y4	% responses y8
Approach:	Station		
Year:	4 & 8		
Focus:	Habitats of creatures		
Total score:	10–11	14	37
	9	18	27
	8	21	17
	7	17	10
	6	14	6
	0–5	16	3

LINK TASK: 8		% responses y4	% responses y8
Approach:	Station		
Year:	4 & 8		
Focus:	Animal adaptations – eggs		
Total score:	11–12	3	15
	9–10	22	43
	7–8	36	28
	5–6	22	9
	0–4	17	5

LINK TASK: 9		% responses y4	% responses y8
Approach:	Station		
Year:	4 & 8		
Focus:	Plant adaptation		
Total score:	5–8	15	35
	4	27	40
	3	20	13
	2	12	6
	0–1	26	6

LINK TASK: 10		% responses y4	% responses y8
Approach:	Team		
Year:	4 & 8		
Focus:	Classification of sea creatures		
Total score:	19–31	5	25
	17–18	16	29
	15–16	30	21
	13–14	24	20
	0–12	25	5

4 Physical World

The assessments included 16 assessment tasks related to the physical world strand of the science curriculum.

Twelve tasks were identical (or in one case overlapped substantially) for year 4 and year 8 students. Seven of these are trend tasks (fully described with data for both 2003 and 2007) and five are link tasks (to be used again in 2011 so only partially described here). Two released tasks (fully described with data for 2007 only) and two link tasks were attempted only by year 8 students.

The task details and results for trend tasks are presented in the first section, followed by the task details and results for released tasks. The third section contains a little task information and the results for the link tasks. Within these sections, tasks used with both year 4 and year 8 students are presented first, followed by tasks used only with year 8 students.

Comparing Results for Year 4 and Year 8 Students

Averaged across 69 task components used with both year 4 and year 8 students, 13% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made quite substantial progress between year 4 and year 8 in the skills assessed by the tasks. The largest gains generally occurred for task components requiring explanations of physical world phenomena, and the lowest gains for task components requiring accurate experimentation, observation and reporting.

Boys performed slightly better than girls at both year levels. Pakeha students scored statistically significantly higher than Māori students on just one of the year 4 tasks (9%) and 43% of year 8 tasks. Pakeha students scored statistically significantly higher than Pasifika students on 55% of year 4 tasks and 64% of year 8 tasks. Students whose predominant language at home was English scored statistically significantly higher than other students on 45% of year 4 tasks, but on none of the year 8 tasks. It is very noticeable that Māori and Pasifika students performed similarly to Pakeha students on quite high proportions of the practical tasks (tasks requiring accurate experimentation, observation and reporting).

Trend Results: Comparing 2003 and 2007 Results

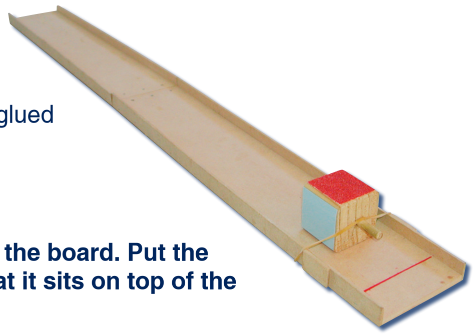
Seven trend tasks involving a total of 40 components were administered to year 4 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 12 components, more 2003 than 2007 students succeeded on 26 components, and there was no difference on two components. Averaged across the 40 components, 3% fewer students succeeded in 2007 than in 2003. This is a small but noteworthy difference, especially because there was an identical (3%) decline in performance between 1999 and 2003.

Seven trend tasks involving 40 task components were administered to year 8 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 17 components, more 2003 than 2007 students succeeded on 16 components, and there was no difference on seven components. Averaged across the 40 components, 1% fewer students succeeded in 2007 than 2003. This difference is not important, despite a similar 1% decline between 1999 and 2003.

Trend Task: Slides Away

Approach:	One to one	**Year:**	4 & 8
Focus:	Friction		
Resources:	Wooden board, long rubber band, wooden block		

Questions / instructions:



Preparation: Stretch the rubber band between the two wooden anchors on the wooden board.

Show the student the wooden block.

If you turn the wooden block over you will see that there are three different materials glued to three sides of it. It has sides that are wood, plastic, flannel and sandpaper.

Show wooden block.

I'll show you how this works with the wood touching the board.

Demonstrate the wooden block sliding along the board with the wood touching the board. Put the wooden side face down and next to the rubber band. Lift the rubber band so that it sits on top of the peg then pull the block back to the line. Let it go.

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Which side touching the board do you think will make the block slide further?	✔ plastic	77 (75)	82 (87)
	wood	5 (6)	5 (7)
	flannel	14 (18)	12 (6)
	sandpaper	3 (0)	0 (0)
2. Why do you think that?	less "friction"	0 (2)	4 (9)
	smooth, slippery, less catching/ rubbing/grippy	74 (79)	84 (81)
3. Which one of the four sides do you think will prevent the block from sliding as far?	plastic	2 (5)	1 (0)
	wood	4 (1)	1 (1)
	flannel	17 (6)	9 (8)
	✔ sandpaper	77 (86)	89 (90)
4. Why do you think that?	more "friction"	0 (0)	5 (12)
	rough, more catching/rubbing/grippy	58 (70)	80 (78)

Now you can test out your ideas. Put the side you are testing face down and next to the rubber band. Lift the rubber band so it sits on top of the peg and pull the block back to the line. Then let it go.

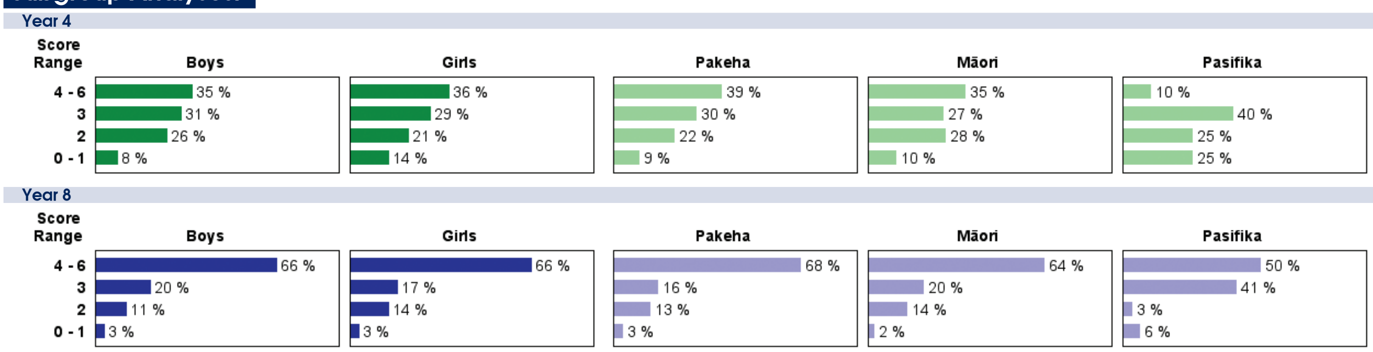
If necessary help the student set up the block.

5. What did you find out?

PROMPT: *Explain why that happened.*

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
Tested all sufaces:	yes *(without prompting)*	12 (15)	19 (30)
	yes *(with prompting)*	51 (53)	55 (50)
	no	37 (32)	26 (20)
Reported:	sandpaper least distance	53 (58)	61 (56)
For slide furthest, reported:	plastic	78 (78)	85 (85)
	wood	6 (5)	3 (6)
	flannel	1 (2)	2 (2)
Quality of explanation:	very good *("friction")*	0 (0)	8 (9)
	good *(smooth plus)*	2 (4)	7 (5)
	fair *(smooth vs. rough)*	51 (58)	61 (57)
	poor/missing	47 (38)	24 (29)
Total score:	4–6	35 (49)	66 (68)
	3	31 (24)	18 (23)
	2	23 (17)	13 (8)
	0–1	11 (10)	3 (1)

Subgroup Analyses:



Commentary:

The performance of the apparatus for this popular task was a little erratic, so that the anticipated results were not always observed. The total score focused on prediction and explanation, rather than experimental findings. There was a moderate decline in the performance of year 4 students between 2003 and 2007. Māori students performed similarly to Pakeha students.

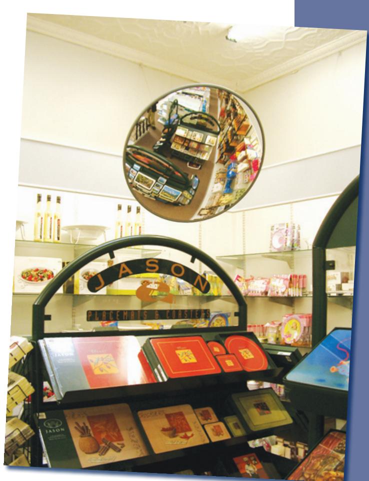
Trend Task: Mirrors

Approach: One to one **Year:** 4 & 8
Focus: Investigating mirrors
Resources: Mirror (flexible plastic sheet with mirror surface), picture

Questions / instructions:

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Give the student the mirror.		
This is a mirror. You can bend it gently in different ways. Have a look at your face in it. Now bend the mirror towards you so that the mirror makes a U-shape. This is called a concave mirror.		
1. How does the shape of your face change in the concave mirror?		
is wider, bigger	63 (68)	71 (76)
face/image is doubled when mirror is sharply curved	34 (33)	30 (30)
Now bend the mirror the other way so the edges are away from you. This is called a convex mirror.		
2. How does the shape of your face change in the convex mirror?		
is taller, skinner	88 (89)	94 (94)
Try bending the mirror other ways to see how it changes your face.		

Give student picture.

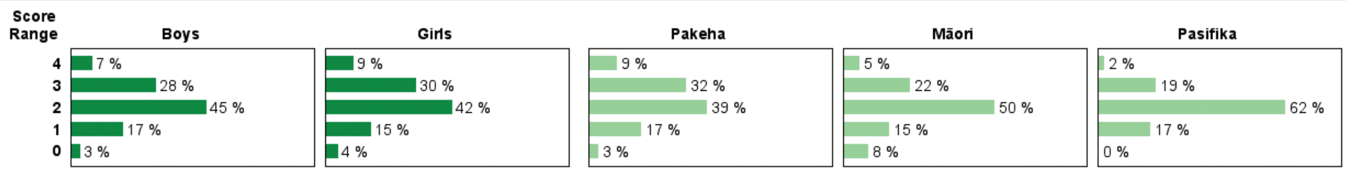


	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Have a careful look at the mirror in this shop.		
3. Why do you think they used a convex mirror?		
see more of shop/wider view	35 (49)	67 (80)
to catch shoplifters/watch people in shop *[not counted in total score]*	68 (57)	60 (56)

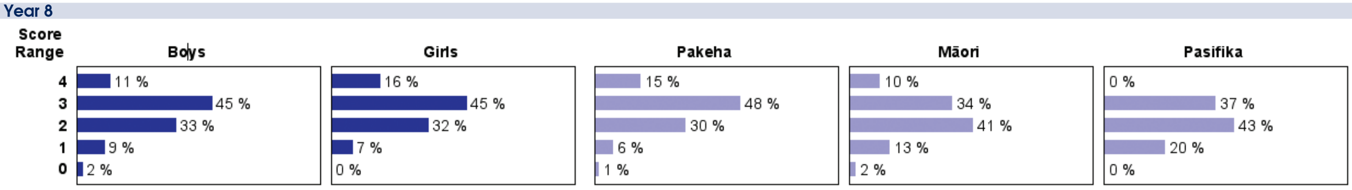
Total score:	year 4	year 8
4	8 (9)	14 (19)
3	29 (37)	44 (50)
2	43 (40)	33 (24)
1	17 (12)	8 (6)
0	3 (2)	1 (1)

Subgroup Analyses:

Year 4



Year 8



Commentary:

There was a small decline in performance on this task between 2003 and 2007 at both year levels.

Trend Task: **Mystery Card**

Approach:	One to one	**Year:**	4 & 8
Focus:	Exploring closed and open circuits		
Resources:	Circuit with bulb, battery, mystery card, recording book, pencil		

Questions / instructions:

In this activity, you will be using this electric circuit to work out where the electricity goes between the circles on this mystery card.

Give student the circuit.

First, touch the clips together on the circuit to make sure that the bulb lights up.

Give student mystery card.

Now have a try at touching different circles on the mystery card with the clips to see what happens.

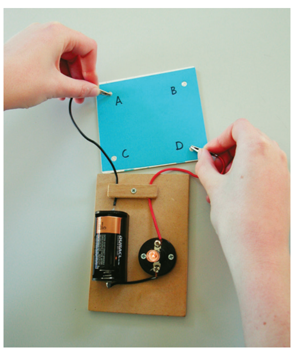
Allow time.

Now touch Circle A with one clip. **At the same time**, touch Circle B with the other clip.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. What's happening to the bulb?		
bulb lights up	99 (99)	99 (100)

Now touch A with one clip, at the same time touch C with the other clip.

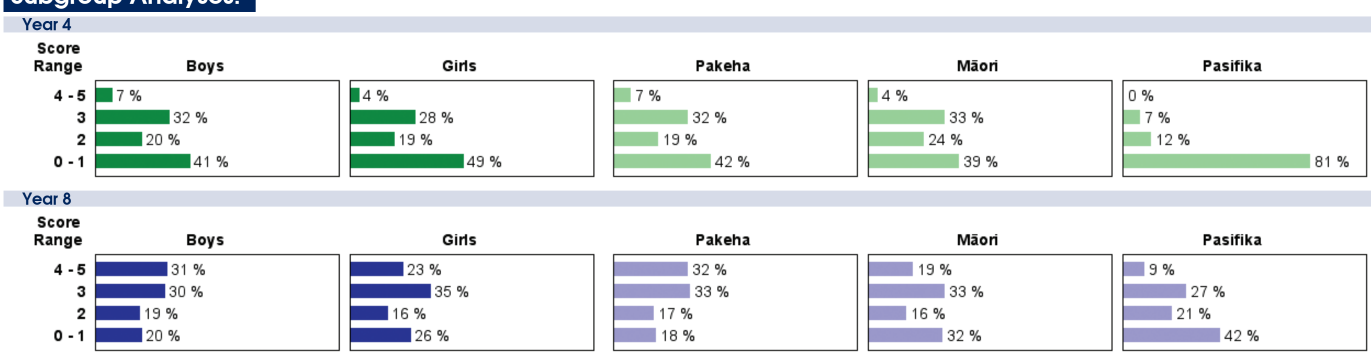
	year 4	year 8
2. What's happening to the bulb?		
bulb doesn't light up	98 (99)	99 (99)



Now touch A with one clip, at the same time touch D with the other clip.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
3. What's happening to the bulb?		
bulb lights up	82 (84)	75 (94)
4. Why do you think the bulb didn't light up when A and C were touched?		
Give student recording book and pencil.		
Quality of explanation: *(A and C not connected, so circuit not complete, so electricity can't flow to light up bulb)*		
clear, detailed explanation	0 (2)	7 (4)
partial explanation	10 (15)	31 (34)
5. Draw what you think is inside the mystery card.		
Allow time.		
A connected to B *(directly or via D)*	54 (60)	76 (82)
A connected to D *(directly or via B)*	47 (56)	60 (79)
A not connected to C *(directly or indirectly)*	81 (88)	86 (88)
6. Use your diagram to explain why the bulb lights up when some circles are touched but not with other circles.		
Explanation:		
clear, convincing explanation, using diagram *(explains lighting up AND not lighting up)*	5 (7)	17 (24)
partial explanation, using diagram *(explains at least one of lighting up OR not lighting up)*	21 (25)	38 (38)
Total score: 4–5	5 (11)	28 (34)
3	30 (40)	32 (40)
2	20 (12)	17 (10)
0–1	45 (37)	23 (16)

Subgroup Analyses:



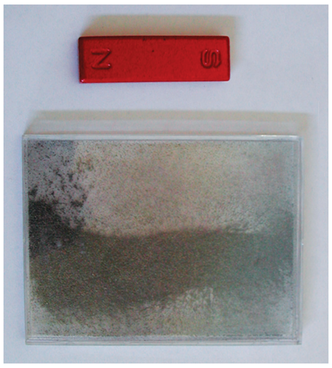
Commentary:

This task was very popular but there were some problems with the mystery card for year 8 students in 2007 (the A to D link did not reliably produce the intended result). Performance dropped markedly for year 4 students between 2003 and 2007, but similar judgements are not justified for year 8 students because of the equipment problems. Year 4 Pakeha and Māori students performed similarly.

