National Assessment Program

Science Literacy 2023

Public Report

AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

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Acknowledgement of Country

ACARA acknowledges the Traditional Owners and Custodians of Country and Place throughout Australia and their continuing connection to land, waters, sky and community. We pay our respects to them and their cultures, and Elders past and present.

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List of acronyms

Acronym	Full form
AC	Australian Curriculum
ACARA	Australian Curriculum, Assessment and Reporting Authority
ASGS	Australian Statistical Geography Standard
CCT	Critical and Creative Thinking
ICT	Information and Communication Technology
IRT	item response theory
KPM	key performance measure
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
NAP	National Assessment Program
NAPLAN	National Assessment Program – Literacy and Numeracy
NAP–CC	National Assessment Program – Civics and Citizenship
NAP–ICTL	National Assessment Program – Information and Communication Technology Literacy
NAP–SL	National Assessment Program – Science Literacy
PSAP	Primary Science Assessment Program 2003
SEIFA – IEO	Socio-Economic Indexes for Areas – Index of Education and Occupation
STEM	Science, Technology, Engineering and Mathematics

Terms used in this report

Term	Definition
Assessment platform	The Online National Assessment Platform enables the online delivery of National Assessment Program events including NAP–SL, NAP–CC and NAPLAN.
Confidence interval	An estimate derived from a sample is subject to uncertainty because the sample may not reflect the population precisely. The extent to which this variation exists is expressed as the confidence interval. The 95% confidence interval is the range within which the estimate of the statistic based on repeated sampling would be expected to fall for 95 of 100 samples that might have been drawn. Confidence intervals are provided in each of the data tables in this report.
Correlation coefficient	A statistical measure that indicates the degree to which 2 variables are related. The values range between -1.0 (a perfect negative correlation) and 1.0 (a perfect positive correlation). A coefficient of 0.0 shows no linear relationship between the 2 variables being studied.
Critical and Creative Thinking	In this report, when the initial letters of the term "Critical and Creative Thinking" are capitalised, it refers to the general capability of Critical and Creative Thinking in the F–10 Australian Curriculum. When the term is written without capitals, it refers to the broader thinking skills of reason, logic, innovation and creativity.
Effect size	The difference between group means divided by the standard deviation. Effect size provides a comparison of the difference in average scores between 2 groups with reference to the degree in which the scores vary within the groups. When the effect size is large, it means that the difference between average scores is large relative to the spread of the scores. The difference could therefore be considered "important". Conversely, when the effect size is small, it means that the observed difference is relatively small compared with the spread of the scores and thus arguably less "important".
Exempt	Students with very limited English language proficiency and students with significant intellectual or functional disabilities may be exempted from NAP sample testing.
Geolocation	The Australian Statistical Geography Standard (ASGS) Remoteness Structure is used to classify relative geographic remoteness across Australia. In this report, the 5 classes (major cities, inner regional, outer regional, remote and very remote) are collapsed into 3 classes (major cities, regional and remote) for the purposes of classifying the remoteness of individual schools.
Indigenous status	A student's Indigenous status refers to whether a student identifies as being of First Nations Australian Aboriginal and/or Torres Strait Islander origin. The term "origin" is considered to relate to people's First Nations Australian Aboriginal or Torres Strait Islander descent and for some, but not all, their cultural identity. A student who identifies as a First Nations Australian student is also considered to be of Aboriginal and/or Torres Strait Islander origin.

Term	Definition
Inquiry task	A set of contextualised independent items in the NAP–SL instrument that aims to engage students and assess methods of scientific inquiry. A student is led through a whole scenario content sequence and asked to apply scientific skills to answer predominantly open-ended questions across various response formats.
Jurisdiction	For the purposes of this report, jurisdiction refers to all 3 educational sectors (government, Catholic and independent) that sit within an Australian state or territory. The state/territory level is the most granular level of analysis undertaken for the purposes of NAP sample reporting.
Language other than English spoken at home	A language other than English spoken in the home by a student. If a student speaks more than one language other than English at home, the language other than English the student speaks most often is reported.
Limited assessment language proficiency	The student is unable to read or speak the language of the assessment and would not be expected to overcome the language barrier in the assessment situation. Typically, a student who had received less than one year of instruction in the language of the assessment would be excluded.
NAP–Science Literacy Assessment Framework	The overarching assessment design that describes the content to be assessed, the cognitive engagement that is expected of students, the types of assessment tasks, contextual information and overall structure of the assessment.
NAP–Science Literacy scale	A continuous scale that provides a measure of student achievement in science literacy.
Objective item	Standalone items or items in short units in the NAP–SL instrument designed to assess student knowledge and skill.
Parental education	The highest level of parental school or non-school education that a parent/guardian has completed. This includes the highest level of primary or secondary school completed or the highest post-school qualification attained. For the purposes of this report, where a student has parental education data for 2 parents/guardians, the higher of the 2 values is used.
Parental occupation	The occupation group that includes the main work undertaken by the parent/guardian. If a parent/guardian has more than one job, the occupation group that reflects their main job is reported. For the purposes of this report, where a student has parental occupation data for 2 parents/guardians, the higher of the 2 values is used.
Percentage	A number or ratio that can be expressed as a fraction of 100. In this report, the percentages of students represented in the tables have been rounded and may not always sum to 100.
Percentage point	The unit of measurement used to describe the difference between 2 percentages.

Term	Definition
Proficiency level	A defined range of the NAP–Science Literacy scale that describes the knowledge and competencies that students at that level are capable of successfully demonstrating.
Proficient standard	A point on the scale that represents a "challenging but reasonable" expectation of student achievement at that year level.
Response rate	Response rates are the percentages of sampled students that participated in the assessment. Response rates are calculated as the number of assessed students from whom data were recorded as a percentage of the total number of sampled students in the year level.
Sample	A subset of a population selected so that reliable and unbiased estimates of statistics for the full population can be inferred.
Science Literacy	The ability to use scientific knowledge, understanding and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information.
Sector	The 3 educational sectors of government, Catholic and independent. All schools throughout Australia belong to one of these 3 school sectors. It is important to note that student responses for NAP sample assessments, in their most disaggregated form, are not analysed or reported by sector but are instead examined at the jurisdictional level.
Severe functional disability	A moderate to severe permanent physical disability that severely limits a student's capacity to participate in the test.
Severe intellectual disability	A mental or emotional disability and/or cognitive delay that severely limits a student's capacity to participate in the test.
Significant	In this report, the term significant refers only to differences that are statistically significant. Once a difference has been identified as statistically significant, the size of this difference (ranging from a small to very large effect size) can be considered.
Significant difference	Refers to the likelihood of a difference being a true reflection of the measured outcomes rather than the result of chance.
Speededness	The extent to which a test's time limit alters a test taker's performance. The manifestation of speededness, or speeded behaviour on a test, can be in the form of random guessing, leaving a substantial proportion of test items unanswered, or rushed test-taking behaviour in general.
Standard deviation	A measure of variability or dispersion in student scores from the mean (or average).
Test form	A collection of selected items sequenced, balanced and grouped together to measure a student's knowledge, skills and understanding of a subject area.

Term	Definition
Trend item	An item (test question) used in at least one of the previous NAP–Science Literacy assessment cycles.

Foreword

Our children today face an environment of unprecedented technological change. From solutions for global warming, to the double-edged sword of artificial intelligence, and on to the existential questions posed by quantum mechanics, it is difficult to find an area of 21st century life that has not been touched by some recent scientific advance or breakthrough.

The future holds great potential, but it is a potential that demands, as its price of entry, increasing levels of scientific ability. It is incumbent upon us, therefore, as education professionals, to provide students with the science literacy necessary, not only to participate in the rewards an advancing technological society can bring, but also to help solve its problems, avoid its dangers and contribute to its development.

To this end, the Australian Curriculum, Assessment and Reporting Authority (ACARA), under the auspices of the Education Ministers Meeting (EMM), conducts the National Assessment Program (NAP) sample assessment in science literacy (NAP–SL).

The NAP–SL assessment is part of a rolling 3-year cycle of assessments taken by a representative sample of Australian students. It both provides a snapshot of student science literacy achievement at national and jurisdictional levels, and monitors and reports on trends in the science literacy of Australian students over time. The assessment seeks insights into the effectiveness of science education programs, helps identify areas for improvement, and supports measurement and reporting on progress towards the objectives outlined in the Alice Springs (Mparntwe) Education Declaration.

The first NAP–SL assessment was held in 2003 and reported on Year 6 students only. In 2018, Year 10 students were assessed for the first time. The seventh cycle in the NAP–SL program was delayed by the COVID-19 pandemic and was administered in 2023.

The NAP–SL 2023 report not only analyses science literacy across Australia's states and territories and their various subgroups, including Aboriginal and Torres Strait Islander students, but also explores the relative performance of students of different gender, geolocation and parental education/occupation.

This data provides a wealth of information on the knowledge, understandings and abilities of Year 6 and Year 10 students within a science literacy context. Cognitive competencies in this area were assessed with reference both to students' science knowledge and to their ability to use this knowledge in the process of scientific enquiry.

The 2023 NAP–SL assessment instrument contained a stronger focus on critical and creative thinking (CCT) than previous rounds of the assessment. A positive correlation was found between students who engaged more frequently in CCT activities and those who had higher levels of science literacy.

ACARA acknowledges and thanks the many senior educators, representing all jurisdictions and sectors, who have contributed to the development of this assessment. ACARA also acknowledges the expertise of the Australian Council for Educational Research. Lastly, ACARA thanks the many principals, teachers and students at government, Catholic and independent schools who participated so graciously in the field trial and the main assessment, thereby helping to provide valuable data on science literacy for the program.

I commend this report to ministers, senior education officials, teachers and community members committed to improving educational outcomes for all young Australians, and to those with a specific interest in helping young Australians to participate in a society where science plays an increasingly crucial role.

Derek Scott
Board Chair

Australian Curriculum, Assessment and Reporting Authority

Executive summary

Introduction

This report documents the findings of the seventh National Assessment Program – Science Literacy assessment cycle and includes comparisons, where appropriate, with findings from previous assessment cycles.

In reporting national key performance measures (KPMs) of Australian students' science literacy, the NAP–Science Literacy assessment provides a way to monitor progress towards the Alice Springs (Mparntwe) Education Goals for Young Australians.

To access editions of this report for the previous 6 cycles, visit https://www.nap.edu.au/nap-sample-assessments/results-and-reports

Context

The NAP–Science Literacy assessment is one of 3 national sample assessments developed and managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA) under the auspices of the Education Ministers Meeting. Together with the NAP–Civics and Citizenship (NAP–CC) and the NAP–Information and Communication Technology Literacy (NAP–ICT Literacy), the NAP–Science Literacy assessment supports the measurement of progress towards the goals first set out in the Adelaide Declaration. These goals were upheld in the subsequent Melbourne Declaration (2008) and Alice Springs (Mparntwe) Education Declaration (2019), and they continue to provide the impetus for the NAP sample assessments.

For the NAP–Science Literacy, the first collection of data was from a sample of Year 6 students in 2003[1]. Subsequent cycles of the assessment involving Year 6 students have been conducted on a rolling 3-yearly basis in 2006, 2009, 2012 and 2015. In 2018, the assessment was extended to include Year 10 students so that both primary and secondary school student progress in science literacy could be measured by an assessment aligned with the Australian Curriculum. The inclusion of both Year 6 and Year 10 student data was maintained for the most recent assessment cycle in 2023[2].

NAP–Science Literacy is designed to ensure that student progress and achievement in science literacy are measured in meaningful ways. It contributes to both:

- assessment for learning – enabling teachers to use information about student science literacy to inform their teaching
- assessment of learning – assisting teachers, education leaders, parents/carers, the community, researchers and policymakers to use evidence of student proficiency in science literacy to assess student achievement against recognised goals and standards, and drive improvements in student outcomes.

What is assessed in NAP–Science Literacy?

The NAP–Science Literacy aligns with the Australian Curriculum: Science in defining science literacy as "an ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information" (ACARA n.d.).