Trend Task: Magnetic Filings

Approach:	One to one	**Year:**	4 & 8
Focus:	Magnetism		
Resources:	Perspex box filled with iron filings, bar magnet		

Questions / instructions:



Give student the box of iron filings.

This is a box of iron filings. Iron filings are little bits of metal.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Explain what you think will happen if you put a magnet on the box of iron filings?		
magnet will attract filings/ will cause filings to move	88 (92)	96 (98)

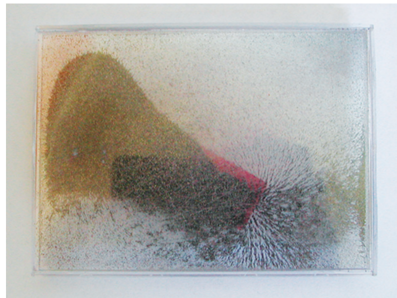
Give student the bar magnet.

	year 4	year 8
2. What happens when you move the magnet around on the box?		
filings moved with magnet	94 (92)	95 (93)

Allow time for student to explore.

Put the magnet on the table. Put the iron filings on top.

	year 4	year 8
3. What has happened to the iron filings?		
filings attracted to magnet	32 (33)	40 (35)
filings concentrated/stood up/were darker at ends of magnet	20 (17)	32 (28)
filings formed patterns/lined up around the magnet	5 (7)	17 (9)

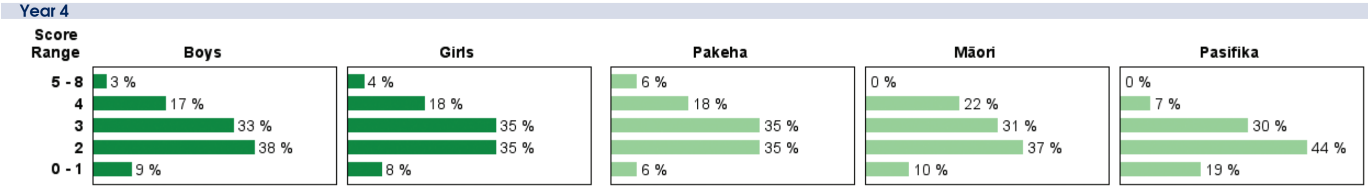


	% response 2007 ('03) year 4	% response 2007 ('03) year 8
4. Try to explain why you think this happened?		
iron is magnetic *(and is attracted to magnet)*	26 (30)	33 (40)
effect is strongest at the ends/poles	6 (5)	18 (14)
particles/filings align with magnetic field which curves between the poles	0 (0)	4 (2)

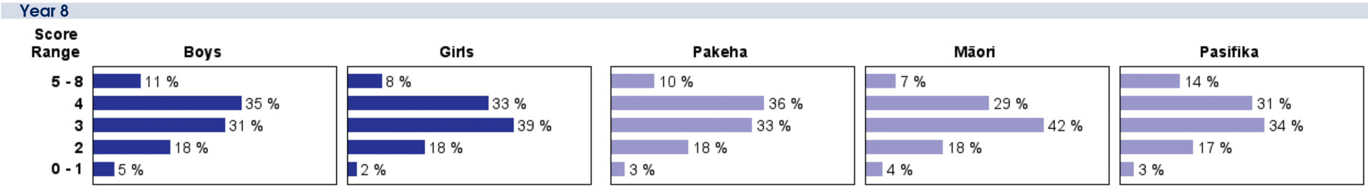
Total score:	year 4	year 8
5–8	4 (4)	10 (10)
4	17 (20)	34 (26)
3	34 (38)	35 (33)
2	36 (28)	18 (29)
0–1	9 (10)	3 (2)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This was another popular task, involving experimentation, observation and explanation. There was little change in performance between 2003 and 2007 for year 4 students and a minor improvement for year 8 students. Māori students performed quite well at both year levels, as did year 8 Pasifika students (who equalled the performance of Pakeha students).

Trend Task:

Rod Balance

Approach: One to one **Year:** 4 & 8

Focus: Predicting the centre of gravity of a rod and a weighted rod

Resources: Rod with markers, 3 rods with weights in different positions, rod weighted at one end and markers indicated, recording book, whiteboard pen, wet paper towel

Questions / instructions:

Show shorter rod.

In this activity you will be trying to balance this rod on your finger. You will see the rod has three markers, a red one, a black one and a blue one.

1. Which marker should be touching your finger so that the rod balances?

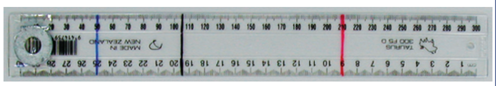
Prediction:	% response 2007 ('03) year 4	year 8
red marker	3 (2)	1 (0)
black marker	7 (6)	5 (4)
✔ blue marker	91 (92)	95 (95)
no answer or more than one answer	0 (0)	0 (0)

Hand out shorter rod.

Now try it out and see what happens

2. Do you want to change your answer?

Result:	year 4	year 8
red marker	0 (0)	0 (0)
black marker	3 (1)	3 (2)
blue marker	6 (3)	1 (3)
no change	90 (95)	94 (94)
no answer or more than one answer	1 (1)	2 (1)



Show longer rod and indicate heavy end.

On this rod one end is heavier than the other end.

3. Which marker should be touching your finger so that the rod balances?

Prediction:	year 4	year 8
red marker	21 (23)	9 (11)
✔ black marker	63 (51)	63 (60)
blue marker	14 (25)	25 (28)
no answer or more than one answer	2 (1)	3 (1)

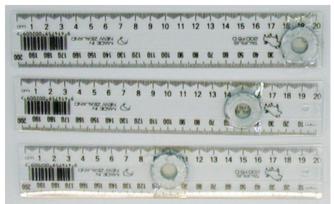
Hand out weighted rod.

Now try it out and see what happens.

4. Do you want to change your answer?

Result:	% response 2007 ('03) year 4	year 8
red marker	2 (1)	1 (1)
black marker	33 (46)	32 (39)
blue marker	3 (2)	0 (1)
no change	57 (49)	63 (57)
no answer or more than one answer	5 (2)	4 (2)

Here are three more rods. Each rod has a weight on it. Find where to put your finger so that each rod balances. Use the whiteboard pen to mark on the rod where your finger was.



Hand out rods.

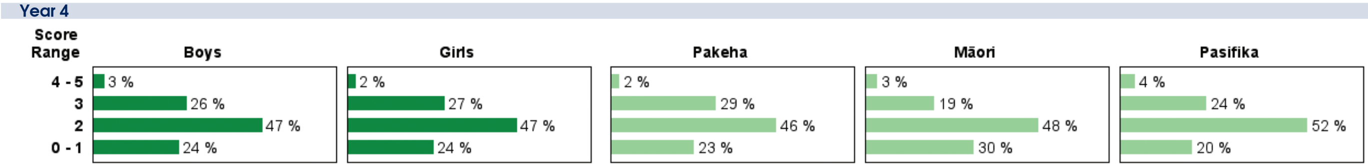
Now look at where the weights are and the pen marks showing where your finger was.

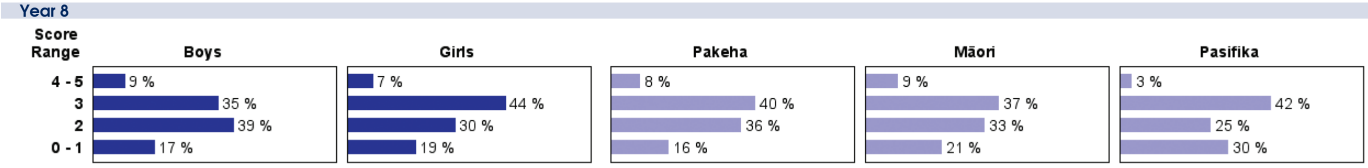
5. What do you notice about where the weights and the pen marks are on the rods?

	year 4	year 8
markers are close to the weights	42 (41)	43 (57)
Description: *(Distance between weight and markers (balance points) increases as weight gets closer to end of ruler)*		
clear, accurate description	1 (1)	4 (12)
on right track, but vague	7 (5)	15 (25)

Total score:	year 4	year 8
4–5	2 (2)	8 (16)
3	27 (21)	39 (38)
2	47 (44)	35 (35)
0–1	24 (33)	18 (11)

Subgroup Analyses:





Commentary:

There was little change between year 4 and year 8 on this task, nor for year 4 students between 2003 and 2007. The performance of year 8 students dropped a little between 2003 and 2007. Māori and Pasifika students at both year levels performed similarly to Pakeha students.

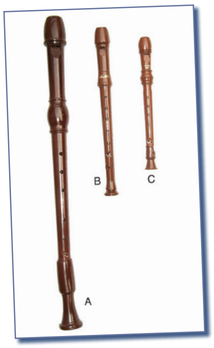
Trend Task: Blow It!

NEMP Access Task

Approach:	Station
Focus:	Pitch from musical instruments
Resources:	Picture, 3 straws, photo

Year: 4 & 8

Questions / instructions:



Look at the picture of the musical instruments.

Draw a circle around the best answer for each question.

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Which one makes the **lowest** sounds:	✔ A	53 (62)	76 (76)
	B	5 (3)	2 (1)
	C	39 (34)	21 (23)
2. Which one makes the **highest** sounds:	A	38 (34)	20 (22)
	B	8 (4)	4 (4)
	✔ C	51 (60)	75 (74)

Blow over the top of each straw, like the person in the photo.

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
3. Which straw gives the **lowest** sounds:	✔ red	57 (62)	79 (73)
	blue	33 (29)	16 (22)
	yellow	7 (6)	4 (4)
4. Which straw gives the **highest** sounds:	red	31 (31)	14 (20)
	✔ blue	47 (56)	66 (61)
	yellow	19 (11)	19 (17)

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
5. What causes the sounds to be higher or lower?	length of instrument determines wavelength of sound waves, therefore frequency, therefore pitch	0 (2)	1 (3)
	clearly associated length with pitch *(longer/lower)*	14 (17)	30 (22)
	vaguely linked length/size with pitch *(but does not give direction)*	42 (41)	55 (57)

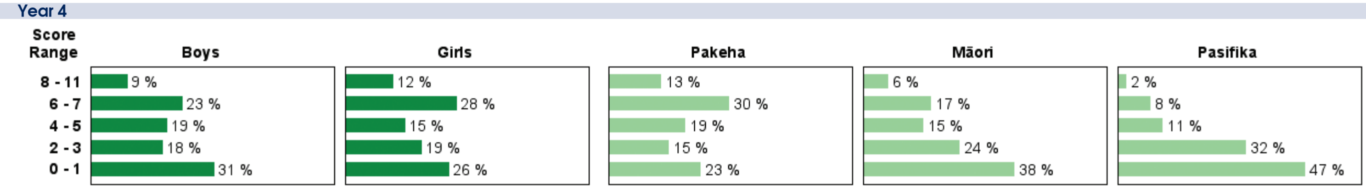
Look at the picture of the musical instruments again.

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
6. Which instrument makes the **lowest** sound:	✔ A	53 (64)	79 (74)
	B	6 (4)	4 (2)
	C	37 (28)	17 (24)
7. Why do you think this instrument makes the lowest sound?	length of instrument determines wavelength of sound waves, therefore frequency, therefore pitch	0 (2)	1 (1)
	clearly associated length with pitch *(longer/lower)*	6 (11)	17 (24)
	vaguely linked length/size with pitch *(but does not give direction)*	39 (44)	59 (50)

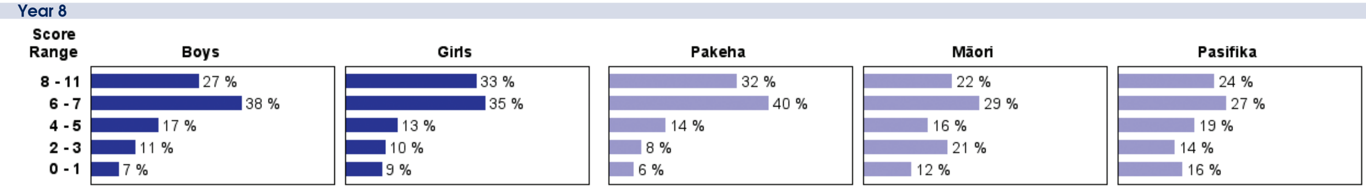
Total score:	year 4	year 8
8–11	10 (12)	29 (27)
6–7	25 (41)	37 (34)
4–5	18 (8)	15 (16)
2–3	18 (14)	11 (12)
0–1	29 (25)	8 (11)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task showed strong increases in performance from year 4 to year 8. The 2003 and 2007 results were similar.

Trend Task: NEMP Access Task

Dancing Currants

Approach: Team **Year:** 4 & 8

Focus: Explaining properties of gas

Resources: 2 plastic glasses, *Working Together* team guide, lemonade, 12 currants, team answer sheet, 2 sample cups

Questions / instructions:

Preparation: Put a glass in front of each pair of students. Half fill the glasses with lemonade.

Discuss *Working Together* Team Guide.

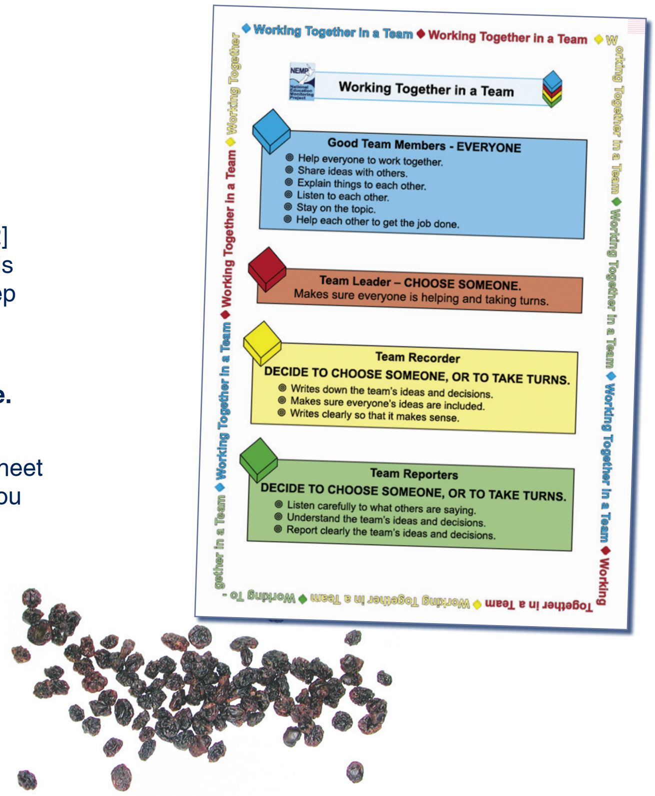
In this activity you are going to watch what happens when you put currants into lemonade. So that you can easily see the currants I have set up two glasses of lemonade. [Student 1] and [Student 2] can watch this glass and [Student 3] and [Student 4] can watch this glass. Look carefully from the top as you drop in six currants. Keep watching to see what the currants do, and talk about why they are moving.

Hand pairs of students six currants to drop into the lemonade. Allow time.

Now as a team you are going to talk about the questions on this sheet *[same as below]* and listen carefully to each other's ideas. Then you will write down your team's ideas.

Hand out answer sheet and read questions to the students. Allow time.

Now tell me the answers you have decided for the questions.



	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Why do the currants start to go to the top?		
carbon dioxide/gas/bubbles/air <u>attach</u> to currants	18 (17)	28 (42)
these bubbles etc. help to <u>lift</u> *(currants to surface)*	53 (50)	64 (64)
Why do the currants then sink to the bottom?		
bubbles etc. pop	41 (40)	63 (56)
less/no bubbles etc. to make currants float	20 (15)	32 (27)
What are the bubbles made of?		
carbon dioxide	6 (10)	37 (32)

Total score:	% response 2007 ('03) year 4	% response 2007 ('03) year 8
5	0 (0)	6 (7)
4	3 (5)	13 (13)
3	19 (13)	28 (22)
2	20 (22)	18 (24)
1	28 (28)	22 (20)
0	30 (32)	13 (14)

Commentary:

Because this was a team task, no graph of subgroup performance is possible. There was substantial improvement from year 4 to year 8, and no meaningful change in performance at either year level between 2003 and 2007.

Task: Which Direction?