[1] In 2003, the assessment was known as the Primary Science Assessment Program (PSAP).
[2] The 5-year gap between 2018 and 2023 was a result of disruptions caused by the COVID-19 pandemic.

As outlined in the NAP–Science Literacy Assessment Framework, the NAP–Science Literacy 2023 assessment content is aligned with the Australian Curriculum: Science strands and sub-strands. The 3 content strands and their associated sub-strands are:

1. Science Understanding
    a. Biological sciences
    b. Earth and space sciences
    c. Physical sciences
    d. Chemical sciences
2. Science as a Human Endeavour
    a. Nature and development of science
    b. Use and influence of science
3. Science Inquiry
    a. Questioning and predicting
    b. Planning and conducting
    c. Processing, modelling and analysing
    d. Evaluating
    e. Communicating.

NAP–Science Literacy content also reflects the key ideas outlined in the Australian Curriculum: Science, which represent important aspects of a scientific view of the world, seeking to bridge knowledge and understanding across the disciplines of science. Where applicable, the items are also aligned with the general capabilities of the Australian Curriculum including the Critical and Creative Thinking (CCT) capability and the cross-curriculum priorities including Sustainability and Aboriginal and Torres Strait Islander Histories and Cultures.

Assessment instrument

The NAP–Science Literacy 2023 assessment instrument was based on the design principles from previous cycles. Covering the Science content strands, each test form comprised a series of test items grouped into content-themed units. Using a rotation design, clusters of units were then grouped together to create test forms with common clusters linking to other test forms.

The online test contained a range of item types including multiple-choice, interactive non-multiple-choice, short/numerical constructed response and extended constructed response items. Each test form comprised an inquiry task and a set of objective test items. The assessment platform imposed a time limit of 60 minutes for Year 6 students and 75 minutes for Year 10 students.

Following the assessment, all students were presented with a questionnaire designed to collect rich attitudinal and behavioural data from participating students. The contextual data collected from the questionnaire also shed light on the factors associated with variations in student achievement.

Assessment administration

The assessment instrument was administered online to representative, random samples of students in Year 6 and Year 10 in Term 2, 2023. Data were provided by 6,069 Year 6 students from 368 schools and 3,433 Year 10 students from 221 schools across Australia.

National overall response rates were acceptable for both Year 6 (88%) and Year 10 (82%).

Detailed descriptions of the methods used to develop and administer the assessment are provided in the NAP–Science Literacy 2023 Technical Report.

NAP–Science Literacy scale

The NAP–Science Literacy scale was established in 2006 and consists of 5 described proficiency levels. The scale was set with a mean score of 400 and a standard deviation of 100 for the national Year 6 sample, and scores for all later assessment cycles are reported on the same metric. In 2018, the scale was extended to include the newly added Year 10 assessment instrument.

The scale comprises 5 proficiency levels that are used to describe the achievement of participating students. Student achievement for Year 6 and Year 10 is reported at the national level and by the following population subgroup categories: gender, Indigenous status, language spoken at home, school geographic location, and parent occupation and education. Further information about the scale, including exemplar assessment items for each proficiency level, is provided in Chapter 3.

NAP–Science Literacy proficient standards

Two proficient standards – one for Year 6 and one for Year 10 – were established on the NAP–Science Literacy scale in 2006 and 2018 respectively. The proficient standards for Year 6 and Year 10 provide reference points of "challenging but reasonable" expectations of student achievement at each year level. The proficient standard for Year 6 is 393 scale score points, which is the boundary between Levels 2 and 3 on the scale. The proficient standard for Year 10 is 497 scale score points, which is the boundary between Levels 3 and 4 on the scale. These national proficient standards have remained unchanged since they were established for Year 6 in 2006, and Year 10 in 2018. The proportion of students achieving or exceeding the proficient standard is the key performance measure for science literacy at each year level.

KPM: Performance against the Year 6 proficient standard

There was no difference in any Australian jurisdiction between the proportion of students who achieved the proficient standard in 2023 in comparison to 2018 and 2015. However, in 3 jurisdictions (Queensland, South Australia and Western Australia), the proportion in 2023 was higher than in at least one cycle of NAP–Science Literacy prior to 2015 (Table ES 1).

Table ES 1: Percentages of Year 6 students attaining the proficient standard nationally and by state and territory since 2006

State/territory	2023	2018	2015	2012	2009	2006
NSW	56 (±5.6)	54 (±5.1)	57 (±3.6)	51 (±4.3)	53 (±5.0)	57 (±4.3)
VIC	55 (±5.5)	56 (±4.8)	54 (±3.8)	51 (±4.7)	55 (±4.6)	58 (±5.0)
QLD	59 (±4.6)	64 (±4.5)	54 (±4.6)	▼ 50 (±3.3)	▼ 49 (±3.8)	▼ 49 (±3.8)
SA	58 (±4.9)	55 (±6.8)	51 (±3.9)	51 (±3.9)	▼ 47 (±5.0)	52 (±4.7)
WA	58 (±5.2)	62 (±5.2)	58 (±3.3)	56 (±4.2)	53 (±4.5)	▼ 47 (±4.7)
TAS	51 (±6.0)	58 (±5.2)	59 (±4.7)	51 (±5.4)	50 (±6.0)	57 (±5.5)
NT	42 (±8.8)	37 (±7.4)	32 (±5.6)	31 (±7.6)	34 (±7.5)	38 (±6.5)
ACT	69 (±8.5)	67 (±6.7)	61 (±5.1)	65 (±5.3)	61 (±4.8)	62 (±5.6)
Aust.	57 (±2.5)	58 (±2.4)	55 (±1.8)	51 (±2.0)	52 (±2.2)	54 (±2.1)

Confidence Intervals (1.96 * SE) are reported in brackets.

▲ if significantly higher than in 2023

▼ if significantly lower than in 2023

Year 6 average score achievement

Similarly to the Year 6 proficient standard results, significant increases in average scale scores were found for Queensland, South Australia and Western Australia between 2023 and early cycles of NAP–Science Literacy.

The Northern Territory showed a significant increase in average scale score for Year 6 students between 2018 and 2023. However, given the change in sample design for remote areas in 2023[3], it is possible that this increase is an artefact of sample design and therefore only apparent in the 2023 cycle.

Table ES 2: NAP–Science Literacy average scale scores nationally and by state and territory for Year 6 since 2006

State/ territory	2023	2018	2015	2012	2009	2006
NSW	405 (±10.1)	397 (±10.5)	411 (±8.6)	395 (±9.9)	396 (±12.1)	411 (±12.5)
VIC	403 (±12.0)	405 (±10.3)	399 (±8.9)	393 (±9.7)	398 (±9.2)	408 (±10.2)
QLD	413 (±11.8)	426 (±8.5)	398 (±10.6)	392 (±6.4)	▼ 385 (±8.9)	▼ 387 (±8.6)
SA	409 (±11.4)	400 (±15.5)	392 (±8.8)	392 (±7.9)	▼ 380 (±10.4)	392 (±10.0)
WA	410 (±10.0)	415 (±14.5)	408 (±7.5)	406 (±9.5)	393 (±9.6)	▼ 381 (±10.0)
TAS	391 (±13.2)	405 (±14.9)	414 (±11.7)	395 (±12.3)	386 (±13.5)	406 (±12.1)
NT	359 (±26.6)	▼ 302 (±39.2)	320 (±25.6)	319 (±31.1)	326 (±28.6)	325 (±33.7)
ACT	432 (±20.7)	427 (±17.6)	414 (±12.1)	429 (±13.2)	415 (±10.6)	418 (±14.3)
Aust.	407 (±5.2)	407 (±5.0)	403 (±4.3)	394 (±4.4)	392 (±5.1)	400 (±5.4)

Confidence Intervals (1.96 * SE) are reported in brackets.

▲ if significantly higher than in 2023

▼ if significantly lower than in 2023

KPM: Performance against the Year 10 proficient standard

For Year 10, jurisdictions have the option to contribute to national results only without reporting at jurisdictional level. None of the 3 states that opted to report at the jurisdictional level showed a significant increase or decrease in the percentage of students achieving the proficient standard compared to 2018 (Table ES 3).

[3] The sample design for very remote areas changed between 2018 and 2023, aligning the sample design with other national and international assessments. As a result, no comparisons can be made between 2018 and 2023 for remote areas.

Table ES 3: Percentages of Year 10 students attaining the proficient standard nationally and by state and territory since 2018

State/territory	2023	2018
NSW	52 (±4.9)	49 (±4.8)
VIC	53 (±5.0)	47 (±5.5)
QLD	-	-
SA	-	-
WA	57 (±6.6)	58 (±7.3)
TAS	-	-
NT	-	-
ACT	-	-
Aust.	54 (±2.9)	50 (±2.8)

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Year 10 average score achievement

None of the 3 states that opted to report at the jurisdictional level showed a significant difference in scale scores for Year 10 students between 2018 and 2023 (Table ES 4).

Table ES 4: NAP–Science Literacy average scale scores nationally and by state and territory for Year 10 since 2018

State/territory	2023	2018
NSW	497 (±13.3)	486 (±11.8)
VIC	500 (±10.6)	487 (±15.3)
QLD	-	-
SA	-	-
WA	509 (±17.2)	515 (±18.7)
TAS	-	-
NT	-	-
ACT	-	-
Aust.	503 (±6.9)	490 (±7.3)

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Achievement by background characteristics

Student achievement is reported at a national level by subgroup for each of the following background characteristics: gender, Indigenous status, language spoken at home, geographic location, and parental occupation and education. Selected student background characteristics, such as Indigenous status, geographic location, and parental occupation and education, were strongly correlated with achievement and may be important when interpreting jurisdictional differences.

A summary of these results is provided below, with more detailed information provided in Chapter 4.

Differences in science literacy achievement by gender

Differences in science literacy between male and female students were not statistically significant in 2023 nor in any previous cycles, either in percentage attaining the proficient standard or in average scale score. Neither gender group showed changes in achievement over time.

Differences in science literacy achievement by Indigenous status

In 2023, one out of 3 Indigenous Year 6 students and one out of 4 Indigenous Year 10 students attained the proficient standard. The achievement gap for Year 6 in average score between Indigenous and non-Indigenous students was significant and large in 2023 and has not changed since 2018. The gap appeared to be larger for Year 10 than for Year 6.

There was no significant change in the percentage of Indigenous students achieving the proficient standard since 2015 for Year 6 and since 2018 for Year 10. However, the 2023 achievement of Indigenous Year 6 students was significantly higher than in 2012 and in 2009, in terms of both the percentage achieving the proficient standard and the average scale scores. There has been no significant change in achievement for non-Indigenous students across all cycles, reflected by both the percentage of students achieving the proficient standard, and the average scale scores.

Differences in science literacy achievement by language spoken at home

More Year 6 students speaking a language other than English at home achieved the proficient standard in 2023 (58%) than in 2012 (48%) and their average achievement was higher in 2023 (412 score points) than in 2009 (384 score points). While differences with the other previous cycles were not statistically significant, there appears to be a positive long-term trend for this group in science literacy. In 2018, students speaking English at home outperformed students speaking other languages at home by 13 score points. This was no longer the case in 2023.

Year 10 students speaking a language other than English at home also showed an increase in average achievement compared to 2018 (512 and 486 score points, respectively).

Differences in science literacy achievement by geographic location

In 2023, almost 60% of Year 6 and Year 10 students in major cities achieved the proficient standard. In regional areas, the percentage was still above 50% in Year 6, but dropped to 42% in regional areas in Year 10 and in remote areas for Year 6.

Students from major cities had significantly higher achievement than students in regional areas. The difference was small in Year 6 and moderate in Year 10. There were no significant changes in achievement of students in major cities or regional areas since 2018. No comparisons can be made between 2023 and 2018 for remote areas due to a change in sample design, aligning NAP–Science Literacy with other national and international assessments.

Differences in science literacy achievement by parental occupation and education

In both Year 6 and Year 10, about 70% of students with at least one parent in the highest occupational group (senior managers and professionals) achieved the proficient standard. This percentage dropped to 41% for Year 6 and 34% for Year 10 with parents in the lowest occupation group.