NEMP Access Task

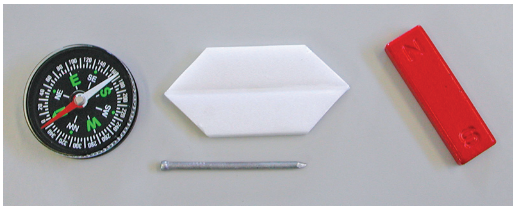
Approach: One to one **Year:** 8

Focus: Magnetic north

Resources: Magnet *(Note: always keep the magnet at a distance from compass)*, compass, nail, bowl of water, polystyrene raft

Questions / instructions:

% responses y8



This activity is about compasses.

Give student compass.

1. What is a compass used for?

   compass is used to find direction — 91

Have a good look at this compass. Turn the compass around and watch the needle as you turn it.

2. What do you notice about the direction the compass needle is pointing?

   the needle pointed in the same direction all of the time — 49

   that direction was approximately north-south — 46

If student doesn't know say the compass always points north-south. Help set the compass so it points north-south.

3. Why does the compass needle always point north-south?

   Explanation:
   [Needle is a magnet, and the earth is a magnet (has a magnetic field), so the needle lines up with the earth's magnetic field.]

   all three points — 2

   identified magnetic nature of needle and earth — 6

   general idea that it involved magnet(s) — 16

Remove the compass.

Hand student nail and magnet.

You can try to make a simple compass. First you will need to stroke the nail longways with an end of the magnet. Stroke the nail 10 times in one direction with the magnet. Stroke it slowly and firmly.

Allow time.

Show student raft and bowl of water.

4. If you place this nail on the raft to float in the water what do you think will happen?

   the nail will turn to a particular direction/point north-south — 41

Help student place nail on raft.

Place compass in front of student.

5. What do you notice about the way the nail is pointing?

   nail pointed in the same direction all of the time — 29

   that direction was approximately north-south — 63

6. Why is the nail pointing in that direction?

   nail now a magnet/magnetic — 23

   nail attracted to the earth's magnetic field — 10

7. What does this tell you about the needle on a compass?

   the compass needle must be a magnet — 33

Total score:	% responses y8
8–12	9
6–7	18
4–5	31
2–3	36
0–1	6

Subgroup Analyses:

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
8 - 12	14 %	3 %	11 %	2 %	4 %
6 - 7	18 %	17 %	22 %	8 %	8 %
4 - 5	34 %	28 %	32 %	36 %	16 %
2 - 3	29 %	44 %	31 %	43 %	60 %
0 - 1	5 %	8 %	4 %	11 %	12 %

Commentary:

This was one of the few tasks on which boys and girls performed significantly differently. Here, boys scored markedly higher than girls. The results showed quite limited understanding of magnetism among year 8 students.

Task:

Hot Stuff

Approach:	Team	**Year:**	8
Focus:	Heat transfer and experiment design		
Resources:	3 cups marked A (paper), B (plastic), C (ceramic); paper towels, measuring jug, 3 thermometers, team answer sheet, stop watch, jug with very hot water		

Questions / instructions:

Boil the jug of water immediately before starting the task. It will cool off a little as students work through the initial part of the task.

Some cups keep liquids warmer for a longer time than other cups. You are going to design an experiment to find out which cup keeps the water hot for the longest amount of time. After you have designed your experiment, you are going to do the experiment.

Show students the equipment, but do not give it to them until after they have designed their experiment.

You will have three cups made from different materials, three thermometers, a stop watch, a measuring jug and a jug of hot water. In your group, design how you will do an experiment to find out which cup keeps the water warm for the longest amount of time. On the answer sheet, write down the steps you will follow in your experiment, and write down how you will keep a record of the results for each cup.

Hand out team answer sheet. Allow time.

1. Before you start to do your experiment, describe to me how you are going to do it.

Give students the equipment (three cups, stop watch, three thermometers, measuring jug and jug of hot water) and caution them on the safe use of the hot water.

You are going to do your experiment now, taking special care with the hot water, and following your plan. Remember, you will need to have a way of writing down the results for each cup.

Students conduct experiment. Teacher keeps an eye on students' handling of the hot water to ensure safety.

2. Now tell me the results of your experiment. What is your conclusion from these results?
3. If there were any changes that you made to your plan for the experiment, explain to me what the changes were, and why you made those changes.

	% responses y8
Used water at <u>same temperature</u> *(e.g. pour into cups quickly one after another):*	
in plan and implemented	36
in plan, but not followed through	6
not in plan, but implemented in experiment	45
not mentioned or done	13
Put the <u>same amount of hot water</u> into each cup: in plan and implemented	54
in plan, but not followed through	3
not in plan, but implemented in experiment	15
not mentioned or done	28
<u>Time</u> from when water was added: in plan and implemented	52
in plan, but not followed through	7
not in plan, but implemented in experiment	18
not mentioned or done	23
Took <u>initial temperature</u> in three cups soon after cups were filled: in plan and implemented	21
in plan, but not followed through	8
not in plan, but implemented in experiment	24
not mentioned or done	47
Took <u>temperatures</u> in three cups at <u>later times</u> after cups were filled: *(recorded time and temperature)*	
in plan and implemented	58
in plan, but not followed through	4
not in plan, but implemented in experiment	10
not mentioned or done	28
Took <u>at least three temperature measurements</u> in each cup after cups were filled:	
in plan and implemented	27
in plan, but not followed through	1
not in plan, but implemented in experiment	7
not mentioned or done	65

	% responses y8
<u>Took temperatures</u> in three cups nearly <u>simultaneously</u> each time temperature was taken: *(or at same interval after filling)*	
in plan and implemented	42
in plan, but not followed through	1
not in plan, but implemented in experiment	31
not mentioned or done	26
Made table/chart/graph of change in temperature across time: in plan and implemented	39
in plan, but not followed through	5
not in plan, but implemented in experiment	30
not mentioned or done	26
<u>Results and conclusion:</u>	
Report matches observations: fully	34
moderately	38
poorly	28
initial drop in temperature when cups are filled was reported *(first temperature recording)*	24
report explicitly deals with <u>different rates of cooling</u>	37
report appropriately identifies cup that keeps water warmest for longest amount of time	53
<u>Ideas for improvement if done again:</u>	
two or more useful suggestions	18
one useful suggestion	41
no useful suggestions	41
Total score: 17–21	13
13–16	27
9–12	29
5–8	22
0–4	9

Commentary:

Because this is a team task, no graph of subgroup performance is possible. This was quite a challenging experimental task, complicated by the high thermal mass of the ceramic cup (which caused an immediate drop in temperature when filled). The performances of the teams of year 8 students were very diverse.

Link Tasks 11 – 17

LINK TASK: 11

Approach:	One to one
Year:	4 & 8
Focus:	Motion experiment and explanation

Total score:	% responses y4	y8
7–8	12	12
5–6	29	35
3–4	45	39
0–2	14	14

LINK TASK: 12

Approach:	One to one
Year:	4 & 8
Focus:	Heat transfer

Total score:	% responses y4	y8
5–6	4	14
4	10	24
3	25	33
2	31	22
0–1	30	7

LINK TASK: 13

Approach:	One to one
Year:	4 & 8
Focus:	Air pressure

Total score:	% responses y4	y8
5–7	1	24
4	6	17
3	13	20
2	31	19
1	39	17
0	10	3

LINK TASK: 14

Approach:	Station
Year:	4 & 8
Focus:	Conductivity testing

Total score:	% responses y4	y8
8	29	62
7	21	19
6	27	9
5	12	4
0–4	11	6

LINK TASK: 15

Approach:	Station
Year:	4 & 8
Focus:	Fair test – magnetism

Total score:	% responses y4	y8
4–6	5	21
3	12	25
2	17	18
1	38	27
0	28	9

LINK TASK: 16

Approach:	One to one
Year:	8
Focus:	Springs and gravity

Total score:	% responses y4	y8
4–6		2
3		9
2		21
1		39
0		29

LINK TASK: 17

Approach:	One to one
Year:	8
Focus:	Electrical circuits

Total score:	% responses y4	y8
4		5
3		13
2		30
1		36
0		16

5 Material World

The assessments included 12 tasks related to the material world strand of the science curriculum.

Eleven tasks were identical for year 4 and year 8 students. Six of these are trend tasks (fully described with data for both 2003 and 2007) and five are link tasks (to be used again in 2011 so only partially described here). One released task (fully described with data for 2007 only) was attempted only by year 8 students.

The task details and results for trend tasks are presented in the first section, followed by the task details and results for the released task. The third section contains a little task information and the results for the link tasks. Within these sections, tasks used with both year 4 and year 8 students are presented first, followed by tasks used only with year 8 students.

Comparing Results for Year 4 and Year 8 Students

Averaged across 101 task components used with both year 4 and year 8 students, 14% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made quite substantial progress between year 4 and year 8 in the skills assessed by the tasks. The largest gains generally occurred for task components requiring explanations of material world phenomena, and the lowest gains for task components requiring accurate experimentation, observation and reporting.

Boys performed slightly better than girls at both year levels. Pakeha students scored statistically significantly higher than Māori students on 50% of year 4 tasks and 67% of year 8 tasks. Pakeha students scored statistically significantly higher than Pasifika students on 75% of year 4 tasks and 78% of year 8 tasks. There were no tasks, at year 4 or year 8 level, on which students whose predominant language at home was not English scored statistically significantly differently from students whose predominant language at home was English.

Trend Results: Comparing 2003 and 2007 Results

Six trend tasks involving a total of 60 components were administered to year 4 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 16 components, more 2003 than 2007 students succeeded on 40 components, and there was no difference on four components. Averaged across the 60 components, 3% fewer students succeeded in 2007 than in 2003. Considered alongside the 2% decline between 1999 and 2003, this small difference becomes noteworthy.

Six trend tasks involving 60 task components were administered to year 8 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 26 components, more 2003 than 2007 students succeeded on 27 components, and there was no difference on seven components. Averaged across the 60 components, the same percentage of students succeeded in 2007 as in 2003.

Trend Task: Cleaning Up

NEMP Access Task

Approach: One to one | **Year:** 4 & 8

Focus: Explaining the reaction between water, oil and detergent

Resources: Water in jug, 2 jars, bottle of cooking oil (liquid 1), bottle of detergent (liquid 2), 3 ice block sticks, 2 50ml beakers

Questions / instructions:

Pour about 10ml of the oil into a beaker and about 10ml of the detergent into the other beaker. Fill the jars a third full with water.

In this activity you will be doing an experiment with some different liquids.

Hand out oil beaker, jar of water and ice block stick.

By looking at this liquid and mixing it with the water see what you can find out about it. Pour the liquid into the water and stir it with the stick.

Allow time

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. What can you tell me about the liquid you put in the water? yellowish colour	31 (34)	11 (9)
fairly thick/viscous	14 (7)	23 (15)
floats on water/droplets, swirls on surface	43 (51)	72 (76)
forms droplets on/in water	27 (22)	23 (19)
2. What do you think the liquid is that you put in the water? oil or cooking oil	31 (26)	82 (77)

Here is another liquid.

Hand out detergent beaker, jar of water and ice block stick.

By looking at this liquid and mixing it with the water see what you can find out about it. Pour the liquid into the water and stir it with the stick.

	year 4	year 8
3. What can you tell me about the liquid you put into the water? yellowish colour	49 (35)	38 (22)
fairly thin *(not as thick as oil)*	5 (2)	7 (4)
noticeable smell	20 (25)	17 (23)
initially goes to bottom of water	15 (13)	18 (18)
mixes with the water	15 (21)	37 (54)
makes bubbles	62 (48)	78 (51)
4. What do you think this liquid is that you put into the water? detergent/soap	72 (55)	93 (86)

Point to jar with liquid 1 in it.

The liquid you added to this jar of water is cooking oil.

Point to jar with liquid 2 in it.

The liquid you added to this jar of water is detergent.

Now you are going to mix the cooking oil and the detergent together in the water.

Hand out ice block stick.

Tip the jar with the water and detergent into the other jar that has water and oil in it. Give it a stir.

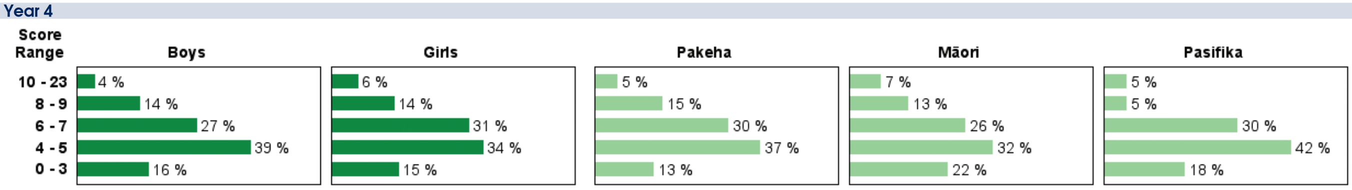
5. Tell me what happened when you stirred it.
6. Why do you think this has happened?

Throw out ice block sticks after use.

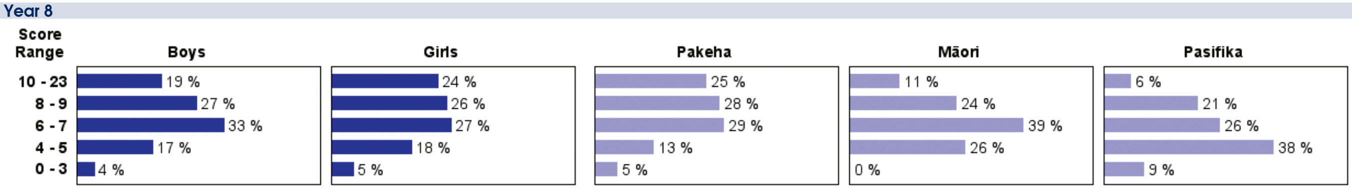
	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Oil droplets get smaller: *(because the detergent broke it up AND because of the stirring)*		
observation plus both explanations	0 (1)	1 (2)
observation plus breaking up explanation	1 (4)	15 (14)
observation plus stirring explanation	4 (3)	5 (5)
observation only given	16 (12)	24 (24)
any other response	79 (80)	55 (55)
Bubbles were made: *(because the detergent mixed with water)*		
observation explained	7 (8)	10 (9)
observation only given	71 (56)	68 (52)
any other response	22 (36)	22 (39)
It went cloudy: *(because of the smaller droplets of oil in water)*		
observation explained	1 (1)	2 (0)
observation only given	29 (31)	24 (30)
any other response	70 (68)	74 (70)
Overall quality of observation and explanation: very good	0 (0)	2 (4)
good	3 (6)	14 (11)
moderately good	27 (25)	39 (34)
poor	70 (69)	45 (51)
Total score: 10–23	5 (5)	22 (25)
8–9	14 (10)	26 (15)
6–7	29 (24)	30 (28)
4–5	37 (38)	17 (19)
0–3	15 (23)	5 (13)

Subgroup Analyses:

Year 4



Year 8



Commentary:

This task, which involved observation, experimentation and interpretation was performed much better, on average, by year 8 students than year 4 students. Year 4 students tended to focus more on superficial attributes like colour rather than the most informative attributes. Year 4 Māori and Pasifika students performed quite similarly to year 4 Pakeha students.

Trend Task: **Pop Off**

NEMP Access Task

Approach:	One to one	**Year:**	4 & 8
Focus:	Predicting, observing and explaining results of a chemical reaction		
Resources:	2 film canisters, 2 lids (one with a hole), paper towels, 2 Alka-Seltzer tablets, 2 pairs of safety goggles, jug of water, tote tray		

Questions / instructions:

% response 2007 ('03)

Preparation: Place jug of water, canister and tablet in the tote tray. Show the student the canister, tablet and water.

In this activity you will be doing an experiment and explaining why something happens. In this canister you will put the tablet and water, then you will put the lid back on.

1. What do you think will happen?

	year 4	year 8
lid will pop off	13 (15)	29 (29)
other prediction	80 (82)	70 (67)

Give student the safety goggles and ensure that they are worn. Teacher also to wear goggles.

This is a tablet that fizzes when you add water. I will put it in the canister, then fill it close to the top with water and put the lid on. Watch what happens.

2. What did you see happening?

	year 4	year 8
tablet fizzes in water/water fizzes	40 (36)	51 (49)
lid pops off	48 (64)	55 (56)

3. Why do you think the lid popped off?

	year 4	year 8
pushed off by gas/air *(pressure)*	21 (33)	63 (72)
pushed off by bubbles, fizz	41 (21)	20 (15)
pushed off by water	8 (10)	4 (1)

Now we will try this again, but this time the lid has a tiny hole in it.

Show student the lid with the hole in it and the clean canister.

4. What do you think will happen this time?

	year 4	year 8
Prediction about lid with hole:		
lid stays on	28 (36)	39 (42)
lid will pop off less strongly/slower	5 (6)	17 (21)
lid will still pop off	16 (14)	7 (7)
no prediction	51 (45)	37 (30)
Prediction about contents:		
contents spray out	29 (30)	30 (19)
any other response	71 (70)	70 (81)

Hand out second tablet.

Here is the fizzing tablet. I will put it in the canister, then put the water in and put the lid on.

5. What do you see happening?

	year 4	year 8
contents fizz	14 (15)	12 (10)
Contents defined as: gas and water	0 (0)	2 (1)
gas	1 (0)	3 (3)
water	24 (23)	22 (32)
"something"	59 (56)	63 (50)
Lid: lid stays on	6 (13)	8 (5)
lid pops off less strongly	0 (0)	0 (0)
lid pops off	0 (0)	0 (2)
no comment about lid	94 (87)	92 (93)

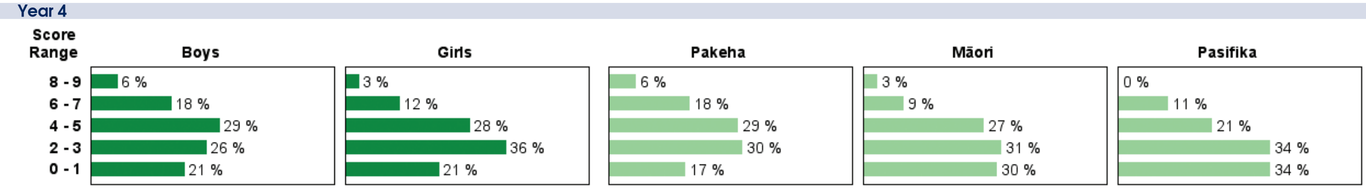
6. Why do you think this was different to the one without a hole in the lid?

	year 4	year 8
some water/fizz/gas escapes through hole *(not "air")*	49 (54)	60 (60)

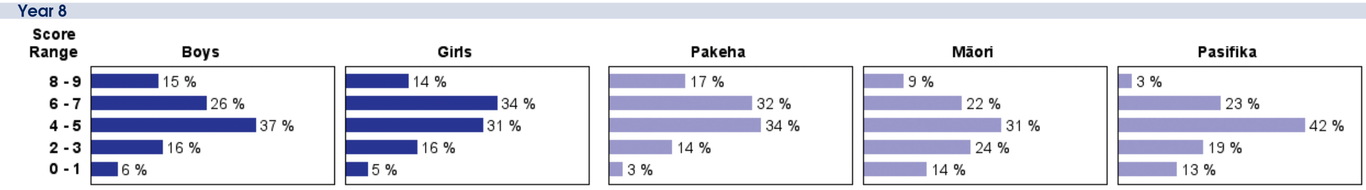
Total score:	year 4	year 8
8–9	3 (8)	14 (17)
6–7	28 (16)	30 (30)
4–5	25 (29)	34 (34)
2–3	28 (29)	16 (12)
0–1	16 (18)	6 (7)

Subgroup Analyses:

Year 4



Year 8



Commentary:

The total score for this task is based on the prediction and explanation components of the task, not the observational components. There was little change in performance between 2003 and 2007 at either year level.

Trend Task: Candle in a Jar

NEMP Access Task

Approach:	One to one	Year:	4 & 8
Focus:	Chemical changes		
Resources:	Plastic glass, birthday candle, teaspoon, baking soda, vinegar, long matches, blu tack		

Questions / instructions:

Make sure that the candle is securely stuck to the bottom of the plastic glass. Put four teaspoons of baking soda in the bottom of the plastic glass.

	% response 2007 ('03) year 4	year 8
1. What does a candle need to keep burning? oxygen	6 (9)	32 (21)
air	7 (13)	13 (16)

In this activity, I'm going to light the candle in this glass. Then I'm going to pour some vinegar onto the baking soda at the bottom.

	year 4	year 8
2. Before we do this I want you to tell me what you think will happen to the baking soda when I add the vinegar.		
Baking soda will react with vinegar: yes, using word	1 (0)	6 (5)
yes, more general	1 (2)	3 (4)
baking soda will fizz/make bubbles/ give off a gas	40 (31)	73 (69)
baking soda will give off carbon dioxide	0 (1)	2 (3)

I'm going to light the candle now.

Light the candle.

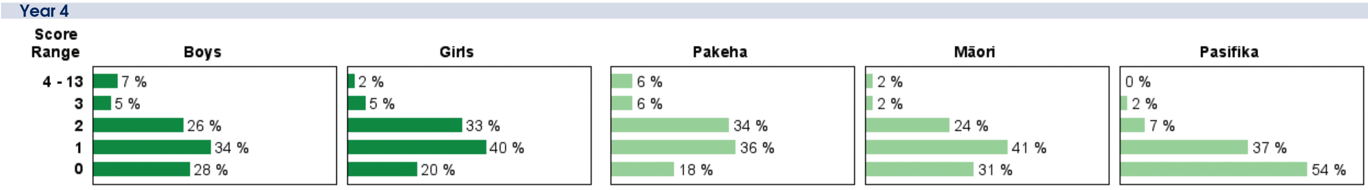
Now, I'm going to squirt the vinegar down the side of the glass onto the baking soda so that it becomes very wet.

Squirt vinegar down side of glass onto baking soda.

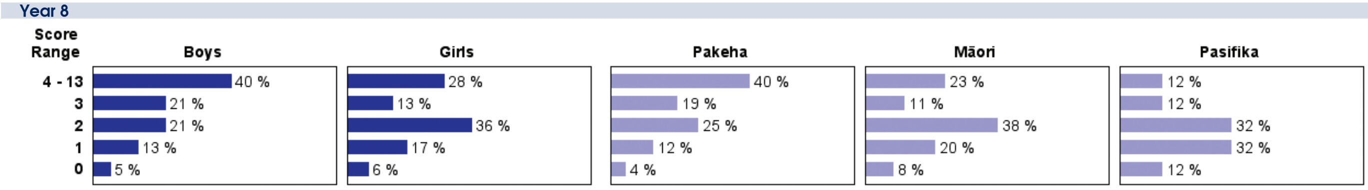
	% response 2007 ('03) year 4	year 8
3. What happened to the baking soda?		
baking soda <u>reacted</u> with vinegar	1 (3)	10 (6)
baking soda fizzed/made bubbles/ gave off a gas/frothed/foamed	65 (67)	80 (77)
baking soda gave off carbon dioxide	1 (0)	2 (3)
4. What happened to the candle flame? not marked	•	•
5. What do you think might have put out the candle flame?		
carbon dioxide *(from the reaction)*	1 (2)	6 (6)
gas/fumes *(from the reaction)*	1 (3)	16 (15)
6. Do you know any gases that would put out a candle flame?		
carbon dioxide	2 (3)	17 (18)
other gases that do not support combustion *(e.g. nitrogen, helium, neon, argon)*	1 (1)	4 (3)
Total score: 4–13	4 (2)	35 (29)
3	5 (13)	17 (17)
2	30 (26)	27 (25)
1	37 (38)	16 (22)
0	24 (21)	5 (7)

Subgroup Analyses:

Year 4



Year 8



Commentary:

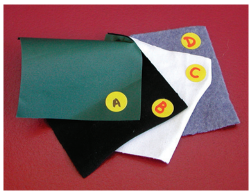
Good performance on this task required chemical knowledge, careful observation and interpretation. About 60% of year 4 students, compared to 20% of year 8 students, had very little success with this task. There was little change in performance at either year level between 2003 and 2007. Year 8 boys scored higher than year 8 girls while most Pasifika students had low scores at both year levels.

Trend Task: Material Purposes

Approach:	Station	**Year:**	4 & 8
Focus:	Selecting the material best suited for a given purpose		
Resources:	Fabric sample: nylon (A), black cotton (B), white cotton (C), fleece (D); Pot holders: tile (A), cloth (B), plastic lid (C); Lunch holders: holey plastic bag (A), plastic bag (B), paper bag (C)		

Questions / instructions:

In this activity you will be choosing the best material for the job.



Look at the T-shirt materials.

Question		% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Which piece of material would be good to make a T-shirt to keep you cool? Write the letter in the box.	A	27 (41)	24 (26)
	B	25 (10)	22 (13)
	✔ C	35 (43)	48 (56)
	D	11 (5)	4 (4)
2. Why is this a good material to keep you cool?	thin/light	33 (42)	61 (64)
	loosely woven/breathes *(lets air in and out)*	8 (5)	16 (15)
	(light in colour so) reflects sunlight/heat	5 (10)	23 (31)

Look at the things to put a hot pot on to stop it burning the table or bench.

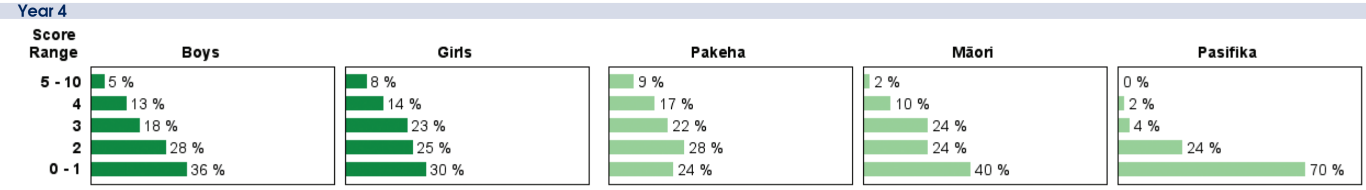
Question		% response 2007 ('03) year 4	% response 2007 ('03) year 8
3. Which one is the best one to put a hot pot on? Write the letter in the box.	✔ A	67 (73)	78 (76)
	B	9 (12)	7 (7)
	C	18 (11)	11 (11)
	D	1 (1)	1 (1)
4. Why is this a good material to put a hot pot on?	insulates/prevents heat getting through it/absorbs	4 (3)	14 (10)
	material will not melt/be damaged	26 (33)	52 (44)

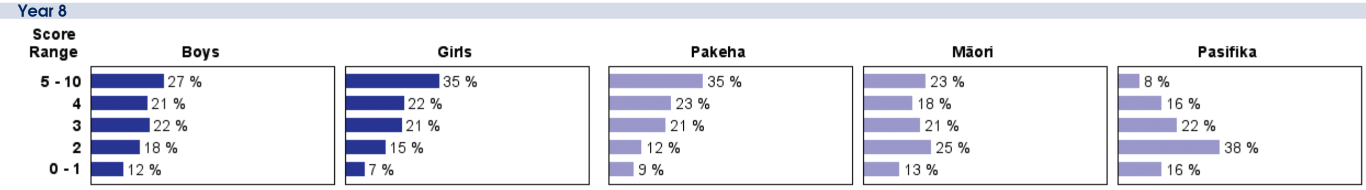
Look at the bags to put your lunch in.

Question		% response 2007 ('03) year 4	% response 2007 ('03) year 8
5. Which bag is the best one to pack your sandwiches in to keep them fresh? Write the letter in the box.	A	26 (24)	26 (27)
	✔ B	28 (23)	34 (45)
	C	43 (52)	38 (26)
6. Why is this a good bag to keep your sandwiches fresh?	keeps moisture/goodness in/ won't dry out	15 (15)	34 (42)
	keeps other substances out *(e.g. dirt, bacteria)*	5 (4)	7 (4)

Total score:		year 4	year 8
	5–10	6 (9)	31 (39)
	4	14 (12)	21 (19)
	3	21 (29)	21 (17)
	2	26 (24)	17 (14)
	0–1	33 (26)	10 (11)

Subgroup Analyses:





Commentary:

There was little change in performance between 2003 and 2007. Girls scored higher than boys at both year levels, but especially at year 8 (where the difference was statistically significant). Performance patterns for the ethnic subgroups were typical, except for the particularly low performance of year 4 Pasifika students.

Trend Task: Jelly Crystals

NEMP Access Task

Approach:	Team
Year:	4 & 8
Focus:	Design a fair test experiment into the dissolving rates of jelly crystals
Resources:	Jelly crystals, jug of hot water, jug of cold water, 2 plastic glasses, 2 teaspoons, recording sheet, stopwatch

Questions / instructions:

Preparation: Jug of hot water.

Don't hand out equipment yet.

This activity involves testing jelly crystals. In your team you will design a test to find out if jelly crystals dissolve faster in hot or cold water. You will need to do a fair test. In a fair test, only one important thing is changed at a time (for example, the temperature of water).

In your team think about how you will do your test. Here is some equipment you will be able to use. When you have decided on how to do the test I will ask you to tell me what you will do.

Hand out equipment. Allow time.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Tell me how you will do the test so that it is a fair test.		
Record team response.		
Plan: same amount of water	29 (36)	78 (91)
same amount of jelly crystals	49 (72)	84 (98)
start timing for both as soon as water or jelly crystals are added	36 (41)	65 (59)
emphasis on treating both alike *(e.g. stir both at same speed and intensity)*	24 (34)	51 (55)
careful observation and timing of when dissolving is complete	40 (44)	57 (58)
2. How will you know which one dissolves fastest?		
compare the times it takes to dissolve all jelly crystals	42 (51)	53 (74)
3. How is your test a fair test? You explain it to me and I will write it down to help you during your test.		
Record team response.		
not marked	•	•

You can now do your experiment. After you have done the test, you will tell me what you found out.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Actual experiment:		
used same amount of water	63 (64)	86 (96)
used same amount of jelly crystals	71 (93)	94 (94)
started timing for both as soon as jelly crystals or water added	48 (62)	75 (80)
emphasis on treating both alike *(e.g. stir both at same speed and intensity)*	32 (35)	63 (67)
watched carefully for dissolving to be completed/timed accordingly	75 (65)	91 (89)
compared specific times it took to dissolve	22 (31)	39 (45)
4. Do jelly crystals dissolve faster in hot or cold water? hot	88 (92)	100 (100)
5. What else did you find out?		
6. Now I want you to look at what you told me you would do to make sure it was a fair test. Is that what you did?		
7. Tell me about how that part went.		
Retrospective evaluation: *(suggested corrections)*		
same amount of water	9 (13)	11 (6)
same amount of jelly crystals	3 (9)	6 (2)
start timing for both as soon as water or jelly crystals are added	8 (9)	10 (17)
emphasis on treating both alike *(e.g. stir both at same speed and intensity)*	9 (13)	31 (46)
careful observation and timing of when dissolving is complete	14 (4)	5 (15)
compare specific times it takes to dissolve	6 (4)	6 (6)
Participation in planning, experiment and discussion:		
all students participated	84 (70)	81 (83)
all except one student participated	13 (26)	17 (15)
half of the students participated	3 (4)	2 (2)
less than half of the students participated	0 (0)	0 (0)
Total score: 12–18	4 (10)	17 (22)
10–11	13 (7)	36 (50)
8–9	17 (30)	33 (21)
6–7	26 (33)	13 (7)
0–5	40 (20)	1 (0)

Commentary:

Because this is a team task, no graph of subgroup performance is possible. Year 8 teams generally showed much stronger understanding of fair testing requirements. At both year levels, but especially year 4, there was a marked decline in performance between 2003 and 2007.

Trend Task: NEMP Access Task

Bubbles

Approach: Team **Year:** 4 & 8
Focus: Generating and classifying questions
Resources: Bubble mixture, straws, paper towels, 2 notepads, cue card, 4 jars, red and blue stickers, answer sheet

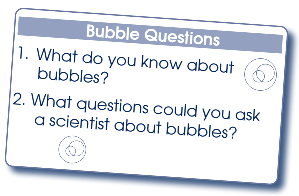
Questions / instructions:

Preparation: Put a small amount of bubble mixture and a straw into each jar.

In science it is important to be able to think up good questions to help you learn more. Your team will be blowing bubbles and thinking up good questions about the bubbles. When you have thought up your questions you will decide which ones you might be able to find the answer to by doing experiments. You will also decide which ones you would need to ask a scientist about. You won't have to work out the answers to your questions.

Here are two questions for you to think about in your team.

Show and read cue card.