Regarding parental education, about 70% of students with at least one parent with a bachelor's degree attained the NAP–Science Literacy proficient standard compared to less than 50% of students whose parent's highest education was high school.

Results of the student questionnaire

Chapters 5, 6 and 7 outline the results of the student questionnaire. The key findings from these chapters are summarised below. The wording of each question in the questionnaire instrument is provided in Appendix D.

Science as a Human Endeavour

- Students in Year 10 who agreed with statements about the nature of science (for example, "Science is about doing experiments") tended to perform better on the NAP–Science Literacy assessment.
- The majority of students had positive attitudes towards science, expressed interest in continuing to engage with science, and stressed the importance of science for society.
- Students who believed that science has a strong influence on society (for example, that science "helps to understand global issues that impact the environment") tended to have higher levels of science literacy.
- Students at both year levels were consistent in their attitudes towards what the scientific process entails (for instance, that science is about "making observations about the world").
- Students in Year 10 and students who had higher levels of science literacy tended to have stronger agreement in their attitudes towards what the scientific process entails.
- Students at both year levels were quite positive about the equality that exists for people of different cultures, people of different gender groups and people of different ages in their involvement with science.
- There were no gender differences in how students perceived equality in science, but Year 6 students perceived greater equality than Year 10 students. In addition, just over half of Year 10 students believed female scientists get as much recognition as male scientists.
- Year 10 students tended to be at least somewhat confident in their own ability to apply critical and creative thinking (for example, "making predictions based on prior evidence"). Those that were more confident tended to have higher achievement scores.

Teaching and learning in science

- At a national level, more than two-thirds of Year 6 students reported undertaking science lessons once a week or more, with a similar proportion reporting that their own classroom teacher teaches them science. Five per cent of students reported that they never undertook science lessons at school.
- For Year 6 students, there appears to be some variation in reported science lesson frequency among the states and territories.
- There was no significant difference found between male and female students at either year level with respect to the breadth of science topics they reported studying at school.

- For Year 10 students, those with higher science literacy achievement reported having studied a greater breadth of science topics than those with lower achievement. This was true for both male and female students. For Year 6 students, no discernible association between achievement and breadth of science topics studied was found.
- In terms of the perceived clarity of scientific instruction, 82% of Year 6 students and 77% of Year 10 students reported that their teacher explains scientific concepts clearly to their class.
- Less than half of students at either year level reported having "in-depth discussions about science ideas" in their science lessons, with more than 10% of students reporting that they never did this.
- In Year 6, female students reported undertaking activities conducive to CCT in their science lessons more frequently than their male counterparts. In Year 10, there was no discernible difference between the female and male students reported for this index.
- Year 6 students reported undertaking activities conducive to CCT more frequently than students in Year 10.
- Male students in Year 6 reported higher levels of agreement with statements about their family's support for CCT behaviours than their Year 10 counterparts. This difference between year levels was not apparent for female students.
- Family support for CCT was positively associated with student achievement in science literacy. This was true in both Year 6 and Year 10 and for both male and female students.

Student engagement with science

- Year 10 students who more frequently participated in science-related activities outside of school (for example, "Talk about science with my family") tended to perform better on the NAP–Science Literacy assessment.
- A large proportion of both Year 6 and Year 10 students tended to frequently or often participate in some science-related activities at home including, "Talk about science with family", "Watch television or stream content related to science" and "'Like' someone else's content on science-related topics on the internet or social media".
- Students reported frequently or often participating in some science-related activities at school, including "Watch television or stream content about science" and "Read physical and digital books, newspapers or articles about science".
- Year 10 students who more frequently participated in science-related activities at school tended to have higher levels of science literacy.
- Students in Year 6 were more likely to participate in science-related activities outside of school than Year 10 students. Conversely, students in Year 10 were more likely to participate in science-related activities at school than their Year 6 counterparts.
- Outside of school, most students participated in CCT activities (for example, "Come up with my own activities to entertain myself") at least sometimes.
- Year 10 students who more frequently participated in CCT activities tended to have higher levels of science literacy.

Chapter 1: Introduction

Chapter 1: Introduction

The National Assessment Program (NAP) was established to measure student achievement and to monitor progress towards the education goals first outlined in the 1999 Adelaide Declaration on National Goals for Schooling in the 21st Century. As part of the NAP, ministers for education in Australia agreed that nationally comparable data across jurisdictions would be collected in the domains of literacy, numeracy, science literacy, information and communication technology (ICT) literacy, and civics and citizenship.

The NAP–Science Literacy assessment is one of 3 national sample assessments developed and managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA) under the auspices of the Education Ministers Meeting. Together with the NAP–Civics and Citizenship (NAP–CC) and the NAP–Information and Communication Technology Literacy (NAP–ICT Literacy), the NAP–Science Literacy assessment supports the measurement of progress towards the goals first set out in the Adelaide Declaration. These goals were upheld in the subsequent Melbourne Declaration (2008) and Alice Springs (Mparntwe) Education Declaration (2019), and they continue to provide the impetus for the NAP sample assessments.

For the NAP–Science Literacy, the first collection of data was from a sample of Year 6 students in 2003[4]. Subsequent cycles of the assessment involving Year 6 students have been conducted on a rolling 3-yearly basis in 2006, 2009, 2012 and 2015. In 2018, the assessment was extended to include Year 10 students so that both primary and secondary school student progress in science literacy could be measured by an assessment closely aligned with the Australian Curriculum. The inclusion of both Year 6 and Year 10 student data was maintained for the most recent assessment cycle in 2023. The 5-year gap between 2018 and 2023 was a result of disruptions caused by the COVID-19 pandemic.

The NAP–Science Literacy 2023 assessment is the second NAP sample assessment to occur since the 2-year pandemic hiatus, following the NAP–ICT Literacy assessment in 2022. It is also the first of the NAP sample assessments to shift to the earlier main study testing window of May, a calendar year shift of 5 months from the previous cycle of the assessment in 2018, which took place in October. For this reason, changes in achievement between 2023 and previous cycles of the assessment need to be interpreted with some caution.

Science literacy as an educational goal for young Australians

The NAP–Science Literacy contributes to the measurement of commitments in the Alice Springs (Mparntwe) Education Declaration by measuring the science literacy of Australian students in both Years 6 and 10.

The Declaration has 2 distinct but interconnected goals. These are:

1. The Australian education system promotes excellence and equity
2. All young Australians become:
    - confident and creative individuals
    - successful lifelong learners
    - active and informed members of the community.

[4] In 2003, the assessment was known as the Primary Science Assessment Program (PSAP).

As part of its preamble, the Declaration asserts that our education system:

> ... must also prepare young people to thrive in a time of rapid social and technological change, and complex environmental, social and economic challenges. Education plays a vital role in promoting the intellectual, physical, social, emotional, moral, spiritual and aesthetic development and wellbeing of young Australians, and in ensuring the nation's ongoing economic prosperity and social cohesion. They need to deal with information abundance and navigate questions of trust and authenticity. They need flexibility, resilience, creativity, and the ability and drive to keep on learning throughout their lives.

(Education Council 2019:2)

The Declaration goes on to elaborate that all young Australians should "become confident and creative individuals, successful lifelong learners, and active and informed members of the community" (2019:7). Furthermore, it states that successful lifelong learners:

- are able to think deeply and logically, and obtain and evaluate evidence as the result of studying fundamental disciplines
- are creative, innovative and resourceful, and are able to solve problems in ways that draw upon a range of learning areas and disciplines and deep content knowledge
- are inquisitive and experimental, and have the ability to test different sources and types of knowledge

(Education Council 2019:5)

In the "A Commitment to Action" section, the Declaration highlights the need to promote and deliver a world-class curriculum and assessment. It states that the Science, Technology, Engineering and Mathematics (STEM) learning area is a key national focus for school education in Australia and that it is critical to equipping students with the skills needed to engage productively in the world due to rapid changes in technology.

These aspects of the Declaration point to the importance of science literacy among young Australians so that they may be engaged, informed and confident participants in society. Furthermore, the goals outlined in the Declaration establish the context and rationale for the measurement and reporting of student progress in this area over time.

The NAP–Science Literacy Assessment Framework

The development of the NAP–Science Literacy 2023 assessment and questionnaire was informed by the NAP–Science Literacy 2023 Assessment Framework.

The inaugural NAP–Science Literacy assessment administered in 2003 to Year 6 students was based on an assessment framework that predated the Australian Curriculum. Following the development and implementation of the national curriculum, some NAP–Science Literacy items were mapped to the Australian Curriculum for the 2015 cycle. In 2017, further work was undertaken to develop a framework with specifications for both the Year 6 assessment and the introduction of a Year 10 assessment from 2018, to move to an online assessment platform and to incorporate innovative science assessment strategies. The redeveloped framework guided the structure of the 2018 assessments.

The updated framework for NAP–Science Literacy 2023 maintains the 2018 assessment framework but contains refined specifications for both the Year 6 and the Year 10 science literacy assessments. The 2023 framework draws on the 2019 national Alice Springs (Mparntwe) Education Declaration on education goals for all Australians to reflect recent refinements to the Foundation – Year 10 Australian Curriculum. It provides the basis for an effective measure of students' science literacy over time.

The NAP–Science Literacy 2023 Assessment Framework provides historical information about the origin and development of the NAP–Science Literacy assessment. It describes the content to be assessed, the cognitive engagement that is expected of students, the types of assessment tasks, the contextual information collected and the overall structure of the assessment.

Defining science literacy

NAP–Science Literacy measures science literacy as defined in the Australian Curriculum: Science as: "An ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information" (ACARA n.d.).

NAP–Science Literacy content dimension

The NAP–Science Literacy Assessment Framework organises the content domains and sub-domains according to the strands and sub-strands of the Australian Curriculum: Science, respectively. The content strands and sub-strands are:

1. **Science Understanding**, which refers to the selection and integration of appropriate science knowledge to explain and predict phenomena, and to the application of that knowledge to new situations. Science knowledge refers to facts, concepts, principles, laws, theories and models that have been established over time.
    a. **Biological sciences**, which is concerned with understanding living things including animals, plants and microorganisms, and their interdependence and interactions within ecosystems.
    b. **Earth and space sciences**, which is concerned with Earth's dynamic structure and its place in the cosmos.
    c. **Physical sciences**, which is concerned with understanding the nature of forces and motion, and matter and energy.
    d. **Chemical sciences**, which is concerned with understanding the composition and behaviour of substances.
2. **Science as a Human Endeavour**, which refers to the nature of science, including the role of science inquiry in developing science knowledge, and the factors that affect the use and advancement of science.
    a. **Nature and development of science**, which refers to the unique nature of science and scientific knowledge, including that scientific knowledge is based on empirical evidence and can be modified in light of new or reinterpreted evidence.
    b. **Use and influence of science**, which explores how science knowledge and applications affect individuals and communities, including informing their decisions and identifying responses to contemporary issues.
3. **Science Inquiry**, which is concerned with the diverse ways that scientists study the natural world and propose explanations based on evidence (National Research Council 2000).
    a. **Questioning and predicting**, which refers to identifying and constructing investigable questions, proposing hypotheses and predicting possible outcomes.
    b. **Planning and conducting,** which refers to making decisions about how to investigate or solve a problem, and carrying out an investigation.

c. **Processing, modelling and analysing**, which refers to analysing and representing data in meaningful ways and identifying trends, patterns and relationships in data.

d. **Evaluating,** which refers to considering the quality of available evidence and the merit or significance of a claim, proposition, explanation or argument with reference to that evidence.

e. **Communicating,** which refers to conveying information or ideas to others in ways appropriate to the purpose and audience.

NAP–Science Literacy cognitive dimension

The NAP–Science Literacy Assessment Framework cognitive dimension describes the science-focused thinking skills students are expected to use as they respond to assessment tasks, and represents the cognitive processes required in the application of science concepts. The cognitive areas are:

1. **Knowing and using procedures**, which refers to knowledge of facts and definitions, the ability to illustrate scientific concepts by providing or identifying examples, knowing and being able to perform simple science processes or procedures.