Use this bubble mixture to work in pairs to make bubbles. As you make the bubbles talk with your partner about some good questions that would help you to know more about bubbles. Try to think up about eight questions together. I'll give you a few minutes to work out your questions in pairs, then we'll get you together as a team again.

Hand out bubble mixture, notepads and pens. Allow time for discussion in pairs, then bring students together for group discussion.

Now it's time to put the bubble mixture aside and share your ideas for really good questions with the group. I want each pair to share their questions, and the others to listen carefully. Then you can work out which are the best questions and write them down. Here is a recording sheet for writing your questions on. Try to write about eight questions.

Hand out answer sheet. Allow time.

Here are some red stickers and some blue stickers. Beside your questions put a blue sticker if you could find the answer by doing an experiment or a red sticker if you would need to ask a scientist about it.

Hand out stickers.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Proportion of questions which could lead to useful knowledge about the science associated with bubbles:		
all or almost all	44 (41)	44 (55)
more than half *(60-80%)*	39 (35)	37 (28)
about half	7 (14)	7 (5)
less than half *(20-40%)*	7 (7)	11 (12)
none or almost none	3 (3)	1 (0)
Proportion of questions with blue dots which could reasonably be answered by children doing experiments:		
all or almost all	6 (5)	15 (10)
more than half *(60-80%)*	13 (19)	22 (22)
about half	15 (12)	16 (11)
less than half *(20-40%)*	33 (20)	24 (24)
none or almost none	33 (44)	23 (33)
Proportion of questions with red dots which could not reasonably be answered by children doing experiments:		
all or almost all	37 (58)	52 (57)
more than half *(60-80%)*	16 (25)	24 (23)
about half	15 (3)	10 (7)
less than half *(20-40%)*	16 (9)	9 (10)
none or almost none	16 (5)	5 (3)

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Proportion of questions with red dots which could best be answered by appropriately qualified scientists:		
all or almost all	15 (22)	26 (30)
more than half *(60-80%)*	18 (24)	31 (28)
about half	21 (10)	14 (10)
less than half *(20-40%)*	28 (27)	21 (24)
none or almost none	18 (17)	8 (8)
Number of questions listed: 8 or more	50 (68)	65 (67)
6 or 7	31 (27)	26 (25)
4 or 5	17 (5)	7 (6)
less than 4	2 (0)	2 (2)
Total score: 17–19	1 (5)	13 (13)
15–16	11 (17)	25 (22)
12–14	32 (39)	31 (33)
9–11	34 (24)	21 (25)
0–8	22 (15)	10 (7)

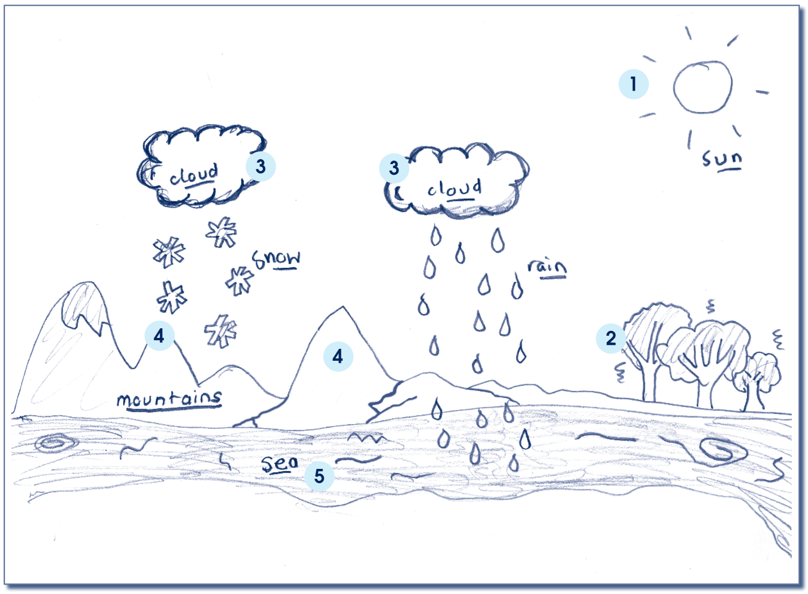
Commentary:

Because this is a team task, no graph of subgroup performance is possible. There was little change in performance between 2003 and 2007 for year 8 students, but a marked decline for year 4 students.

Task: Water Cycle

NEMP Access Task

Approach: One to one
Year: 8
Focus: Describe the water cycle
Resources: Diagram

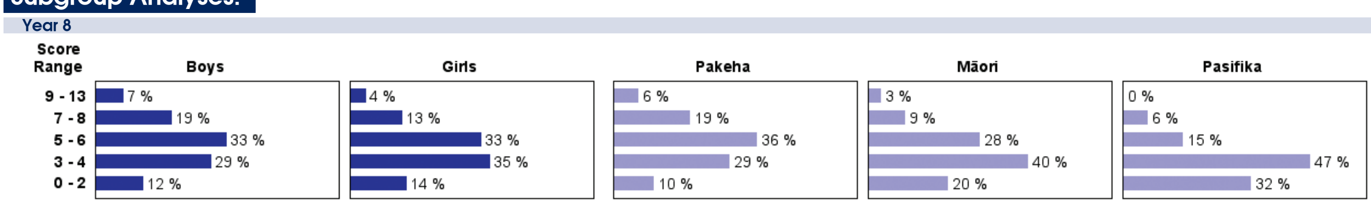


Questions / instructions:

	% responses y8
Hand student diagram.	
Here is a diagram showing the water cycle. It was drawn by a year 8 student.	
Try to explain what you think is happening at each part of the water cycle.	
1. What do you think is happening in the water cycle at 1?	
the sun is shining	66
consequence is things getting warmed up/heat	32
2. What do you think is happening in the water cycle at 2?	
evaporation of moisture *(water)* into sky	58
3. What do you think is happening in the water cycle at 3?	
cloud contains water as water vapour	24
rain/snow falling from the cloud	89
Quality of explanation: strong	4
moderate	12
no explanation	84

	% responses y8
4. What do you think is happening in the water cycle at 4?	
rain or snow falling onto mountains or hills	60
some stored in cold areas as snow/ice	11
some runs down as streams, rivers *(into sea)*	26
some absorbed into ground	2
5. What do you think is happening in the water cycle at 5?	
water from rain, snow, hail has reached sea	63
water in sea is evaporating back into sky/ the process starts again	38
Total score: 9–13	5
7–8	16
5–6	34
3–4	32
0–2	13

Subgroup Analyses:



Commentary:

Most year 8 students could only offer partial explanations of the stages of the water cycle. Few Pasifika students scored well on this task.

		% responses y4	y8
LINK TASK: 18			
Approach:	One to one		
Year:	4 & 8		
Focus:	Chemical reaction		
Total score:	7–11	1	5
	5–6	8	20
	3–4	26	43
	1–2	51	30
	0	14	2
LINK TASK: 19			
Approach:	One to one		
Year:	4 & 8		
Focus:	Explaining phenomena		
Total score:	5–13	1	13
	3–4	6	22
	2	8	14
	1	18	21
	0	67	30
LINK TASK: 20			
Approach:	One to one		
Year:	4 & 8		
Focus:	Floating and sinking		
Total score:	11–12	1	8
	9–10	33	51
	7–8	53	37
	0–6	13	4
LINK TASK: 21			
Approach:	Station		
Year:	4 & 8		
Focus:	Chemical testing		
Total score:	5	66	79
	4	26	9
	3	6	8
	0–2	2	4
LINK TASK: 22			
Approach:	Team		
Year:	4 & 8		
Focus:	Properties of liquids		
Total score:	24–27	2	19
	21–23	12	46
	18–20	28	21
	15–17	24	7
	0–14	34	7

6 Planet Earth and Beyond

The assessments included 15 tasks related to the planet Earth and beyond strand of the science curriculum.

Eleven tasks were identical for year 4 and year 8 students. Four of these are trend tasks (fully described with data for both 2003 and 2007) two are released tasks (fully described with data for 2007 only), and five are link tasks (to be used again in 2011 so only partially described here). Two trend and two link tasks were attempted only by year 8 students.

The task details and results for trend tasks are presented in the first section, followed by the task details and results for released tasks. The third section contains a little task information and the results for the link tasks. Within these sections, tasks used with both year 4 and year 8 students are presented first, followed by tasks used only with year 8 students.

Comparing Results for Year 4 and Year 8 Students

Averaged across 133 task components used with both year 4 and year 8 students, 11% more year 8 than year 4 students produced correct or good responses. This indicates that, on average, students have made useful progress between year 4 and year 8 in the skills assessed by the tasks.

Boys performed slightly better than girls at both year levels. Pakeha students scored statistically significantly higher than Māori students on 80% of year 4 tasks and 69% of year 8 tasks. Pakeha students scored statistically significantly higher than Pasifika students on all year 4 tasks and 92% of year 8 tasks. Students whose predominant language at home was English scored statistically significantly higher than other students on 40% of year 4 tasks and 46% of year 8 tasks.

Trend Results: Comparing 2003 and 2007 Results

Four trend tasks involving a total of 46 components were administered to year 4 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on eight components, more 2003 than 2007 students succeeded on 28 components, and there was no difference on 10 components. Averaged across the 46 components, 2% fewer students succeeded in 2007 than in 2003. This is a very small difference. Between 1999 and 2003 there had been no change.

Six trend tasks involving 60 task components were administered to year 8 students in both the 2003 and 2007 assessments. More 2007 than 2003 students succeeded on 18 components, more 2003 than 2007 students succeeded on 32 components, and there was no difference on 10 components. Averaged across the 60 components, 2% fewer students succeeded in 2007 than in 2003. This is a very small difference. Between 1999 and 2003 there had been a 3% increase for this strand.

Trend Task:

Rivers

Approach: One to one **Year:** 4 & 8
Focus: Rivers and their effect on the lanvd
Resources: 2 pictures

Questions / instructions:

Show picture 1.

Here is a picture of part of a river.

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. Where could this river have started?		
mountains/hills/glacier	14 (21)	39 (41)
(small) streams	5 (5)	7 (3)
spring/underground source	2 (1)	4 (2)
(inland) lake/dam	11 (11)	18 (15)
2. Where could this river end up?		
sea/ocean	49 (55)	75 (73)
lake/dam	14 (14)	28 (25)
another river	4 (5)	6 (9)

Show picture 2.
[substitute resource due to copyright.]

Over a long time this river has changed the land that it is running through.

3. How has the land changed because of the river?
4. How has the river caused those changes?

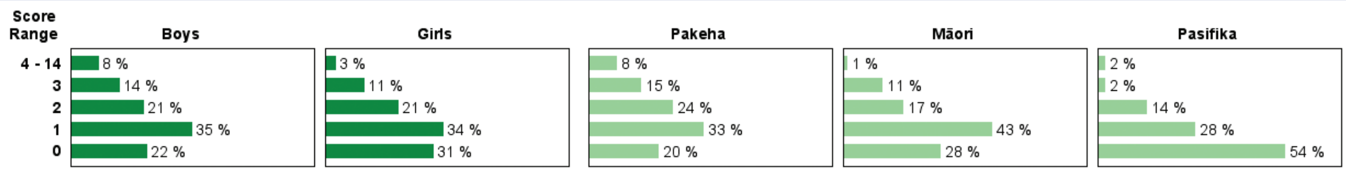
Mentioned:

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
Erosion effects: *(wearing away of soil/rock, creating valleys/cliffs)*		
detailed response	3 (6)	14 (16)
mentioned	13 (13)	28 (28)
not mentioned	84 (81)	58 (56)
Depositing effects: *(rocks, soil, timber left downstream, creating gravel, plains, broad valleys)*		
detailed response	1 (1)	3 (2)
mentioned	6 (3)	14 (17)
not mentioned	93 (96)	83 (81)
effects of steepness/speed of flow *(high erosion in steep areas, depositing in flat areas)*	1 (2)	7 (5)
irrigation effects *(providing water for vegetation/animals)*	14 (12)	15 (21)
soil benefits in valleys/plains from periodic flooding	0 (1)	1 (3)
Total score: 4–14	6 (7)	31 (31)
3	12 (15)	19 (17)
2	21 (24)	23 (28)
1	35 (30)	20 (16)
0	26 (24)	7 (8)

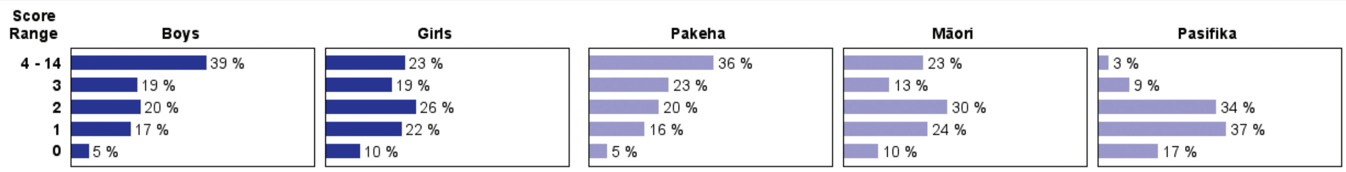
Illustrations sourced from:
1: Flying Fish. Available: http://www.flyingfish.co.nz/new_zealand_photo_library202/rivers_and_gorges1/k033.jpg (March, 2002).
2: Flying Fish. Available: http://www.flyingfish.co.nz/new_zealand_photo_library202/rivers_and_gorges1/k016.jpg (May, 2008).

Subgroup Analyses:

Year 4



Year 8



Commentary:

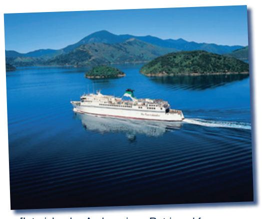
This task showed substantial improvements in performance from year 4 to year 8, with little change at either level between 2003 and 2007. Boys performed significantly better than girls at both year levels, while year 8 Pasifika students averaged lower than the other groups.

Trend Task: Weather Map

NEMP Access Task

Approach:	One to one
Focus:	Understanding weather map symbols
Resources:	2 weather maps, picture
Year:	4 & 8

Questions / instructions:



[Interislander-Arahura.jpg. Retrieved from: http://www.discovernewzealand.com/default.aspx?DN=b6f9d0e0-b400-4ba9-b158-eb3dad4471c2 Tourism Holdings Ltd (May 2008)]

Show picture.

Here is a picture of a ferry boat that goes from the North Island of New Zealand to the South Island across Cook Strait. People who travel on the ferry are always keen to know what the weather will be like when the boat is going.

Show map one.

This map shows the weather for one day. There is a red dotted line to show you where the boat will be going from the North Island to the South Island.

1. What do you think the weather will be like on this day for going on the ferry boat?

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
calm	3 (4)	16 (10)
clear, fine/sunny	25 (29)	28 (38)
hot, warm *(and/or cool at night)*	55 (50)	51 (47)
a good day	13 (17)	25 (20)

2. How does the map tell you that the weather will be like that?

	year 4	year 8
'H': means high pressure/anticyclone	0 (1)	4 (6)
means high	15 (21)	27 (27)
related to temperature/hot	44 (39)	37 (33)
no relevant comment	41 (39)	32 (34)
no close-together circles/lines *(isobars)* mean little wind	1 (3)	7 (7)

Show map two.

This map shows the weather for another day.