2. **Reasoning, analysing and evaluating**, which refers to the ability of students to engage in applying knowledge, skills and processes, as well as the analysis and evaluation of information, evidence and arguments with respect to quality, relevance and sufficiency of data.

3. **Synthesising and creating**, which refers to the consideration of a number of different factors, variables or concepts to compile elements in new or different ways to form a coherent hypothesis, argument or explanation.

Critical and Creative Thinking

The general capability of Critical and Creative Thinking (CCT) is integrated into NAP–Science Literacy through the cognitive dimension of the NAP–Science Literacy Assessment Framework. Aspects of CCT arise from important cognitive skills inherent in scientific inquiry and in broader scientific thinking. The elements and sub-elements of the CCT learning continuum from the Australian Curriculum have guided the development of assessment tasks and reflect the thinking skills and intellectual processes students are expected to use as they respond to the assessment tasks.

Within the context of NAP–Science Literacy, CCT represents important ways of thinking that help students inquire into the world around them. Within the cognitive dimension of the NAP–Science Literacy Assessment Framework, critical thinking involves students analysing and assessing possibilities, constructing and evaluating arguments, and using information, evidence and logic to draw reasoned conclusions and to solve problems. Thinking creatively involves students generating new ideas, considering alternative explanations and possibilities, and transferring knowledge and skills to new and unfamiliar contexts.

NAP–Science Literacy and the Australian Curriculum

The construct of science literacy is further informed by the rationale of the Australian Curriculum: Science (ACARA 2023a) that aims for students to develop:

- an interest in science as a way of expanding their curiosity and willingness to explore, ask questions about and speculate on the changing world they live in
- a solid foundation of knowledge of the biological, Earth and space, physical and chemical sciences, including being able to select and integrate scientific knowledge and practices to explain and predict phenomena and to apply understanding to new situations and events

- an understanding of scientific inquiry and the ability to use a range of scientific inquiry practices, including questioning; planning and conducting experiments and investigations based on ethical and interculturally aware principles; generating and analysing data; evaluating results; and drawing critical, evidence-based conclusions
- an ability to communicate scientific understanding and findings to a range of audiences, to justify claims with evidence, and to evaluate and debate scientific explanations and arguments
- an ability to solve problems and make informed decisions about current and future uses of science while taking into account ethical, environmental, social and economic implications of decisions
- an understanding of the dynamic nature of science knowledge including historical and global contributions, and an understanding of the relationship between science and society including the diversity of science careers.

The NAP–Science Literacy items included in the 2023 assessment cycle are aligned with the Australian Curriculum strands and sub-strands, as described above. Where applicable, items are also aligned with the general capabilities of the Australian Curriculum including the CCT capability and the cross-curriculum priorities including Sustainability and Aboriginal and Torres Strait Islander Histories and Cultures. The items also reflect the key ideas of the Australian Curriculum: Science, which represent key aspects of a scientific view of the world and bridge knowledge and understanding across the disciplines of science.

Structure of this report

This report provides educators and policymakers with the main findings of the 2023 NAP–Science Literacy assessment.

Chapter 1 is an introductory chapter that provides an overview of the National Assessment Program and the sample assessments that sit within it. It provides some contextual information about the NAP–Science Literacy assessment, the assessment framework that underpins it, and its alignment with the Australian Curriculum.

Chapter 2 provides a high-level overview of the stages of NAP–Science Literacy assessment development and implementation. With regard to the assessment and questionnaire instruments, it outlines the instrument design, structure, response formats and item types. It also describes the NAP–Science Literacy 2023 assessment administration procedures and sampling processes.

Chapter 3 describes the science literacy scale and provides example items to illustrate what science literacy looks like at each of the NAP–Science Literacy proficiency levels.

Chapter 4 presents findings on Australian student achievement in the NAP–Science Literacy 2023 assessment. It reports the achievement data for Year 6 and Year 10 students at a national level and, where possible, disaggregated to a state and territory level. Student achievement is reported through the comparison of scale scores, the percentages of students in each proficiency level, and the percentages of those reaching the proficient standard. Additionally, student achievement is reported by sub-population. The groups reported include male and female students, Indigenous and non-Indigenous students, and students from various geographic locations, parental occupation and education, and student language backgrounds. This chapter also provides comparisons of the achievement of Australian students over time: since 2006 for Year 6 students, and since 2018 for Year 10 students.

Chapters 5, 6 and 7 present the results of the student questionnaire. In these chapters, students' opinions and ideas about science and the role of science in their lives and society are examined. The relationship between students' responses to the questionnaire and their achievement of the NAP–Science Literacy proficient standard is also explored.

NAP–Science Literacy 2023 Technical Report

The 2023 NAP–Science Literacy Technical Report provides more detailed information about instrument design, data collection and the psychometric analysis that underpin the findings presented in this public report, which can be found here.

Notes on reading the tables and figures in this report

Omissions

Reporting of Year 10 data at the state and territory level is not possible for Queensland, South Australia, Tasmania, the Northern Territory or the Australian Capital Territory in 2023. This is because these jurisdictions chose a Year 10 sample design and size to enable the reporting of national estimates, but of insufficient size to enable reporting at the jurisdictional level. Sample sizes for New South Wales, Victoria and Western Australia enabled the reporting of Year 10 outcomes for these jurisdictions. Data from all Australian states and territories contribute to the national figures presented in this report.

As per previous cycles, results from the 2003 NAP–Science Literacy assessment (known as PSAP in 2003) have not been included in this report. This is due to a change in the structure of the assessment and the methodology for school and student sampling in 2006.

Rounding

In this report, percentages and scale scores are presented to the nearest whole number. Sums and differences of percentages and scale scores are calculated using their unrounded values. Slight differences between sums and differences calculated using the unrounded values and those shown in the tables are due to rounding. For example, the percentages reported in tables may not always add up to 100% and reported differences between average scores may not exactly match differences calculated using the rounded values shown in the tables.

Calculating the precision of estimates

For any sample assessment, there is a level of uncertainty regarding the extent to which an estimate measured from the sample of students is the same as the true value for the population (that is, all students). An estimate derived from a sample is subject to uncertainty because data from the sample may not reflect the population precisely.

Throughout this report, data are reported with confidence intervals that denote the range in which one can have 95% confidence the true value of the reported figure is located. The magnitude of the confidence intervals varies depending on the exact ways in which the data have been collected. For example, in this report, larger confidence intervals are consistently seen around estimates based on smaller numbers of students (such as from the smaller states and territories). Further information about how the confidence intervals are calculated can be found in the NAP–Science Literacy 2023 Technical Report.

Reporting the size of differences between groups and measures of association

In large samples, it is possible that relatively small differences are statistically significant, even if the differences themselves have little educational importance. In this report, the term “significant” refers only to differences that are statistically significant. If a difference is significant, the size of the difference (the effect size) can be considered. Effect size is useful when considering the differences between measured scores (such as NAP–Science Literacy scale scores and questionnaire scale scores) across groups.

Effect size provides a comparison of the difference in average scores between 2 groups with reference to the degree to which the scores vary within the groups. When the effect size is large, it means that the difference between average scores is large relative to the spread of the scores. The difference could therefore be considered “important”. Conversely, when the effect size is small, it means that the observed difference is relatively small compared with the spread of the scores and thus arguably less “important”. The effect size is the difference between group means divided by the standard deviation.

The NAP–Science Literacy achievement scale was established in 2006 with a Year 6 mean of 400 and a standard deviation of 100. We use fractions of 100 for approximate estimates of the effect sizes.

Following the precedent of other NAP sample assessments and considering the spread of significant mean differences in NAP–Science Literacy, this report has adopted the following categories as descriptors for the size of significant differences:

- effect sizes of 1 or greater are very large
- effect sizes between 0.5 and less than 1 are large
- effect sizes between 0.3 and less than 0.5 are moderate
- effect sizes above 0.1 and less than 0.3 are small.

Descriptors relating scale score differences to standard deviations are used in the report when regarded as informative.

A moderate effect on the NAP–Science Literacy scale corresponds to approximately 30 scale points, which is equivalent to the average learning growth of about one year between Year 6 and Year 10.

For the questionnaire scales, the national mean for Year 6 students was set to 50 scale points with a standard deviation of 10. This means that a moderate effect is represented by approximately 3 scale points.

In chapters 5, 6 and 7 of this report, the Pearson’s correlation coefficient (r) is reported as a measure of the association between scale scores for student responses to selected questions on the student questionnaire and student achievement. Where the Pearson’s correlation coefficient (r) is statistically significant, the strength of the association is described as:

- strong if the magnitude of the coefficient (r) is 0.5 or greater
- moderate if the magnitude of the coefficient (r) is greater than 0.3 and less than 0.5
- weak if the magnitude of the coefficient (r) is between 0.1 and 0.3
- negligible if the magnitude of the coefficient (r) is less than 0.1.

Chapter 2: Assessing science literacy

Chapter 2: Assessing science literacy

Chapter highlights

- In May 2023, 589 schools from across Australia participated in the NAP–Science Literacy main study. At the Year 6 level, 6,069 students from 368 schools participated. For Year 10, 3,433 students from 221 schools took part.
- National overall response rates were acceptable for both Year 6 (88%) and Year 10 (82%). These response rates are in line with international standards for large-scale sample assessments.
- For the main study, a total of 271 new items (90 Year 6 items, 104 Year 10 items and 77 Year 6/10 link items), complemented by 90 trend items, were administered across 36 test forms. The format of the items used in the main study included multiple-choice, interactive non-multiple-choice, short response and constructed response.
- NAP–Science Literacy assessment content was aligned with the Australian Curriculum: Science across the domains of Science Understanding, Science as a Human Endeavour and Science Inquiry.
- Each test form comprised a series of test items grouped into content-themed units, which were rotated in clusters to counteract any “position effect” within a test form. Each test form comprised an inquiry task and a set of objective test items.
- For participating students, the assessment platform enforced a time limit of 60 minutes for Year 6 and 75 minutes for Year 10. An untimed questionnaire designed to be completed by most students within 20 minutes was presented to all Year 6 and Year 10 students immediately following the assessment.
- The student questionnaire collected rich attitudinal and behavioural data from participating students. Questionnaire responses were scaled to provide various construct indicators relating to students’ perceptions of, and level of engagement with, science. These contextual scales were analysed to better understand the factors associated with variations in student science literacy achievement.
- School and student sampling procedures followed established NAP sample assessment processes, which are designed to minimise any potential bias and to maximise the precision of estimates.

Assessment instrument

The NAP–Science Literacy 2023 assessment instrument was based on the design principles established in 2006, which continued through the assessment cycles in 2009, 2012, 2015 and 2018. Each test form comprised a series of test items grouped into content-themed units. The assessment platform enforced a time limit of 60 minutes for Year 6 students and 75 minutes for Year 10 students. An overview of the content domains, test structure, cluster rotation design and item types used in the 2023 cycle is presented in the following sections.

Content domains

The NAP–Science Literacy assessment instrument aligns with both the organisation and content of the Australian Curriculum: Science. The instrument addresses a range of proficiency levels required for the effective measurement of scientific literacy across the curriculum and comprises the following 3 content domains and target percentages:

a. Science Understanding (45%)

b. Science as a Human Endeavour (15%)

c. Science Inquiry (40%).

To maintain continuity with previous cycles of NAP–Science Literacy, the content domains and target percentages used in 2023 are broadly consistent with those from previous cycles.

Inquiry tasks and objective items

The assessment items were written and presented in contextual units. Students were each allocated one inquiry task comprising between 11 and 15 items, which was structured as a scientific investigation. Each inquiry task provided a context, included components of the scientific method for a simulated investigation linked to the context, and then required the students to apply the results to the original context.

In addition to one inquiry task, students were also allocated numerous objective items. Objective items were grouped into short units comprising between one and 5 items that were developed around a single theme or stimulus.

Cluster rotation design

The NAP–Science Literacy instrument uses a cluster rotation design where each test form is linked through common clusters to other forms. To achieve the rotation design for NAP–Science Literacy, the items are written in contextual units, where items in that unit assess different aspects of science literacy within that context. Clusters are then constructed by grouping units together, and clusters are then grouped together to create test forms.

An advantage of this test design is that the order of the clusters within the test forms changes: sometimes appearing at the beginning, sometimes in the middle and sometimes at the end of a test form. Changing the position of the clusters in this way helps to control for any position effect that may influence a student's response. For example, if an item or cluster always appears at the end of a test form, many students might not reach it or may experience fatigue or speededness[5], affecting the difficulty estimates of the items in the unit.

For the NAP–Science Literacy assessment, this implemented design also resulted in the inquiry tasks being rotated across 3 positions, ensuring no position effect or bias for items in these larger tasks.

Response formats and item types

To more fully explore the NAP–Science Literacy construct and capture a range of cognitive complexity, different types of assessment items and response formats were incorporated into the assessment instrument. Within the limitations of the assessment platform, 2 main types of response formats were used for NAP–Science Literacy. These were:

1. Selected response format, where students respond to questions by selecting the answer(s) from a given set of alternatives
2. Constructed response format, where students respond to questions by generating their own responses.

Table 2.1 outlines each of these response formats and lists the item types associated with them, as well as a description of how these item types were used in the NAP–Science Literacy assessment instrument.

[5] The extent to which a test's time limit alters a test taker's performance is known as speededness. The manifestation of speededness, or speeded behaviour on a test, can be in the form of random guessing, leaving a substantial proportion of test items unanswered, or rushed test-taking behaviour in general.

Table 2.1: NAP–Science Literacy response formats and item types

Format	Item type	Item use in NAP–Science Literacy
Selected response format	Multiple-choice	• Students must select one of 4 options. • Options can be in word, graphical or pictorial format.
	Multiple-choices	• Students must select multiple options from a total of 5 or more options (e.g. “select all that apply”).
	Two-tier multiple-choice	• Students must select an option for a prediction, explanation, etc. and then select from a different set of options to justify reasoning.
	Interactive match (drag and drop)	• Students must select, drag and drop words, graphical or pictorial elements for classification purposes or to place items in order.
	Interactive match (draw lines)	• Students must connect 2 columns of options by drawing a line from an option in one column to an option in the second column. • Options can be images, numbers, words or descriptions.
	Interactive match (checkbox)	• Students must select a checkbox from columns within a table. • Multiple responses may be required to what is often a dichotomous “yes/no”-type question.
	Interactive gap match	• Students must select from multiple words to insert at various points in a sentence or passage.
	Hotspot	• Students must select one or more predefined areas on a diagram, graph or other image.
	Composite (inline choice)	• Students must select an answer from a drop-down menu. • Drop-down options are usually numbers, single words or short sentence fragments of 2 to 3 words. • An item may contain several inline choices where multiple responses are required.
	Composite (multiple interactions)	• Students must make 2 or more interactions from the item types listed above, where there are related concepts that constitute parts of a whole.

Format	Item type	Item use in NAP–Science Literacy
Constructed response formats	Short constructed	• Students must use one or 2 words, a phrase or numerical response.
	Single numerical	• Students must enter a single numerical answer in a text box, including setting values for input variables in simulations.
	Extended constructed	• Students must write between one sentence and several paragraphs of text. • This is particularly useful for probing students' deeper understanding and assessing higher proficiency levels.

Questionnaire

The student questionnaire complements the cognitive component of the NAP–Science Literacy assessment and collects rich, contextual information about participating students. The inclusion of this contextual aspect not only allows us to "examine the rich attitudinal and behavioural data of participating students, but also permits a better understanding of the factors associated with variations in student achievement" (ACARA 2023:24).

First introduced as the "student survey" in 2009, the NAP–Science Literacy student questionnaire has been updated and enhanced for 2023 to better align with the Australian Curriculum: Science and its definition of science literacy:

> An ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information.
>
> (ACARA n.d.)

Broadly speaking, the questionnaire covers 3 distinct areas:

1. Science as a Human Endeavour
2. Teaching and learning in science
3. Student engagement with science.

To retain relevance and provide data on contemporary issues, the questionnaire was updated in 2023 to include content on student beliefs towards science in the face of national emergencies (for instance, during the COVID-19 pandemic).

The addition of content related to the CCT component of the Australian Curriculum general capabilities was also applied in 2023. This included items relating to:

- student reports on school climate for encouraging CCT
- self-efficacy in undertaking CCT to solve problems

- student reports on outside of school support for CCT (i.e. from family and friends)
- student attitudes to the value of CCT
- student self-reports on engagement in undertaking CCT activities.

In 2023, the student questionnaire was presented to all Year 6 and Year 10 students immediately following the assessment. It was designed to be completed by most students in approximately 20 minutes. Unlike the assessment, the questionnaire was not timed, and students could take as long as they needed to complete it.

For the purposes of this report, questionnaire responses are scaled to provide various construct indicators relating to students' perceptions of, and level of engagement with, science. Chapters 5, 6 and 7 of this report discuss how these contextual scales are related to students' overall achievement in science literacy.

Assessment administration

The NAP–Science Literacy 2023 assessment was conducted within a 3 week period in May 2023. Notably, this testing window was 5 months earlier in the calendar year than the previous cycles of the assessment, which took place in October.

Schools were permitted to schedule the assessment on a day that suited them within the testing window. Schools generally undertook the test in one session on a single day, though a small number nominated to run the test with smaller groups of students over several days for logistical or technical reasons.

Each school nominated a staff member as the test administrator who would administer the assessment to the students. These test administrators were trained in specific NAP–Science Literacy assessment administration procedures and were provided with a detailed manual, an instructional video and a script for use during the assessment session. A support service was also maintained for these teachers via a 1800 number and dedicated email address. The training and associated resources provided to test administrators helped ensure the smooth administration of the assessment while also maintaining a high level of data quality and uniformity of participant test experience across Australia.

To maximise student participation, schools were asked to administer follow-up sessions in cases where a significant proportion (more than 20%) of students was absent on the scheduled assessment day. This helped to ensure a minimum student response rate of 80% at most participating schools.

Delivery method

Assessment platform

All participating schools undertook the NAP–Science Literacy 2023 assessment via the Locked Down Browser app, an online assessment platform also used for NAPLAN online. Students completed their assessment using desktop, laptop or tablet devices that were provided by the school or, in some cases, by the students themselves[6].

In preparation for the actual assessment, schools downloaded the Locked Down Browser onto each of the assessment-designated devices. An online device check was then carried out on a sample of devices to ensure that they met minimum assessment specifications. A technical support service was provided to all schools with troubleshooting assistance in the lead-up to the assessment. This service aimed to resolve any technical issues in a timely manner and helped ensure the smooth running of the assessment on test

[6] The use of either school- or student-provided devices depended on the device-use policies in effect at each participating school.

day. During the assessment period, this support service was also available to schools to assist with any technical, logistical or administrative issues that arose during the conduct of the assessment.

Technological enhancements versus uniformity over time

The NAP–Science Literacy 2023 assessment took advantage of technology-based enhancements to test delivery in order to broaden the range of stimulus material presented and content assessed, and the cognitive complexity of the responses required. These enhancements included the use of multimedia stimuli (e.g. videos and animations) and the use of a wider range of item types to assess student proficiency (see Table 2.1).

However, to enable comparisons of student achievement over time, there must be uniformity in the test-taking experience for participating students between cycles. While technological enhancements were used for the 2023 assessment, the overall user experience for participating students remained consistent with previous cycles.

As in previous cycles, the test interface had:

- a central information section that contained the item stem (question) and response options (for selected response items) or extended text boxes (for constructed response items)
- a resource panel on the left-hand side that could be toggled to expand or collapse the content
- a surrounding border of navigation facilities and user tools.

The test administration timings were also consistent across cycles, with students completing:

- a series of practice questions that introduced the system (untimed)
- a 60-minute (Year 6) or 75-minute (Year 10) assessment component
- a student questionnaire (untimed).

Sample

Sample design

The NAP–Science Literacy 2023 assessment was administered to a representative sample of Year 6 and Year 10 students across Australia[7]. A 2-stage sampling design was implemented following sampling procedures established in previous NAP–Science Literacy cycles as well as the other 2 NAP sample assessments in the program (NAP–Civics and Citizenship and NAP–ICT Literacy). These sampling procedures are designed to minimise any potential bias and to maximise the precision of estimates.

First sampling stage – school sampling

The first sampling stage involved drawing a separate, independent sample of schools for each state or territory and school sector, known as explicit stratification. Within each explicit stratum, schools were implicitly stratified by the following variables:

- school type (primary, secondary, combined)
- school NAPLAN performance quintile (from lowest fifth to highest fifth)

[7] For Year 10, the school sample was too small to generate accurate estimates at a state/territory level for Qld, SA, Tas, NT and ACT. This is because these states and territories opted to have a smaller Year 10 sample to reduce the perceived burden of participation on their schools. While not reported at the state/territory level, data collected from these jurisdictions still contribute to the national estimates for Year 10.

- a measure of school socio-economic status known as the Socio-Economic Indexes For Areas – Index of Education and Occupation (SEIFA – IEO)
- School Australian Statistical Geography Standard (ASGS) remoteness class (Major cities, Inner regional, Outer regional, Remote and Very remote)
- Enrolment size at the target grade (either Year 6 or Year 10).

The school samples for Year 6 and Year 10 were drawn independently within each stratum and of each other. Up to 2 substitute schools were assigned to each sampled school at the time of sampling. Substitute schools were chosen to be as similar as possible to the sampled school with respect to the implicit stratification variables listed above. This enabled the sample size and representativeness to be maintained if a sampled school was unable to participate. To maintain the integrity of the original sample, the use of substitute schools was kept to a minimum where possible.

Second sampling stage – student sampling

The second sampling stage involved selecting students within the participating schools. For this purpose, a random sample of 20 students was drawn from the target year level in each school, making sure the gender composition was kept constant between sample and cohort. If fewer than 20 eligible students were enrolled in the target grade (in smaller schools, for instance), all students in the year level were selected to participate.

School exclusions

At the school level, exclusions from the target population included:

- schools that had participated in NAP–Science Literacy field trial
- very remote schools in all jurisdictions except the Northern Territory
- schools with fewer than 5 students at the target year level
- non-mainstream schools, such as language schools, special schools and schools for distance education.

Student exclusions

In each of the sampled schools, individual students were exempted from the assessment if they met any one of the following criteria:

- Severe functional disability: the student has a moderate to severe permanent physical disability that severely limits their capacity to participate in the test.
- Severe intellectual disability: the student has a mental or emotional disability and/or cognitive delay that severely limits their capacity to participate in the test.
- Very limited assessment language proficiency: the student is unable to read or speak the language of the assessment (English) and would not be expected to overcome the language barrier in the assessment situation. Typically, a student who had received less than one year of instruction in English would be exempted.

More information about the sample design and its implementation, together with further details on school and student exclusions, is provided in the NAP–Science Literacy 2023 Technical Report.

Target and achieved sample

Table 2.2 presents the number of schools and students in both the target and achieved samples. The target sample refers to the schools and students sampled using the sampling procedures described previously, after the removal of any school-level exclusions. The achieved sample denotes the number of schools and students that participated in the assessment.

At a Year 6 level, 6,069 students from 368 schools participated in the NAP–Science Literacy 2023 main study. At Year 10, 3,433 students from 221 schools took part.

Nationally, overall response rates were 88% for Year 6 and 82% for Year 10 (after replacement and weighting), which are in line with the technical standards for international large-scale assessments from the Organisation for Economic Co-operation and Development (OECD) and International Association for the Evaluation of Educational Achievement (IEA). More information about response rates is provided in the NAP–Science Literacy 2023 Technical Report.