3. What do you think the weather will be like on this day for going on the ferry boat?

	% response 2007 ('03) year 4	% response 2007 ('03) year 8
windy	43 (50)	67 (67)
southerly	1 (1)	3 (5)
(relatively) cool/cold	31 (31)	41 (41)
a bad day	9 (16)	19 (15)
cloudy/rainy/stormy	31 (25)	24 (30)

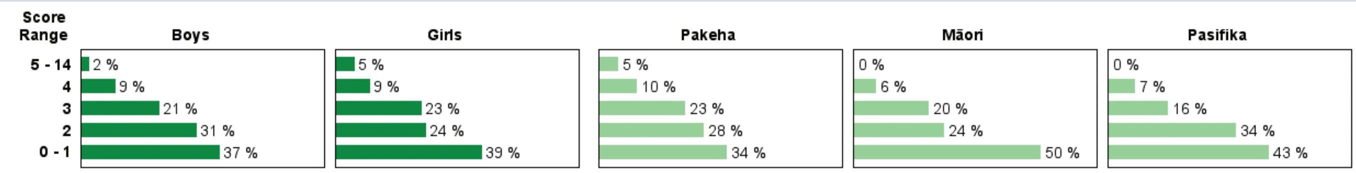
4. How does the map tell you that the weather will be like that?

	year 4	year 8
'L': means low pressure/depression	1 (0)	5 (7)
means low	11 (8)	32 (39)
related to temperature/cold	29 (29)	12 (12)
no relevant comment	59 (63)	51 (42)
circles/lines close together *(isobars)* mean wind	16 (16)	35 (26)
location of lines, front, 'L' – all suggest southerly *(at least one mentioned and that it suggests southerly)*	2 (2)	6 (7)
cold front symbol supports cold temperature	2 (0)	9 (11)

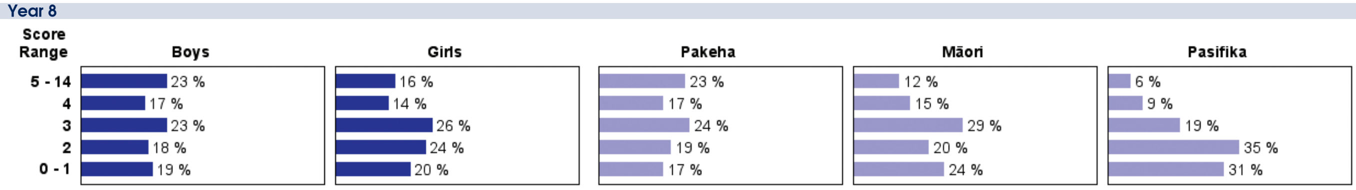
Total score:	year 4	year 8
5–14	3 (9)	20 (23)
4	9 (6)	16 (18)
3	22 (22)	24 (24)
2	28 (23)	20 (22)
0–1	38 (40)	20 (13)

Subgroup Analyses:

Year 4



Year 8



Commentary:

Students at both year levels showed quite limited understanding of the meaning of the symbols H and L on weather maps, tending to associate them with temperature rather than air pressure. In fact, an H is not always associated with warm weather or an L with cold weather. Overall, performance was quite low, with little evidence of change between 2003 and 2007.

Trend Task: NEMP Access Task

Time

Approach: Station

Year: 4 & 8

Focus: Planetary motion and time

Resources: None

Questions / instructions:

hour	day	week	month	year

Choose one word from the box which is the best answer to each question.

Question	Answer	% response 2007 ('03) year 4	% response 2007 ('03) year 8
1. How long does it take for the Moon to go right around the Earth?	hour	13 (12)	4 (3)
	day	32 (31)	35 (32)
	week	11 (9)	12 (8)
	✔ month	19 (26)	31 (41)
	year	22 (20)	15 (13)
2. How long does it take for the Earth to turn once on its own axis?	hour	12 (10)	7 (4)
	✔ day	23 (27)	37 (41)
	week	17 (17)	15 (17)
	month	24 (22)	20 (19)
	year	19 (21)	19 (17)
3. How long does it take for the Earth to go right around the Sun?	hour	8 (8)	3 (2)
	day	13 (16)	15 (13)
	week	15 (13)	8 (7)
	month	18 (15)	10 (9)
	✔ year	44 (45)	63 (66)

Total score:	% response 2007 ('03) year 4	% response 2007 ('03) year 8
3	5 (9)	18 (25)
2	14 (15)	19 (19)
1	42 (41)	39 (35)
0	39 (35)	24 (21)

Subgroup Analyses:

Year 4

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
3	7 %	4 %	7 %	2 %	5 %
2	14 %	13 %	17 %	9 %	4 %
1	41 %	44 %	43 %	41 %	42 %
0	38 %	39 %	33 %	48 %	49 %

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
3	20 %	16 %	23 %	8 %	0 %
2	21 %	17 %	19 %	19 %	26 %
1	37 %	42 %	39 %	41 %	28 %
0	22 %	25 %	19 %	32 %	46 %

Commentary:

About 80% of year 4 students and 65% of year 8 students showed little knowledge of the relationships between planetary motion and time periods on Earth. There was little change in performance at either level between 2003 and 2007.

Trend Task: Compost

NEMP Access Task

Approach:	Station	Year:	4 & 8
Focus:	Identifying biodegradable rubbish		
Resources:	14 small pictures, 1 large picture, sheet of stickers		

Questions / instructions:

Compost is made when small soil bugs and worms feed on rubbish and break it down. Compost is put on gardens to help plants grow.

Stick the stickers here of things that go in the compost.

Stick the stickers here of things that should NOT go in the compost.

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
For compost:	vegetable peelings	93 (96)	98 (98)
	apple core	90 (88)	98 (97)
	egg shells	68 (65)	76 (79)
	leaves	74 (78)	90 (95)
	toast	63 (60)	84 (87)
	newspaper	30 (30)	38 (34)
	tea bags	47 (49)	51 (52)

1. Why can this rubbish go in the compost?

Appropriate comment about:

	year 4	year 8
how it behaves *(breaks down, rots, decomposes, biodegrades)*	22 (29)	62 (60)
categorised as vegetable or organic	6 (9)	8 (9)
both of the above	1 (3)	7 (6)

		% response 2007 ('03) year 4	% response 2007 ('03) year 8
NOT for compost:	bones	57 (66)	66 (64)
	chip packets	85 (85)	96 (96)
	yoghurt container	79 (87)	94 (97)
	pot scrub	79 (81)	83 (90)
	cans	85 (87)	97 (97)
	glass bottle	89 (94)	98 (98)
	plastic bags	85 (85)	95 (97)

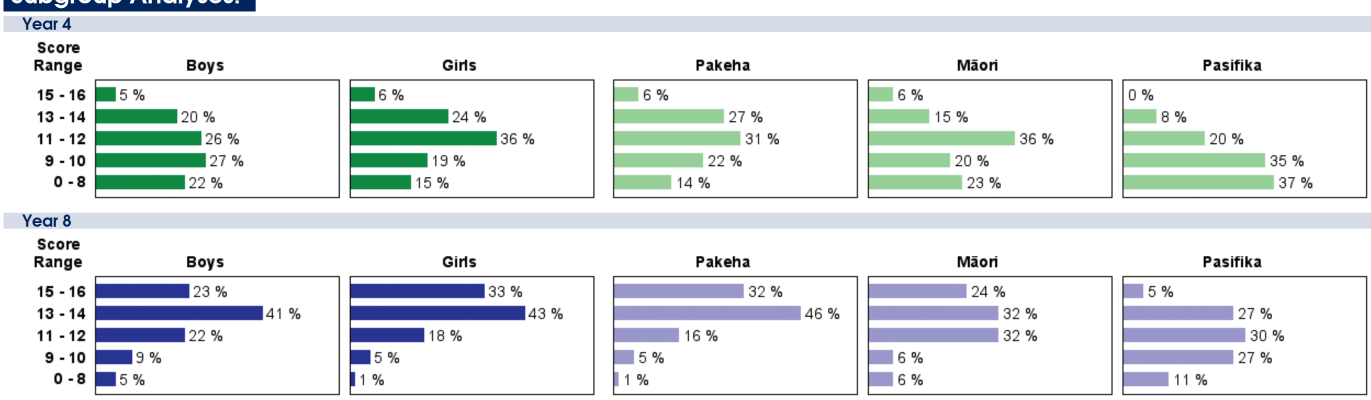
2. Why can't this rubbish go in the compost?

Appropriate comment about:

	year 4	year 8
how it behaves *(doesn't break down/ rot/decompose, not biodegradable)*	19 (25)	58 (57)
categorised as man-made, not organic	7 (11)	8 (9)
both of the above	1 (2)	7 (4)

Total score:	year 4	year 8
15–16	5 (11)	28 (29)
13–14	22 (21)	42 (44)
11–12	31 (34)	20 (18)
9–10	24 (19)	7 (5)
0–8	18 (15)	3 (4)

Subgroup Analyses:



Commentary:

In general, year 8 students did much better than year 4 students at explaining reasons for or against composting different materials. Between 2003 and 2007, performance declined a little for year 4 students but was unchanged for year 8 students. Year 8 girls scored significantly higher than boys, while Pasifika students, at both year levels, had limited success.

Vegetable Peelings

Tea Bags

Yoghurt Container

Toast

Chip Packets

Newspaper

Pot Scrub

Egg Shells

Apple Core

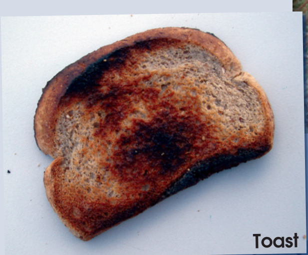
Bones

Glass Bottle

Plastic Bags

Cans

Leaves

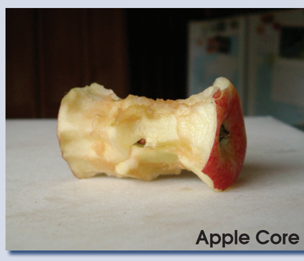


Toast

Chip Packets

Tea Bags

Vegetable Peelings



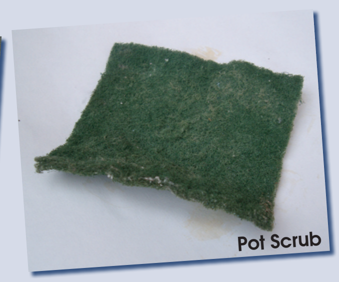
Apple Core

Yoghurt Container

Bones

Egg Shells

Cans



Pot Scrub

Glass Bottle

Newspaper

Leaves

Plastic Bags

Trend Task: Rock Detective

Approach:	One to one	**Year:**	8
Focus:	Identifying rocks		
Resources:	Rocks (A,B,C,D), graph, descriptions card, recording book		

Questions / instructions:

% response 2007 ('03) year 8

In this activity you will be describing some rocks and thinking about how they could have been formed. Here are four rocks. Pick them up to see what they are like.

Hand out rocks.

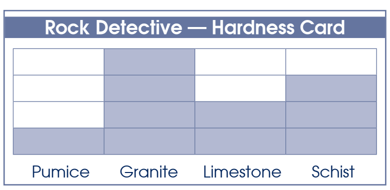
1. Here are some words to describe these rocks. I want you to match the rocks with these descriptions.

Place descriptions card in front of student and read the descriptions to the student.

		% response 2007 ('03) year 8
Description 1:	D - Pumice	99 (100)
Description 2:	A - Granite	52 (60)
Description 3:	B - Limestone	94 (93)
Description 4:	C - Schist	58 (68)

Now you are going to try and work out the names of the rocks using this graph. The graph shows how hard the different rocks are. The rocks are pumice, granite, limestone and schist.

Hand out graph.



		% response 2007 ('03) year 8
2. Which rock do you think is pumice?	D	95 (95)
3. Which rock do you think is granite?	A	40 (52)
4. Which rock do you think is limestone?	B	57 (55)
5. Which rock do you think is schist?	C	34 (37)

6. Can you tell me about how one of these types of rocks was made?

PROMPT: *Which rock?*
How was it formed?

Explanation:

Limestone (sedimentary rock):
- made from (crushed) sea shells (of dead sea animals)
- buried together (with sand)

Pumice (igneous rock):
- came out of a volcano (volcanic lava)
- cooled/hardened quickly
- gas bubbles/air got trapped in it (is full of holes)

Schist (metamorphic rock):
- came from deep underground
- where it was pressured and got very hot
- minerals grew (gives it its silvery layers)

Granite (igneous rock):
- hot rock (magma) underground
- cooled/hardened slowly

	% response 2007 ('03) year 8
substantial, quite accurate	9 (10)
limited	27 (33)

Total score:	% response 2007 ('03) year 8
9–10	10 (14)
7–8	22 (28)
5–6	33 (33)
3–4	34 (24)
0–2	1 (1)

Subgroup Analyses:

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
9 - 10	10 %	10 %	11 %	6 %	0 %
7 - 8	25 %	20 %	25 %	10 %	17 %
5 - 6	32 %	34 %	32 %	39 %	39 %
3 - 4	32 %	35 %	31 %	43 %	44 %
0 - 2	1 %	1 %	1 %	2 %	0 %

Commentary:

This popular task showed a moderate decline in year 8 student performance between 2003 and 2007.

Trend Task: NEMP Access Task

Shadow Tales

Approach: Station **Year:** 8

Focus: Using shadows to tell time

Resources: 5 pictures, 5 time cards

Questions / instructions:

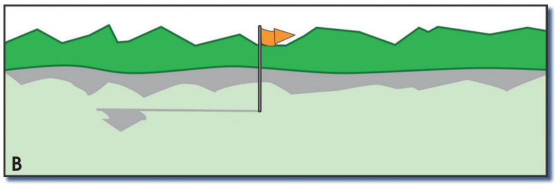
These pictures show a flagpole at different times during the day when looking north. There are also some different times on cards. The pictures and the times are muddled up.

Rearrange the pictures so that they are in the correct order. Then write down the time which you think goes with each picture.

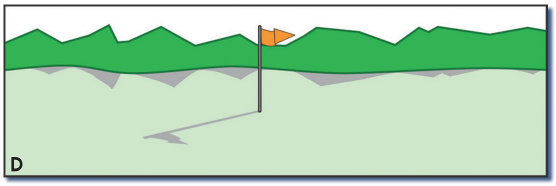
The first one has been done for you.

1. B ______ ______ ______ ______
2. 6.00am ______ ______ ______ ______

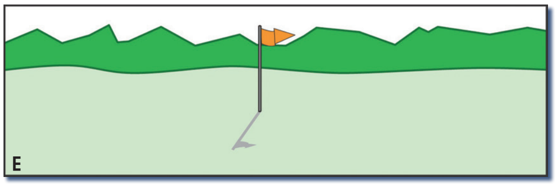
% response 2007 ('03) year 8



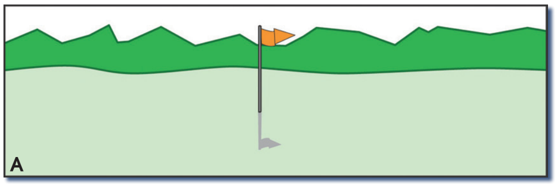
B with 6:00am



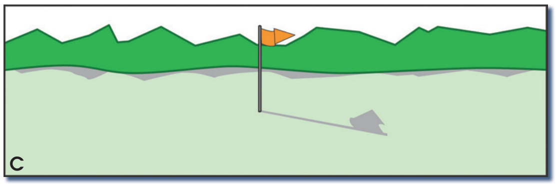
D with 8:30am — 72 (76)



E with 11:00am — 65 (75)



A with 12:00pm — 65 (73)



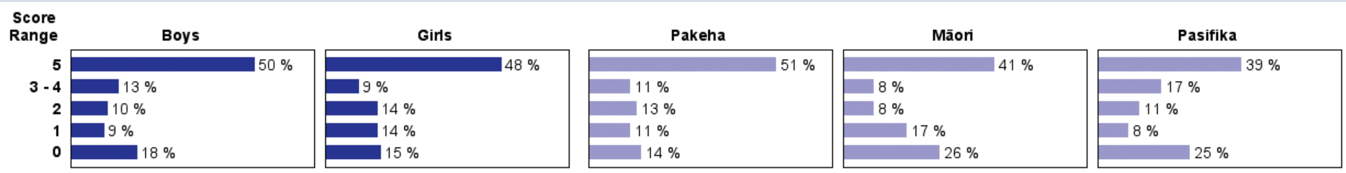
C with 5:30pm — 61 (67)

order from left to right is D E A C — 57 (57)

Total score:	year 8
5	49 (57)
3–4	10 (11)
2	13 (12)
1	11 (11)
0	17 (9)

Subgroup Analyses:

Year 8



Commentary:

There was a slight decline in performance on this task between 2003 and 2007. It also featured a relatively strong performance by Pasifika students who scored a little higher than Māori students and only slightly lower than Pakeha students.

Task: Way Out There

Approach:	One to one	Year:	4 & 8
Focus:	Solar system – earth, comets, moon		
Resources:	3 pictures		

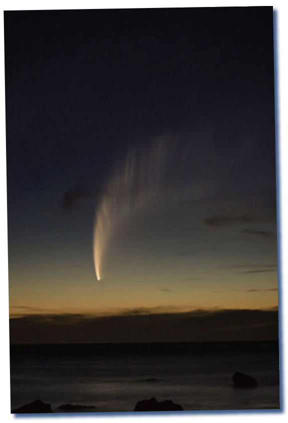
Questions / instructions:

Hand student planet picture.

Here is a picture taken from outer space of part of planet Earth.