Table 2.2: Numbers of students and schools in the target and achieved samples

	Year 6				Year 10			
	Schools		Students		Schools		Students	
State/territory	Target sample	Achieved sample	Target sample	Achieved sample	Target sample	Achieved sample	Target sample	Achieved sample
NSW	57	57	1106	977	60	58	1200	919
VIC	57	55	1091	941	56	56	1120	855
QLD	56	56	1101	929	39	38	780	573
SA	52	51	999	835	14	14	280	214
WA	51	51	990	855	40	39	800	623
TAS	45	45	850	679	8	8	160	124
NT	38	32	666	495	5	4	100	63
ACT	22	21	440	358	4	4	80	62
Aust.	378	368	7243	6069	226	221	4520	3433

Participating sample characteristics

To allow the data collected in the NAP–Science Literacy 2023 assessment to be analysed and reported by demographic variables, schools and education systems were required to provide background data for each of the participating students. The specific student background variables collected in 2023 aligned with standard NAP protocols as set out in ACARA's Data Standards Manual (ACARA 2022).

These variables were:

- age
- gender
- Indigenous status
- parental occupation
- parental education
- main language spoken at home.

Geographic location was inferred from the location of the school the student attended.

The relationships between student background characteristics and NAP–Science Literacy achievement are explored in Chapter 4.

Table 2.3 presents the background characteristics of the Year 6 and Year 10 students who participated in the NAP–Science Literacy 2023 assessment. Two sets of percentages are reported for each background variable, by year level. The first column denotes the percentage of all participating students (including those with missing data for a given background variable), while the second column provides only the percentage of students with a valid response to the background variable being examined.

In terms of missing data, the coverage and completeness of student background data in 2023 improved when compared with previous cycles. While the parental occupation and parental education variables showed the highest levels of missing data, with up to 5% of that data missing for participating students, this was a marked improvement on the proportion of missing data from the previous cycle for these variables, which ranged between 5% and 9%.

The “Language spoken at home” variable also showed improvements in coverage for this cycle, with only 2% and 1% of data missing from Year 6 and Year 10, respectively. This is down from the 2018 figures of missing data of 14% and 6% for Year 6 and Year 10, respectively.

Regarding the parental occupation variable, schools and educational authorities were asked to provide data about the occupational groups of both parent/guardian 1 and parent/guardian 2 of participating students. For the parental education variables, schools and central authorities were similarly asked to provide data about the highest level of both school and non-school education achieved by both parents/guardians. For students who did not have a second parent/guardian, the variable was coded as missing. For the purposes of analysis, parental occupation and parental education for both parents/guardians were presented as combined variables that represented the highest parental occupation or education group indicated by either parent/guardian.

For the purposes of this report, geographic location refers to whether a student attended school in a metropolitan, regional or remote zone. The constituent areas that comprise each zone are informed by the ASGS Remoteness Structure, whereby:

- the major cities category includes all major cities of Australia
- the regional category includes all inner regional and outer regional areas in Australia
- the remote category includes all remote and very remote areas in Australia.

Table 2.3: Distribution of student background characteristics (weighted)

	Year 6		Year 10	
Student background characteristic	**All students (%)**	**Students with valid responses (%)**	**All students (%)**	**Students with valid responses (%)**
Gender				
Male	51	51	50	50
Female	49	49	50	50
Other	0	0	0	0
Total	100	100	100	100
Missing	0		0	
Parental occupation				
Senior managers and professionals	33	34	36	38
Other managers and associate professionals	23	24	22	23
Tradespeople & skilled office, sales and service staff	22	23	21	22
Machine operators, labourers, hospitality, and related staff	11	12	11	12
Not in paid work in last 12 months	7	7	5	6
Total	95	100	95	100
Missing	5		5	
Parental education				
Bachelor degree or above	47	48	46	48
Advanced diploma/diploma	14	14	14	15
Certificate I to IV (inc trade cert)	24	25	23	24
Year 12 or equivalent	7	7	7	8
Year 11 or equivalent	1	1	2	2
Year 10 or equivalent	2	2	2	2
Year 9 or equivalent or below	2	2	2	2
Total	98	100	96	100
Missing	2		4	
Indigenous status				
Non-Indigenous students	92	95	93	95
Indigenous students	5	5	5	5
Total	97	100	99	100
Missing	3		1	

(Continued) Table 2.3: Distribution of student background characteristics (weighted)

	Year 6		Year 10	
Student background characteristic	**All students (%)**	**Students with valid responses (%)**	**All students (%)**	**Students with valid responses (%)**
Language spoken at home				
English only	70	72	73	73
Language other than English	27	28	26	27
Total	98	100	99	100
Missing	2		1	
Geographic Location				
Major cities	72	72	72	72
Regional	27	27	27	27
Remote	1	1	1	1
Total	100	100	100	100
Missing	0		0	

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Chapter 3: The NAP–Science Literacy scale

Chapter 3: The NAP–Science Literacy scale

Chapter highlights

- The NAP–Science Literacy scale was established in 2006 and consists of 5 described proficiency levels. The scale was set with a mean score of 400 and a standard deviation of 100 for the national Year 6 sample, and scores for all later assessment cycles are reported on the same metric.
- In 2018, the scale was extended to include the newly added Year 10 assessment instrument. Vertical link items between Year 6 and Year 10 allowed equating between the year levels so that student achievement could be reported on the same scale for both year levels.
- Proficiency levels were established at equally spaced intervals across the scale, with each level spanning slightly more than 100 scale score points.
- Proficiency level descriptions were reviewed to ensure that they accurately reflected the NAP–Science Literacy content and adequately described the knowledge, skills and understandings that a student at each level can demonstrate. While the descriptions were updated, care was taken to ensure the underlying conceptualisation of science literacy measured in NAP–Science Literacy remains constant.
- Higher levels on the scale refer to more complex applications of knowledge, skills and comprehension. The scale is developmental in the sense that students are assumed to be typically able to demonstrate achievement of the skills and cognition described in the level below as well as at their measured level of achievement.
- The proficient standards for Year 6 and Year 10 provide reference points of “challenging but reasonable” expectations of student achievement at each year level. The proficient standard for Year 6 is 393 scale score points, which is the boundary between Levels 2 and 3 on the NAP–Science Literacy scale. The proficient standard for Year 10 is 497 scale score points, which is the boundary between Levels 3 and 4 on the scale.
- Exemplar items from the NAP–Science Literacy 2023 assessment instrument are provided at the end of this chapter. These items are representative of Levels 1 through 5 of the NAP–Science Literacy achievement scale.

Developing the NAP–Science Literacy scale

The main objective of NAP–Science Literacy is to monitor and report on trends in science literacy achievement. One convenient and informative way of doing this is to create a common scale on which levels of proficiency for both Year 6 and Year 10 students can be reported. The following sections describe how this reporting scale was constructed for NAP–Science Literacy, and how the component proficiency levels and proficient standards were developed.

The empirical scale

The NAP–Science Literacy scale was established in 2006 and was based on data collected from Year 6 students during the main study assessment of that year. While the inaugural NAP–Science Literacy assessment took place in 2003, the later shift in methodology for school and student sampling, as well as a change to the structure of the assessment itself, meant that the 2006 assessment data provided a more suitable baseline for scale development.

In 2006, the NAP–Science Literacy scale was set with a mean of 400 and a standard deviation of 100. In all subsequent cycles, data from the common items across assessment cycles (i.e. historical link items) were used to equate the assessments and derive comparable student achievement scores on the established NAP–Science Literacy scale.

In 2018, the scale was extended to incorporate the newly added Year 10 assessment instrument. Common questions between the Year 6 and Year 10 assessments, known as vertical link items, were developed in cycles 2018 and 2023. This made it possible to equate the assessment items from Year 6 and Year 10 so that student achievement could be reported across both year levels on the same scale.

More information about the scaling model and procedures is provided in the NAP–Science Literacy 2023 Technical Report.

The proficiency levels

The NAP–Science Literacy scale comprises 5 proficiency levels that describe the achievement of students in Year 6 and, from 2018 onwards, Year 10. Typically, students whose results are located within a proficiency level can demonstrate the understandings and skills associated with that level as well as possessing the understandings and skills of lower proficiency levels.

With the addition of Year 10 content to the scale in 2018, as well as the implementation of a standard-setting exercise[8] in the same year, adjustments to the width of the proficiency levels were made so that it adequately covered the breadth of scale scores across the 2 year-level cohorts.

The scale score cut-points for the proficiency levels remained unchanged for 2023 and are shown in Figure 3.1. As can be seen from the figure, the width of each level is slightly over 100 scale score points.

Level	Cut-point in scale score
Level 5	
	602
Level 4	
	497
Level 3	
	393
Level 2	
	288
Level 1	

Figure 3.1: Cut-points for proficiency levels

Describing the NAP–Science Literacy scale

The scale descriptions for the NAP–Science Literacy proficiency levels have been reviewed following each cycle of the assessment, including most recently in 2023, to ensure they accurately reflect the NAP–Science Literacy test content.

While the level descriptions have been updated to reflect new scientific contexts and refreshed assessment frameworks, the underlying conceptualisation of science literacy measured in NAP–Science Literacy has remained constant. This principle is important in assessments that extend over several cycles and are concerned with measuring change. It is accepted that changes in methods and content are necessary for assessments to remain relevant, but that maintaining the meaning of the construct is a necessary condition for measuring change.

Each level description provides a synthesised overview of the knowledge, skills and understandings that a student working within the level can demonstrate. The levels are set so that any student is likely to respond correctly to at least half of the items in their proficiency level. A student with an achievement

8 The standard setting exercise in 2018 was needed to determine the proficient standard for the newly added Year 10 component. Further information about this exercise is provided in "The proficient standards" section of this chapter.

scale score at the bottom of a level has a 62% chance of correctly answering any question at the bottom of that level and a 38% chance of correctly answering any question at the top of that level.

The NAP–Science Literacy scale represents a hierarchy of the knowledge, skills and understanding included in the construct of science literacy. Overall, higher levels on the scale refer to more complex applications of knowledge, skills and comprehension. The scale is developmental in the sense that students are assumed to be typically able to demonstrate achievement of the skills and cognition described in the level below as well as at their measured level of achievement.

Table 3.1 provides the proficiency level descriptions of the NAP–Science Literacy scale. The proficient standards and student achievement in relation to these proficiency levels are discussed in the following sections.

Table 3.1: NAP–Science Literacy proficiency level descriptions

Proficiency level	Description
Level 5	At Level 5, students can apply scientific principles and abstract concepts to develop and evaluate scientific explanations for complex, multi-faceted phenomena in familiar and unfamiliar contexts. Students are able to propose and justify their own scientific solutions and critique solutions made by others to address personal, community and global issues. Students can design valid scientific investigations that would systematically generate reliable data and explain the purpose of an experimental design, including how equipment allows data to be collected accurately. They can explain the value of models to investigate scientific phenomena and evaluate their advantages and limitations. Students can critically evaluate the outcomes of scientific investigations to identify limitations and sources of error, and propose alternative strategies. They can explain relationships between variables, evaluate data and information presented in a variety of formats, and justify conclusions that are consistent with evidence.
Level 4	At Level 4, students can apply scientific principles and concepts to construct and evaluate scientific explanations for complex, related phenomena in familiar contexts. Students are able to explain how scientific knowledge informs decisions and actions, and propose scientific solutions to address personal, community and global issues. Students can select equipment to collect accurate data and explain how to control variables to obtain valid outcomes. Students are able to analyse data and information resulting from investigations presented in a variety of formats. They can draw conclusions using evidence and scientific explanations and can propose strategies to improve the reliability of investigations.
Level 3	At Level 3, students can draw on scientific principles and concepts to construct and interpret scientific explanations of phenomena of increasing complexity in familiar contexts. Students can explain how scientific knowledge influences strategies proposed to solve personal and community problems. Students are able to plan straightforward investigations including identifying equipment to collect accurate data and identify and classify variables in a fair test. They can identify a source of error in an investigation and analyse data and information presented in a variety of formats. Students are able to draw conclusions consistent with evidence and support or refute predictions using evidence.

Proficiency level	Description
Level 2	At Level 2, students can draw on basic scientific principles and concepts to identify, explain and classify phenomena in familiar contexts. Students are able to recognise how the application of scientific knowledge can be used to develop solutions in their personal and community contexts. In the context of scientific investigations, students can identify scientific questions and predictions, and understand how variables influence outcomes. They can select appropriate equipment for a scientific investigation, perform simple calculations and label simple scientific diagrams. They can interpret data and information presented in a variety of formats and identify information that supports a conclusion from simple investigations.
Level 1	At Level 1, students can draw on basic knowledge and personal experience to recognise and describe aspects of phenomena using science concepts in familiar contexts. Students can identify familiar issues relating to a scientific concept that may affect their daily life. Students are able to use basic science inquiry skills to identify suitable equipment and identify risk management strategies for an investigation, take measurements and label graphics in familiar contexts. They can analyse simple representations of data and information to identify patterns and draw basic conclusions.