1. What does this picture tell us about the shape of the earth?

% responses	y4	y8
that the earth is a sphere *(ball)*	9	13
that the earth is curved/round	76	76
no relevant response	15	11



Hand student comet picture.

Here is a picture of a comet seen in our night sky.

2. What is a comet?

% responses	y4	y8
a fast moving object in space	14	25
a bright moving object in sky	13	13
it has a tail	3	7
it is made up of rock/ice/dust	6	16

Hand student moon phase picture.

Here are some pictures of the moon on different nights.

3. Why does the moon look different on different nights?

% responses	y4	y8
because the sun's light reflects off the moon to our eyes	14	28
which parts of the moon are seen depends on the relative positions of the sun,earth and moon	12	29
student gives a really clear example *(such as seeing left side of moon because sun is shining from the left, as we are looking at the moon)*	1	3

Total score:	y4	y8
4–9	6	16
3	11	19
2	28	30
1	45	31
0	10	4

Images sourced from:
1: NZCER; *http://arb.nzcer.org.nz/resources/science/planet/9000/pe9056.htm* (March, 2007). Originally derived, by NZCER, from *http://www.nasa.gov*.
2: Cidadao, A., U.S.N.O., *http://aa.usno.navy.mil/faq/docs/moon_phases* (March, 2007).
3: Roseingrave, M., *http://sn.mlr.co.nz/entry.php?id=77* (March, 2007).

Subgroup Analyses:

Year 4

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
4 - 9	5 %	6 %	8 %	3 %	2 %
3	12 %	9 %	14 %	6 %	2 %
2	29 %	28 %	28 %	29 %	28 %
1	45 %	45 %	42 %	53 %	44 %
0	9 %	12 %	8 %	9 %	24 %

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
4 - 9	19 %	11 %	19 %	4 %	15 %
3	19 %	19 %	19 %	26 %	3 %
2	32 %	29 %	32 %	23 %	32 %
1	27 %	35 %	27 %	40 %	44 %
0	3 %	6 %	3 %	7 %	6 %

Commentary:

Most students showed limited knowledge and understanding of these astronomical features or phenomena.

Task: Dunes

Approach:	One to one	**Year:**	4 & 8
Focus:	Sand dunes: function and protection		
Resources:	2 photos		

Questions / instructions:

This activity is about the sand dunes that can be seen at some beaches.

Give student photo 1.

Here is a photo of a beach with sand dunes.

1. What do you think sand dunes are good for?

	% responses y4	% responses y8
provide protection from the sea for the land and buildings further inland	6	24
protect coast from being eroded by waves/sea/storms	2	12
habitat for plants and creatures	41	41
nice to look at or play in/on/among	41	42

Give student photo 2.

Here is a photo of another beach with sand dunes.

2. How are these dunes different to the dunes in the first photo?

	% responses y4	% responses y8
much steeper *(on ocean side)*	36	56
less/poorer vegetation	19	12

Sand dunes closest to the beach change often. They build up and wear away, or erode, because of the forces of the wind and the water. In this photo these dunes have eroded and have become very steep.

3. What could be done to help prevent the dunes from being eroded or getting too steep?

	% responses y4	% responses y8
plant suitable plants on the dunes	7	13
stop erosion from people, animals and vehicles climbing on the dunes	4	6
do not allow sand to be taken from the dunes	0	0

Total score:	y4	y8
4–9	4	10
3	13	24
2	31	32
1	36	25
0	16	9

Images sourced from:
1: Hesp, P., *http://www.massey.ac.nz/~wwglobal/Hesp/dunes.htm* (March, 2007).
2: Coney, S., *http://www.piha.co.nz/gfx/storms.JPG* (March, 2007).

Subgroup Analyses:

Year 4

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
4 - 9	5 %	4 %	4 %	6 %	2 %
3	12 %	14 %	16 %	10 %	3 %
2	30 %	32 %	35 %	22 %	29 %
1	37 %	34 %	31 %	45 %	42 %
0	16 %	16 %	14 %	17 %	24 %

Year 8

Score Range	Boys	Girls	Pakeha	Māori	Pasifika
4 - 9	12 %	9 %	13 %	5 %	0 %
3	25 %	22 %	26 %	15 %	21 %
2	35 %	30 %	33 %	31 %	37 %
1	23 %	26 %	20 %	37 %	33 %
0	5 %	13 %	8 %	12 %	9 %

Commentary:

Most students showed very limited understanding of coastal erosion processes and protection.

Link Tasks 23 – 29

LINK TASK: 23
Approach: One to one
Year: 4 & 8
Focus: Understanding seasons

Total score:	% responses y4	% responses y8
8–13	5	13
6–7	17	22
4–5	32	36
2–3	25	15
0–1	21	4

LINK TASK: 24
Approach: One to one
Year: 4 & 8
Focus: Climate issues

Total score:	% responses y4	% responses y8
7–18	1	10
5–6	5	25
3–4	9	28
1–2	32	25
0	53	12

LINK TASK: 25
Approach: Station
Year: 4 & 8
Focus: Ordering universe objects

Total score:	% responses y4	% responses y8
12	3	10
10–11	5	16
8–9	11	21
6–7	21	24
4–5	30	18
0–3	30	11

LINK TASK: 26
Approach: Station
Year: 4 & 8
Focus: Waste disposal

Total score:	% responses y4	% responses y8
15–16	1	19
13–14	12	32
11–12	23	29
9–10	26	14
0–8	38	6

LINK TASK: 27
Approach: Team
Year: 4 & 8
Focus: Soil behaviour

Total score:	% responses y4	% responses y8
10–14	1	7
8–9	6	11
6–7	20	29
4–5	37	30
0–3	36	23

LINK TASK: 28
Approach: One to one
Year: 8
Focus: Shadows

Total score:	% responses y4	% responses y8
10–14		11
8–9		17
6–7		23
4–5		25
0–3		24

LINK TASK: 29
Approach: Team
Year: 8
Focus: Clouds

Total score:	% responses y4	% responses y8
18–20		14
16–17		22
14–15		24
12–13		20
0–11		20

Science Surveys 7

Attitudes and Motivation

The national monitoring programme recognises the impact of attitudinal and motivational factors on student achievement in individual assessment tasks. Students' attitudes, interests and liking for a subject have a strong bearing on progress and learning outcomes. Students are influenced and shaped by the quality and style of curriculum delivery, the choice of content and the suitability of resources. Other important factors influencing students' achievements are the expectations and support of significant people in their lives, the opportunities and experiences they have in and out of school, and the extent to which they have feelings of personal success and capability.

Science Surveys

The national monitoring science surveys sought information from students about their curriculum preferences and their perceptions of their achievement and potential in science. Students were also asked about their involvement in science related activities within school and beyond. There are numerous research questions that could be asked when investigating student attitudes and engagement. In national monitoring it has been necessary to focus on a few key questions that give an overall impression of how students regard science in relation to themselves.

Each survey was administered in a session which included team and independent tasks, with a teacher reading the survey to year 4 students, and available to help with writing. The surveys included 18 questions that could be responded to by ticking or circling a chosen response. Responses to these 18 questions are summarised in the large tables on the next two pages. Two questions required written responses, which are summarised below.

Students were asked to indicate their first three preferences from a list of six class science activities. Two activities ("doing things like experiments" and "going on field trips") were strong first preferences at both year levels, with year 4 regarding both similarly and year 8 strongly favouring experiments. When the top three preferences were considered, it became clear that "being

shown about science" was the third most valued activity for both year 4 and year 8 students. For year 8 students, "being told about science" was clearly fourth, with "reading about science" and "talking about science" well behind, while for year 4 students all three of these were lowly rated.

One open-ended question was asked. Responses to the question, "What do you like doing most in science in your own time" were coded into three categories. Easily the most popular category was "doing experiments" (49% of year 4 students and 60% of year 8 students). Reading/viewing/listening/writing activities related to science drew about 15% support from year 4 students and 12% support from year 8 students, with very similar support levels for the third category: activities involving applied science or technology, such as making a radio, building creations, or cooking.

YEAR 4 SCIENCE SURVEY RESPONSES 2007 [2003] (1999)

1. How much do you like doing science at school?	64 [62] (67)	24 [29] (24)	10 [5] (7)	2 [4] (2)	
	heaps	***quite a lot***	***some***	***little***	
2. How much do you think you learn about science at school?	24 [25] (28)	29 [37] (41)	31 [27] (23)	16 [11] (8)	
	more	***about the same***	***less***		
3. Would you like to do more or less science at school?	71 [56] (58)	24 [34] (34)	5 [10] (8)		
	heaps	***quite a lot***	***sometimes***	***never***	
4. How often does your class do really good things in science?	12 [12] (16)	18 [27] (27)	55 [55] (52)	15 [6] (5)	
5. How often do you do these things in science at school?					
a. Field trips/work outside	23 [13] (19)	19 [21] (20)	46 [58] (52)	12 [8] (9)	
b. Visit science activities	14 [8] (10)	11 [12] (12)	40 [52] (54)	35 [28] (24)	
c. Research/projects	30 [23] (24)	28 [37] (31)	29 [32] (36)	13 [8] (9)	
d. Group work	49 [38] (39)	28 [36] (36)	18 [23] (24)	5 [3] (1)	
e. Experiments with everyday things	19 [14] (17)	19 [19] (16)	40 [48] (51)	22 [19] (16)	
f. Experiments with science equipment	17 [16] (15)	19 [16] (20)	37 [44] (44)	27 [24] (21)	
g. Science competitions	13 [8] (8)	8 [6] (7)	21 [29] (31)	58 [57] (54)	
					don't know
6. How good do you think you are at doing science?	35 [27]	46 [43]	9 [12]	3 [4]	7 [15]
7. How good does your teacher think you are at doing science?	26	32	8	2	32
8. How good does your mum, dad or caregiver think you are at doing science?	52	21	6	2	19
	heaps	***quite a lot***	***sometimes***	***never***	
9. How much do you like doing science things in your own time, when you're not at school?	47 [42] (24)	27 [29] (19)	17 [19] (38)	9 [10] (19)	
10. Do you do some really good things in science in your own time — when you're not at school?	22 [17] (15)	20 [22] (21)	42 [43] (45)	16 [18] (19)	
	yes	***maybe***	***no***		
11. Do you want to keep learning about science when you grow up?	57 [46] (43)	41 [47] (47)	2 [7] (10)		
12. Do you think you would make a good scientist when you grow up?	27 [24] (28)	49 [58] (52)	24 [18] (20)		

Year 4 students were generally very positive about doing science at school. Almost two thirds chose the highest rating for the first question (about liking to do science at school), and 71% would like to do more science at school. Over half wanted to keep learning about science when they grew up, and about a quarter thought they would make good scientists when they grew up. The year 4 students were less confident that they learned a lot of science at school, with 24% saying that they learned "heaps" and only 12% saying that their class did really good things in science "heaps". The proportion of students who felt they had very limited opportunities to learn science has increased over the last eight years: 16% said that they learned "very little" in science at school (compared to 8% in 1999), 15% said they "never" did really good things in science at school (compared to 5% in 1999), and there were increased percentages saying that they "never" did the following things in science at school: experiments with science equipment, experiments with everyday things, research or projects, and visits to science activities. Indeed, the responses to question 5 suggest that much science in school is bookwork, with practical work, field trips, visits and experiments less common. In a question introduced for the first time in the 2007 survey, it is a concern that 32% of year 4 students marked "don't know" in response to the question, "How good does your teacher think that you are at doing science".

YEAR 8 SCIENCE SURVEY RESPONSES 2007 [2003] (1999)

1. How much do you like doing science at school?	24 [32] (37)	39[51] (48)	33[13] (12)	4 [4] (3))	
	heaps	*quite a lot*	*some*	*little*	
2. How much do you think you learn about science at school?	10 [13] (15)	39 [44] (44)	40 [37] (35)	11 [6] (6)	
	more	*about the same*	*less*		
3. Would you like to do more or less science at school?	44 [32] (39)	46 [54] (51)	10 [14] (10)		
	heaps	*quite a lot*	*sometimes*	*never*	
4. How often does your class do really good things in science?	2 [3] (7)	18 [23] (22)	64 [64] (63)	16 [10] (8)	
5. How often do you do these things in science at school?					
a. Field trips/work outside	5 [2] (4)	10 [12] (13)	54 [57] (50)	31 [29] (33)	
b. Visit science activities	2 [2] (3)	8 [9] (9)	52 [55] (53)	38 [34] (35)	
c. Research/projects	16 [18] (21)	46 [43] (40)	33 [35] (36)	5 [4] (3)	
d. Group work	25 [30] (31)	38 [41] (40)	33 [25] (27)	4 [4] (2)	
e. Experiments with everyday things	7 [8] (14)	21 [29] (47)	53 [50] (28)	19 [13] (11)	
f Experiments with science equipment	10 [9] (14)	22 [25] (25)	42 [50] (43)	26 [16] (18)	
g. Science competitions	4 [4] (4)	12 [12] (10)	42 [50] (56)	42 [34] (30)	
					don't know
6. How good do you think you are at doing science?	12 [14]	49 [52]	22 [17]	3 [3]	14 [14]
7. How good does your teacher think you are at doing science?	9	35	15	3	38
8. How good does your mum, dad or caregiver think you are at doing science?	19	34	12	2	33
	heaps	*quite a lot*	*sometimes*	*never*	
9. How much do you like doing science things in your own time, when you're not at school?	15 [14] (15)	28 [30] (31)	34 [40] (39)	23 [16] (15)	
10. Do you do some really good things in science in your own time — when you're not at school?	3 [3] (5)	12 [11] (15)	54 [58] (52)	31 [28] (28)	
	yes	*maybe*	*no*		
11. Do you want to keep learning about science when you grow up?	34 [31] (33)	57 [58] (59)	9 [11] (8)		
12. Do you think you would make a good scientist when you grow up?	5 [9] (9)	41 [48] (46)	54 [43] (45)		

Compared to year 4 students, year 8 students were less inclined to use the most positive categories. This pattern has been common in national monitoring surveys. Older students can be expected to be more discerning and critical, as well as more realistic about their own abilities. However, trends across time paralleled those already mentioned for year 4 students. Almost half of the year 8 students would like more science at school. The percentage of year 8 students particularly enjoying science at school dropped from 37% to 24% over eight years, while the percentage with a negative view increased from 15% to 37%. Sixteen percent (compared to 8% in 1999) indicated that their class "never" did really good things in science. There were similar increases in the percentages indicating that they "never" did experiments with everyday things or with science equipment. Only 5% indicated that they thought they would be a good scientist when they grew up, while 38% said that they "didn't know" how good their teacher thought they were at doing science.

8 Performance of Subgroups

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 in Chapter 1 (p9).

Analyses of the relative performance of subgroups used an overall score for each task, created by adding together scores for appropriate components of the task.

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 450), 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 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 four of the five school variables, statistically significant differences among the subgroups were found for no more than 17% of the tasks at both year 4 and year 8. For the remaining variable, statistically significant differences were found on more than half of the tasks at both levels. In the detailed report which follows, all "differences" mentioned are statistically significant (to save space, the words "statistically significant" are omitted).

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 rural areas or towns containing less than 10,000 people (rural areas).

For year 4 students, there were no differences on any of the 55 tasks or on any questions of the *Year 4 Science Survey* (p62).

For year 8 students, there were differences on three of the 66 tasks (5%). Students from the main centres scored highest on *Hot Stuff* (p39) and *Bubbles* (p47), while students from provincial cities scored lowest on *Material Purposes* (p45). There were also two differences on questions of the *Year 8 Science Survey* (p63): students from main centres were more positive about doing science in their own time, and about continuing to learn about science when they grew up.

School Size

Results were compared from students in large, medium-sized and small schools (exact definitions were given in Chapter 1). For year 4 students, there were differences among the subgroups on four of the 55 tasks (7%). Students from large schools scored highest on *Bush* (p15), *Kiwi and Kea* (p19) and *Link Task 25* (p60), while students from medium-sized schools scored lowest on *Link Task 1* (p29). There were no differences on questions of the *Year 4 Science Survey* (p62).

For year 8 students, there were differences on three of the 66 tasks (5%). Students from medium-sized schools scored highest on *Link Task 7* (p29) and *Material Purposes* (p45), while students from small schools scored lowest on *Hot Stuff* (p39). There were also differences on five questions of the *Year 8 Science Survey* (p63). Students from small schools were most keen to do more science at school, and judged that they least often did "really good things in science" at school, group work in science, experiments with science equipment, or participated in science competitions.