The proficient standards

One of the purposes of the NAP sample assessments in science literacy, ICT literacy, and civics and citizenship is to monitor and report on student attainment of the key performance measures (KPMs) defined for each of those domains. The proportion of students achieving or exceeding the proficient standard for both Year 6 and Year 10 is one of the 3 national key performance measures for science literacy specified in the Measurement Framework for Schooling in Australia (ACARA 2020).

The proficient standards "represent a 'challenging but reasonable' expectation of student achievement at a year level, with students needing to demonstrate more than elementary skills expected at that year level" (ACARA 2020:6). Importantly, a proficient standard is different from either a benchmark or a national minimum standard, which both refer to a level of minimum competence.

The proficient standard for Year 6 was established in 2006 and for Year 10 in 2018. Both standards were established through a standard-setting process that brought together expert science educators, including practising primary and secondary teachers, from all states and territories across all 3 education sectors. It was also inclusive and reflective of teaching experiences across major cities, regional and remote locations, as well as high and low socio-educational communities.

The proficient standard for Year 6 is 393 scale score points, which is the boundary between Levels 2 and 3 on the NAP–Science Literacy scale. The proficient standard for Year 10 is 497 scale score points, which is the boundary between Levels 3 and 4 on the scale. Year 6 students performing at Level 3 or higher and Year 10 students performing at level 4 or higher have consequently met or exceeded their relevant proficient standard.

Exemplar items

This section provides sample questions that are representative of the NAP–Science Literacy achievement scale. At each proficiency level, a wide range of items that varied in context, format and difficulty were used to give students the best opportunity to provide evidence of their science literacy.

The scale represents increasing levels of knowledge, skills and understanding across all dimensions of the NAP–Science Literacy Assessment Framework. The scale is developmental in the sense that students are assumed to be typically able to demonstrate achievement of the content described in the scale, below, as well as at their measured level of achievement.

Each exemplar item from the NAP–Science Literacy assessment is presented together with the percentage of students nationally (Year 6 and/or Year 10, as appropriate) who answered the item correctly to achieve the maximum score. In addition, these items are presented with references to the NAP–Science Literacy Assessment Framework dimensions and Australian Curriculum: Science strands and sub-strands that the items were developed to assess.

The items are presented as screen shots from the 2023 NAP–Science Literacy online test.

Proficiency level 1

Proficiency level 1 is below the proficient standard for both Year 6 and Year 10.

Exemplar item 1 (proficiency level 1)

Water from rain is absorbed by soil. If the soil cannot hold all the water, the water passes through the soil or across the soil surface. This water is called runoff.

This image shows where runoff has washed away parts of the soil, exposing the roots of the tree.

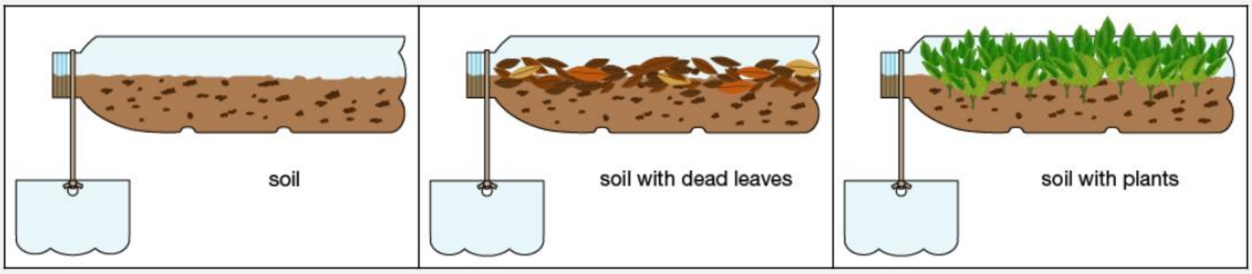
A group of students notice that the ground surface is different in parts of this image. They notice bare soil and dead leaves on some parts but on other parts many plants are growing. They want to know if the plants are stopping the soil washing away when it rains.

The students investigate whether plants can can stop water runoff.

They prepare three bottles and add the same amount of soil to each bottle.

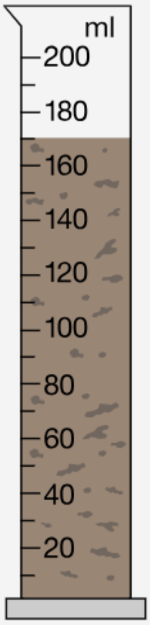
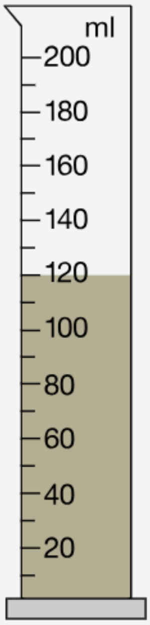
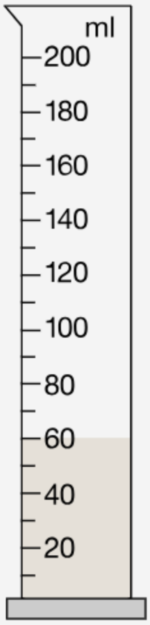
They add a layer of dead leaves to one bottle and grow a layer of plants in another bottle.

They pour 200 mL of water into each bottle and measure the runoff that collects in the containers.



The students observed these results after pouring 200 mL water into each bottle.

Complete the table by writing the volume of runoff collected from the bottle containing only soil.

Bottle	Soil	Soil with dead leaves	Soil with plants
Runoff collected			
Volume of runoff	mL	120 mL	60 mL
Observations	runoff is dark brown and dirty	runoff is light brown	runoff is clear

Strand	Science Inquiry	**Sub-strand**	Planning and conducting		
Cognitive dimension	Knowing and using procedures	**Item type**	Short constructed		
Australian Curriculum content descriptor	Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS104)	**Item intent**	Measures the volume in a measuring cylinder.		
Scale score	284	**Facility Year 6**	80%	**Facility Year 10**	90%

This item was part of the Erosion set. It illustrates performance at proficiency level 1. This item was administered to both Year 6 and Year 10 students. The total number of marks available for this item was one mark. Students who recorded a correct volume of 170 mL were awarded a score of one mark for this item.

Eighty per cent of Year 6 students and 90% of Year 10 students provided a correct response to the item. This item requires students to be able to identify the incremental scale on the measuring cylinder, and read and record the corresponding value of the volume of runoff in the first cylinder to complete the table of information.

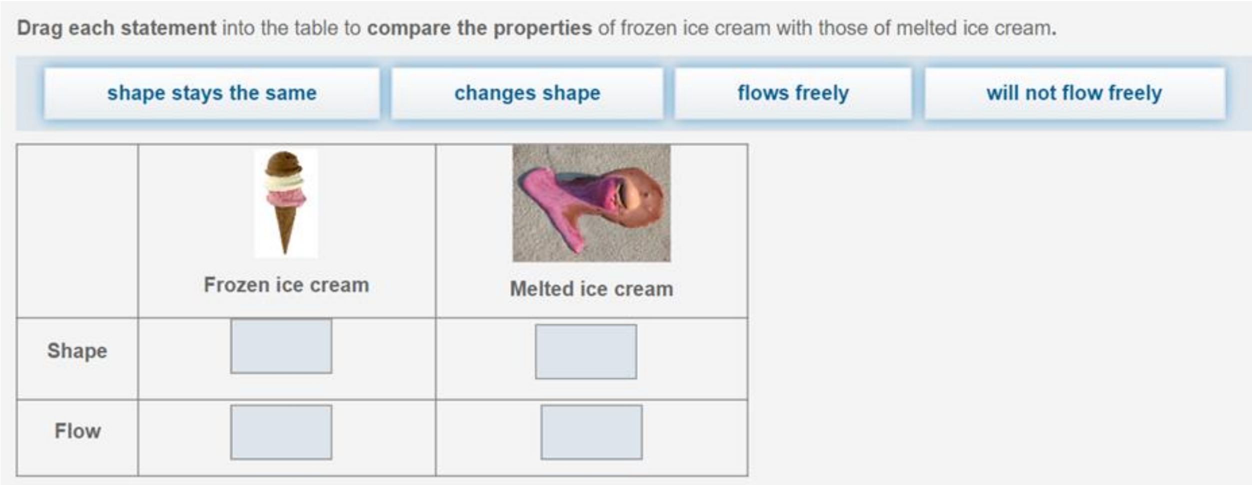
Students who responded correctly demonstrated a clear ability to measure the volume of liquid in a measuring cylinder. The item includes 2 additional measuring cylinders with the volume in each provided as scaffolding for students.

Fifty-one per cent of incorrect student responses (53% Year 6 [n=198], 42% Year 10 [n=55]) recorded a volume of 165 mL, indicating that students did not identify the scale marked on the measuring cylinder correctly.

Proficiency level 2

Proficiency level 2 is below the proficient standard for both Year 6 and Year 10.

Exemplar item 2 (proficiency level 2)



Strand	Science Understanding	**Sub-strand**	Chemical Sciences		
Cognitive dimension	Reasoning, analysing and evaluating	**Item type**	Interactive match (drag and drop)		
Australian Curriculum content descriptor	Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077)	**Item intent**	Compares the properties of a solid and a liquid.		
Scale score	304	**Facility Year 6**	79%	**Facility Year 10**	N/A

This item was part of the Ice cream set. It illustrates performance at proficiency level 2. This item was administered to Year 6 students. The total number of marks available for this item was one mark. A correct response requires students to drag the statements into the table to show that frozen ice cream stays in the same shape and will not flow freely while melted ice cream changes shape and flows freely.

Seventy-nine per cent of Year 6 students answered this item correctly. This item assesses students' understanding of the differences in shape and volume of a substance. This understanding is preliminary knowledge required before students can explain the arrangement and motion of particles of matter in chemical science.

Students who provided the correct response to this item were able to demonstrate knowledge of the differences in observable properties of a familiar substance (ice cream) in different states. Students were required to connect the correct statements about the observable properties of ice cream to compare the substance in its solid and liquid states. Students were supported with images of the ice cream that demonstrate how the properties differ in each state.

Of the remaining students, 7% of students correctly connected the statements about the shape of solids and liquids but incorrectly matched the statements about the difference in flow between the 2 states. The remaining students demonstrated a poor understanding of the differences in observable properties of solids and liquids.

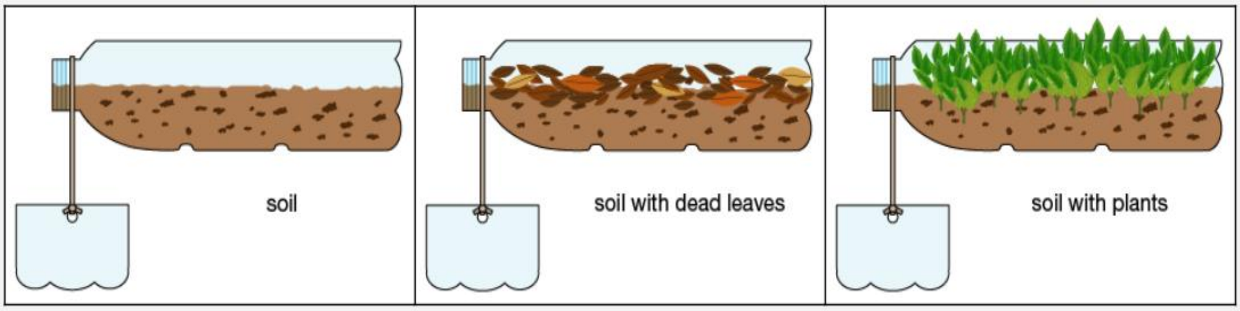
Exemplar item 3 (proficiency level 2)

The students investigate whether plants can can stop water runoff.