School Type

Results were compared for year 8 students attending full primary and intermediate schools. There were differences between these two subgroups on three of 66 tasks (5%). Students from full primary schools scored higher on *Link Task 8* (p29), *Link Task 9* (p29) and *Rivers* (p51). There were also differences on five questions of the *Year 8 Science Survey* (p63). Students from full primary schools were more enthusiastic to do more science at school, and judged that they learned less about science at school and less often did group work in science, experiments with science equipment, or participated in science competitions.

There are now enough year 8 students attending year 7 to 13 high schools to permit comparisons between them and the students attending intermediate schools. There were differences on six of the 66 science tasks (9%). Students from year 7 to 13 schools scored higher on five tasks: *Bush* (p15), *Kiwi and Kea* (p19), *Material Purposes* (p45), *Jelly Crystals* (p46) and *Rivers* (p51). Students from intermediate schools scored higher on *Link Task 22* (p49). There were also differences on five questions of the *Year 8 Science Survey* (p63). Students from intermediate schools were more positive about doing science at school and about doing more science at school, judged that they more often experienced school field trips and research or projects related to science, and judged that they more often did science things in their own time.

Zone

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

For year 4 students, there were differences among the three subgroups on seven of the 55 tasks (13%). Students from Auckland scored highest on *Cheetahs* (p16) but lowest on *Link Task 20* (p49) and *Compost* (p54). Students from the rest of the North Island scored highest on *Link Task 21* (p49) but lowest on *Bush* (p15) and *Weather Map* (p52). Students from the South Island scored highest on *Rivers* (p51). There was also a difference on one question of the *Year 4 Science Survey* (p62), with students from Auckland judging that they most often did experiments in school with everyday things.

For year 8 students, there were differences among the three subgroups on 11 of the 66 tasks (17%). Students from the South Island scored highest on *Wasps* (p28), *Link Task 4* (p29), *Rivers* (p51), *Rock Detective* (p56), *Way Out There* (p58), *Dunes* (p59) and *Link Task 26* (p60) but lowest on *Link Task 21* (p49). Students from Auckland scored highest on *Magnetic Filings* (p34). Students from the North Island excluding Auckland scored lowest on *Bush* (p15) and *Food Web* (p25). There were also differences on five questions of the *Year 8 Science Survey* (p63). Students from Auckland were most positive about studying science at school, doing science things in their own time, continuing to learn about science when they grew up, and becoming a scientist. They also judged that they more often did good things in science in their own time.

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 in the census mesh blocks. 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 37 of the 55 tasks (67%). Because of the large number of tasks involved, they are not listed here. Students in high decile schools performed better than students in low decile schools on all 37 tasks, with students in medium decile schools generally closer in performance to students from high decile schools. Of the 18 tasks not showing differences, nine were practical tasks and five were team tasks (out of a total of six team tasks). There was also a difference on one question of the *Year 4 Science Survey* (p62), with students from low decile schools judging that they most often did really good things in science in their own time.

For year 8 students, there were differences among the three subgroups on 49 of the 66 tasks (74%). Because of the large number of tasks involved, they are not listed here. Students in high decile schools performed better than students in low decile schools on all 49 tasks, with students in medium decile schools generally closer in performance to their counterparts in high decile schools. Of the 17 tasks not showing differences, 10 were practical tasks and six were team tasks (two thirds of the team tasks). There was also a difference on one question of the *Year 8 Science Survey* (p63), with students from low decile schools indicating that they were most keen to become a scientist.

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 here compare the performances of boys and girls, Paheha 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 0.30, for instance, indicates that students in one subgroup scored, on average, three tenths of a standard deviation higher than students in the other 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 49 tasks was 0.04 (boys averaged 0.04 standard deviations higher than girls). This is a small difference. There were statistically significant differences on five of the 49 tasks (10%). Boys performed better on all five tasks: *Link Task 11* (p40), *Link Task 14* (p40), *Link Task 19* (p49), *Rivers* (p51) and *Link Task 25* (p60). There was also a difference on one questions of the *Year 4 Science Survey* (p62), with girls judging that they more often did research or projects in science at school.

For year 8 students, the mean effect size across the 57 tasks was 0.09 (boys averaged 0.09 standard deviations higher than girls). This is a small difference. There were statistically significant differences on 12 of the 57 tasks (21%). Boys performed better on nine tasks: *Link Task 3* (p29), *Which Direction?* (p38), *Link Task 11* (p40), *Candle in a Jar* (p44), *Link Tasks 19* and *20* (p49), *Rivers* (p51), and *Link Tasks 25* and *28* (p60). Girls performed better on three tasks: *Link Task 15* (p40), *Material Purposes* (p45) and *Compost* (p54). There were no differences on questions of the *Year 8 Science Survey* (p63).

Ethnicity

Results achieved by Māori, Pasifika and Pakeha (all other) students were compared using the 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 49 tasks was 0.30 (Pakeha students averaged 0.30 standard deviations higher than Māori students). This is a moderate difference. There were statistically significant differences on 24 of the 49 tasks (49%), with Pakeha students performing better on all 24 tasks (11 living world, one physical world, four material world, and eight planet Earth and beyond). Twelve of the tasks not showing differences were practical tasks, requiring comparatively little prior knowledge. There was also a difference on one question of the *Year 4 Science Survey* (p62), with Pakeha students judging that they more often did experiments in school with everyday things.

For year 8 students, the mean effect size across the 57 tasks was 0.37. This is a moderate difference. There were statistically significant differences on 36 of the 57 tasks (66%): Pakeha students performed better on all 36 tasks (15 living world, six physical world, six material world, and nine planet Earth and beyond). Ten of the tasks not showing differences were practical tasks, requiring comparatively little prior knowledge. There was also a difference on one question of the *Year 8 Science Survey* (p63), with Māori students judging that they more often had field trips in science at school.

Pakeha-Pasifika Comparisons

Readers should note that only 30 to 55 Pasifika students usually were included

in the analysis for a task. 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 49 tasks was 0.58 (Pakeha students averaged 0.58 standard deviations higher than Pasifika students). This is a large difference. There were statistically significant differences on 42 of the 49 tasks (86%): Pakeha students performed better on all 42 tasks. The tasks not showing a difference were all practical tasks within the physical world or material world strands. There were also differences on three questions of the *Year 4 Science Survey* (p62). Pasifika students were more positive about doing science at school, judged that their class more often did really good things in science, and judged that they more often did group work in science at school.

For year 8 students, the mean effect size across the 57 tasks was 0.59. This is a large difference. There were statistically significant differences on 46 of the 57 tasks (81%): Pakeha students performed better on all 46 tasks (18 living world, nine physical world, seven material world, and 12 planet Earth and beyond). There were also differences on three questions of the *Year 8 Science Survey* (p63). Pasifika students were more positive about becoming a scientist, and judged that in science at school they experienced more field trips, research or projects, and group work.

Home Language

Results achieved by students who reported that English was the predominant language spoken at home were compared, using the effect size procedures, with the results of students who reported predominant use of another language at home (most commonly an Asian or Pasifika language. Because of the relatively small numbers in the "other language" group (30 to 64), p = .05 has been used here as the critical level for statistical significance.

For year 4 students, the mean effect size across the 49 tasks was 0.25 (students for whom English was the predominant language at home averaged 0.25 standard deviations higher than the other students). This is a moderate difference. There were statistically significant differences on 19 of the 49 tasks (39%): students for whom English was the predominant language spoken at home performed better on these 19 tasks (10 living world, five physical world, and four planet Earth and beyond). There were also differences on three questions of the *Year 4 Science Survey* (p62). Students whose predominant language at home was not English judged that their class more often did really good things in science, and that at school they more often did experiments with science equipment or participated in science competitions.

For year 8 students, the mean effect size across the 57 tasks was 0.25. This is a moderate difference. There were statistically significant differences on 19 of the 57 tasks (33%): students for whom English was the predominant language spoken at home performed better on these 19 tasks (10 living world, three material world, and six planet Earth and beyond). There was also a difference on one question of the *Year 8 Science Survey* (p63): students whose predominant language at home was not English indicated that they were more enthusiastic about becoming a scientist.

Summary, with Comparisons to Previous Science Assessments

School type (full primary, intermediate, or year 7 to 13 high school), school size, community size and geographic zone were not important factors predicting achievement on the science tasks. This was also true in the 2003, 1999 and 1995 science assessments.

There were statistically significant differences in the performance of students from low, medium and high decile schools on 67% of the tasks at year 4 level (compared to 65% in 2003, 54% in 1999 and 54% in 1995). At year 8 level there were statistically significant differences on 74% of the tasks (compared to 65% in 2003, 63% in 1999 and 56% in 1995). Over the 12 years from 1995 to 2007 there has been a modest increase in disparities of achievement among students from schools at different decile levels.

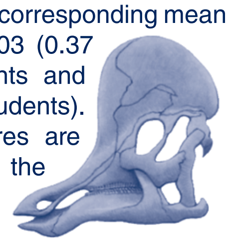
For the comparisons of boys with girls, Pakeha with Māori, Pakeha with Pasifika students, and students for whom the predominant language at home was English with those for whom it was not, effect sizes were used. Effect size is the difference in mean (average) performance of the two groups, divided by 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 0.04 (boys averaged 0.04 standard deviations higher than girls). The advantage for year 4 boys has decreased slightly since 1999, from mean effect sizes of 0.08 in 2003 and 0.15 in 1999. Year 8 boys also averaged slightly higher than girls, with a mean effect size of 0.09 (exactly the same as in 2003, and slightly lower than the mean effect size of 0.14 in 1999).

Pakeha students averaged moderately higher than Māori students, with mean effect sizes of 0.30 for year 4 students and 0.37 for year 8 students. These mean effect sizes are identical at both year levels to the 2003 results, and very slightly higher than the corresponding figures in 1999 (0.27 for year 4 students, 0.34 for year 8 students).

Pakeha students averaged substantially higher than Pasifika students, with mean effect sizes of 0.58 for year 4 students and 0.59 for year 8 students. At both year levels, these show very little change from the corresponding results in 2003 and 1999 (0.57 in 2003 and 0.56 in 1999 for year 4 students, and 0.62 in 2003 and 0.55 in 1999 for year 8 students).

Compared to students for whom the predominant language at home was English, students from homes where other languages predominated performed moderately less well at both year levels (both the year 4 and year 8 mean effect sizes were 0.25). These are lower than the corresponding mean effect sizes in 2003 (0.37 for year 4 students and 0.31 for year 8 students). Comparative figures are not available from the assessments in 1999.



Appendix : The Sample of Schools and Students in 2007

Year 4 and Year 8 Samples

In 2007, 2877 children from 248 schools were in the main samples to participate in national monitoring. Half were in year 4, the other half in year 8. At each level, 120 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 2007, 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 2007.

From these lists, we randomly selected 120 schools with year 4 students and 120 schools with year 8 students. Schools with four students in year 4 or 8 had about a 1% chance of being selected, while some of the largest intermediate (year 7 and 8) schools had more than 90% chance of inclusion.

Pairing Small Schools

At the year 8 level, four of the 120 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. Four pairs of very small schools were included in the sample of 120 schools.

Contacting Schools

In early 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 video on 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 in the middle of July with the principals of the schools selected in the year 4 samples, and they were asked to respond to the invitation by the middle of August.

Response from Schools

Of the 124 schools originally invited to participate at year 8 level, 122 agreed. A middle school asked to be replaced because no space was available, in or near the school, for the assessment activities. It was replaced by a nearby intermediate with similar year 8 enrolment and the same decile rating. An independent year 1 to 13 school withdrew without giving a reason, and was replaced by a year 1-8 primary school with similar year 8 enrolment and socio-economic mix.

Of the 124 schools originally invited to participate at year 4 level, 120 agreed. One school had a severe space shortage and could not accommodate the assessment activities. A second had three productions and a school camp scheduled in term 4 and could not fit in the NEMP assessments.

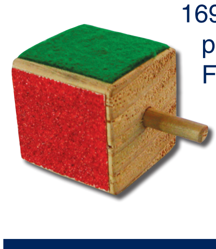
A third stated simply that they were too busy. The final school had an acting principal, was expecting a follow-up visit from the Education Review Office, and was heavily involved in other assessment contracts. These four schools were replaced by nearby schools of similar size and decile ratings.

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 132 comments about particular students. In 70 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. Two were replaced because they were suspended. The remaining 60 comments concerned children with special needs. Each such child was discussed with the school and a decision agreed. 10 students were replaced because they were very recent immigrants or overseas students who had extremely limited English-language skills. Twenty-seven 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 23 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 169 comments about particular students. Fifty-three students originally selected were replaced because they had left the school or were expected to be away throughout the assessment week. Twenty-two students were replaced because of their NESB (*Not from English-Speaking Background*) status and very limited English, two because they were in Māori immersion classes, and five because of a wrong year level. Forty-seven 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 40 children retained in the sample.



Communication with Parents

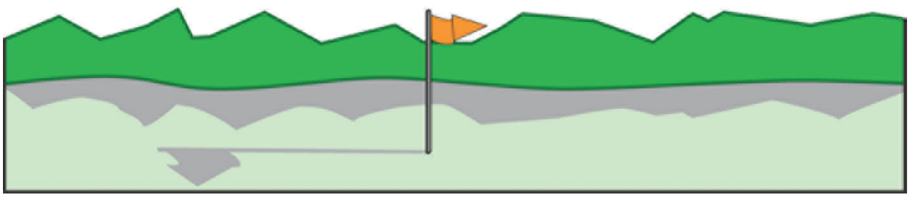
Following these discussions with the school, Project staff prepared letters to all of the parents, including a copy of the NEMP brochure, and asked the schools to address the letters and mail them. Parents were told they could obtain further information from Project staff (using an 0800 number) or their 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. Seven children were replaced because they did not want to participate or their parents did not want them to.

At the year 4 level we also received several phone calls from parents. Some wanted details confirmed or explained (notably about reasons for selection). Six 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. Less than 3% of selected schools in the main samples did not participate, and less than 3% 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 1 – 2% 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. Three student places in the year 4 sample were not filled because insufficient students were available in that school. Three year 8 students and 10 year 4 students left school at short notice and could not be replaced. Three year 8 and two year 4 students withdrew or were withdrawn by their parents too late to be replaced. Thirty-one year 8 students and 16 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 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 almost all 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	4.2	4.2
Auckland	34.1	32.5
Waikato	9.2	10.0
Bay of Plenty/Poverty Bay	8.3	8.3
Hawkes Bay	4.2	4.2
Taranaki	2.5	2.5
Wanganui/Manawatu	5.0	5.8
Wellington/Wairarapa	10.8	10.0
Nelson/Marlborough/West Coast	3.3	4.2
Canterbury	11.7	12.5
Otago	4.2	3.3
Southland	2.5	2.5

DEMOGRAPHY

DEMOGRAPHIC VARIABLES: PERCENTAGES OF STUDENTS IN EACH CATEGORY			
VARIABLE	CATEGORY	% YEAR 4 SAMPLE	% YEAR 8 SAMPLE
Gender	Male	52	52
	Female	48	48
Ethnicity	Pakeha	67	73
	Māori	22	19
	Pasifika	11	8
Main Language at Home	English	87	89
	Other	13	11
Geographic Zone	Greater Auckland	33	31
	Other North Island	45	46
	South Island	22	23
Community Size	< 10,000	19	15
	10,000 – 100,000	22	23
	> 100,000	59	62
School SES Index	Bottom 30%	28	20
	Middle 40%	36	40
	Top 30%	36	40
Size of School	< 25 y4 students	17	
	25 – 60 y4 students	46	
	> 60 y4 students	37	
	<35 y8 students		20
	35 – 150 y8 students		37
	> 150 y8 students		43
Type of School	Full Primary		34
	Intermediate or Middle		44
	Year 7 to 13 High School		17
	Other *(not analysed)*		5

SCIENCE ASSESSMENT RESULTS 2007

Science is an active process, drawing upon and contributing to a growing and changing body of knowledge. It is a universal discipline that involves using knowledge, understandings, skills and imagination to tackle problems and to investigate objects and events of the real world.

A science education encourages students to have enquiring minds and to make sense of the actions and interactions of the biological and physical features of their environment. The aims of a science education include the development of knowledge and understanding, skills of scientific investigation, and attitudes on which such investigation depends.

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
SAPERE AUDE
Te Whare Wānanga o Otāgo

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