They prepare three bottles and add the same amount of soil to each bottle.

They add a layer of dead leaves to one bottle and grow a layer of plants in another bottle.

They pour 200 mL of water into each bottle and measure the runoff that collects in the containers.



Which of the following will prevent soil from eroding in areas that have high rainfall?

- building paths through eroded areas
- clearing the land by cutting down trees
- playing games and sports in parklands
- planting shrubs in areas that have bare soil

Strand	Science as a Human Endeavour	**Sub-strand**	Use and influence of science		
Cognitive dimension	Reasoning, analysing and evaluating	**Item type**	Multiple-choice		
Australian Curriculum content descriptor	Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083)	**Item intent**	Identifies a solution to an environmental problem based on scientific observations.		
Scale score	361	**Facility Year 6**	68%	**Facility Year 10**	77%

This item was also part of the Erosion set and was the fourth item in the unit. It illustrates performance at proficiency level 2. This item was administered to both Year 6 and Year 10 students. The total number of marks available for this item was one mark. Students who correctly identified the solution that minimised the effects of erosion as “planting shrubs in areas that have bare soil” (option D) were awarded a score of one mark for this item.

Sixty-eight per cent of Year 6 students and 77% of Year 10 students provided a correct response to the item. This item requires students to consider the impact of high rainfall on soil and identify that the presence of vegetation is an effective strategy to protect the soil surface through canopy cover and water absorption by the root structures, thereby minimising the effects of erosion.

Students who responded correctly demonstrated a clear understanding of the important role that plants play in stabilising soil, and that the absence of plants, whether through clearing or replacing with made structures such as paths, does not help in controlling soil erosion.

The most common incorrect response selected was “building paths through eroded areas” (option A) that was selected by 20% of Year 6 students and 15% of Year 10 students. Students who selected this option may have considered “building” something as a method for addressing the soil run-off problem. Students may also have matched the word “eroding” in the question with “eroded” in the option.

Twelve per cent of Year 6 students and 9% of Year 10 students selected a solution that would actually contribute to soil erosion (options B and C), rather than attempt to protect the soil. These students have a limited understanding of the causes of erosion and the importance of vegetation in soil conservation. The item demonstrates a growing understanding of the concept of identifying and evaluating solutions to environmental problems, with a greater proportion of Year 10 students providing a correct response to this item than students in Year 6.

Proficiency level 3

Proficiency level 3 is the proficient standard for Year 6 but is still below the proficient standard for Year 10.

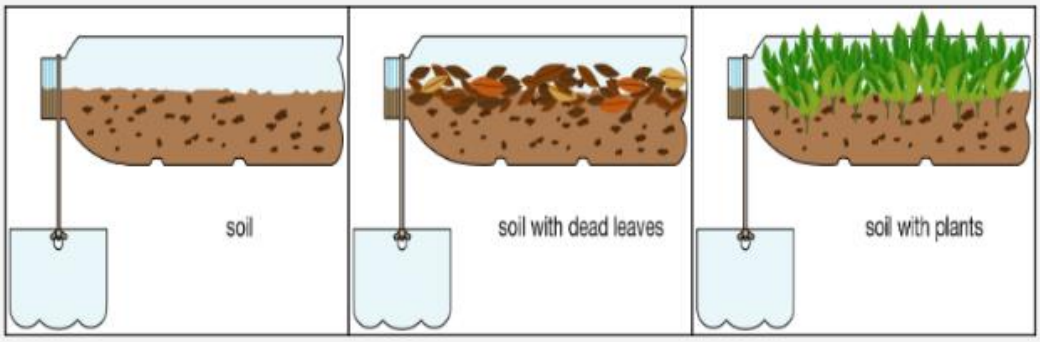
Exemplar item 4 (proficiency level 3)

The students investigate whether plants can can stop water runoff.

They prepare three bottles and add the same amount of soil to each bottle.

They add a layer of dead leaves to one bottle and grow a layer of plants in another bottle.

They pour 200 mL of water into each bottle and measure the runoff that collects in the containers.



What is the variable that is changed in this investigation?

- ○ the type of soil in each bottle
- ○ the surface layer in each bottle
- ○ the amount of runoff in each container
- ○ the volume of water added to each bottle

Strand	Science Inquiry	**Sub-strand**	Planning and conducting		
Cognitive dimension	Knowing and using procedures	**Item type**	Multiple-choice		
Australian Curriculum content descriptor	Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS104)	**Item intent**	Recognises the independent variable in an investigation.		
Scale score	416	**Facility Year 6**	58%	**Facility Year 10**	80%

This item was also part of the Erosion set. This item was the first item in the set, immediately preceding exemplar item 1. It illustrates performance at proficiency level 3. This item was administered to both Year 6 and Year 10 students. The total number of marks available for this item was one mark. Students who correctly identified the independent variable as “the surface layer in each bottle” (option B) were awarded a score of one mark for this item.

Fifty-eight per cent of Year 6 students and 80% of Year 10 students provided a correct response to the item. This item requires students to consider some of the variables described in an investigation about the impact of erosion on water run-off to identify the independent variable.

Students who provided the correct response understand the influence of variables on fair testing and correctly identified that the surface layer in the bottles is the variable being changed in the described experiment. The most common incorrect response selected was “the amount of run off in each container” (option C) that was selected by 18% of Year 6 students and 10% of Year 10 students. Students who selected this option have identified the dependent variable that is measured and therefore may change in the investigation rather than the variable that is deliberately changed in the described investigation. Twenty-four per cent of Year 6 students and 9% of Year 10 students selected a controlled variable described in the experiment (options A and D). These students have a limited understanding of the influence of variables on an investigation; however, the item demonstrates that the concept of variables in science inquiry continues to develop from Year 6 to Year 10 with a greater proportion of Year 10 students providing a correct response to this item than students in Year 6.

Exemplar item 5 (proficiency level 3)

This image shows a honey bee with a sensor attached to its back.

Some bees in Australia are being tagged with small sensors like these to investigate where they travel. The sensors are:

- square
- 2.5 mm x 2.5 mm in size
- weigh 5.4 mg
- attached to bees using superglue.

The sensors collect data about where each bee travels in a day and send it to a computer for scientists to use.

The data collected by the sensors will be useful because people will know

- how big the bees grow.
- when to harvest honey from a beehive.
- where to put beehives to help pollinate crops.
- the animals that are predators to the bees.

Strand	Science as a Human Endeavour	**Sub-strand**	Use and Influence of Science		
Cognitive dimension	Reasoning, analysing and evaluating	**Item type**	Multiple-choice		
Australian Curriculum content descriptor	Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)	**Item intent**	Identifies how scientific knowledge can be used to make community decisions.		
Scale score	415	**Facility Year 6**	59%	**Facility Year 10**	N/A

This item was part of the Bee Backpacks set. It illustrates performance at proficiency level 3. This item was administered to Year 6 students. The total number of marks available for this item was one mark. Fifty-nine per cent of Year 6 students provided a correct response to the item. This item requires students to consider how the data collected by sensors attached to bees could provide useful information for a community. Students who correctly identified that the scientific information could be useful because people will know “where to put beehives to pollinate crops” (option C) were awarded a score of one mark for this item.

Fifty-nine per cent of Year 6 students provided a correct response to the item. Students who provided the correct response understand how scientific knowledge can be used to make decisions that are useful for a community, in this case, identifying the distance bees travel from a hive and therefore the locations to place beehives to help pollinate crops. The most common incorrect response selected by students was “when to harvest honey from a beehive” with 21% of students selecting this option. These students are identifying information about bees that would be useful to a community but have not correlated the purpose of the investigation with the data generated in a day about where bees travel.

Proficiency level 4

Proficiency level 4 is the proficient standard for Year 10 and above the proficient standard for Year 6.

Exemplar item 6 (proficiency level 4)

Like Earth, Mars also experiences day and night.

Which of the following would cause Mars to have day and night?

- ◯ Mars is tilted on its axis.
- ◯ Mars is rotating on its axis.
- ◯ The Sun is rotating on its axis.
- ◯ Mars is orbiting around the Sun.

Strand	Science Understanding	**Sub-strand**	Earth and space sciences		
Cognitive dimension	Knowing and using procedures	**Item type**	Multiple-choice		
Australian Curriculum content descriptor	The Earth is part of a system of planets orbiting around a star (the sun) (ACSSU078)	**Item intent**	Identifies the cause of night and day.		
Scale score	535	**Facility Year 6**	36%	**Facility Year 10**	53%

This item was part of the Living on Mars set. It illustrates performance at proficiency level 4. This item was administered to both Year 6 and Year 10 students. The total number of marks available for this item was one mark. This item requires students to transfer knowledge about the cause of day and night from a familiar context and apply this understanding in a more abstract context. Students who correctly identified that, like Earth, the cause of day and night on Mars would be due to Mars's rotation on its own axis (option B) were awarded a score of one mark for this item.

Thirty-six per cent of Year 6 students and 53% of Year 10 students provided a correct response to the item. Students who provided the correct response to this item are demonstrating a clear understanding of the fundamental phenomenon of the cause of day and night. They can transfer that understanding from a familiar context (Earth) to a more abstract context (Mars). Forty-seven per cent of Year 6 students and 37% of Year 10 students incorrectly attributed the phenomena of day and night on Mars with the reason that "Mars is orbiting around the Sun" (Option D). Selection of this option demonstrates that students have some understanding of astronomical phenomena about the relationship of planets, including Earth and the Sun, but applied this understanding inappropriately, as this response relates to the length of a year rather than the cause of day and night. The options "Mars is tilted on its axis" (Option A) and "The Sun is rotating on its axis" (Option C) were selected approximately evenly by the remaining students (7% and 10%

respectively by Year 6 students and approximately 5% equally by Year 10 students). This item also demonstrates that students continue to develop their understanding of concepts relating to astrological phenomena between Year 6 and Year 10 with more students responding correctly to this item in Year 10 than in Year 6.

Exemplar item 7 (proficiency level 4)

Soil contains organisms called decomposers that break down (decompose) different materials. Decomposers can be:

- animals such as insects and worms that eat the materials,
- or fungi and bacteria that secrete chemicals to decompose the materials outside their bodies.

This soil would contain decomposers.

Materials that break down due to the action of decomposers are said to be 'biodegradable'. A group of students want to investigate how biodegradable each of the following materials are.

The students plan to bury similar sized pieces of each material in damp soil at the same time.

The students decide they will collect data by recording observations of each material. One of the students wants to record observations every hour.

This is NOT a suitable time interval to collect observations in this investigation. Explain why. (1 mark)

Suggest an appropriate time interval for recording observations of each material. Give a reason for your suggestion. (2 marks)

Strand	Science Inquiry	**Sub-strand**	Planning and conducting		
Cognitive dimension	Reasoning, analysing and evaluating	**Item type**	Extended text		
Australian Curriculum content descriptor	Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS103)	**Item intent**	Explains a limitation of a suggested method of monitoring an investigation and proposes an alternative, providing justification for the choice.		
Scale score	551	**Facility Year 6**	23%	**Facility Year 10**	46%

This item was part of the Decomposing inquiry task and is an example of a 3-mark item. This item was administered to both Year 6 and Year 10 students. A score of 2 or 3 marks for this item illustrates performance at proficiency level 4. The total number of marks available for this item was 3 marks: one mark for a correct response to the first part and 2 marks for a correct response to the second part of the question. Twenty-three per cent of Year 6 students and 46% of Year 10 students achieved 3 marks for this item.

The first part of this question requires students to critically consider a suggested method for collecting accurate data in an investigation, identify a limitation with the proposed method and recommend a valid alternative method. Students who provided a plausible explanation for why the time intervals selected were unsuitable were awarded a score of one mark for the first part of the item.

The second part of the item requires students to consider alternative methods for collecting data accurately and provide a reason that explains why their proposed method is a reasonable and practical solution. Students who were able to suggest a reasonable and practical method for making observations in an investigation and provided a rational explanation for their proposal were awarded 2 marks for this part of the item.

Proficiency level 5 and above

Proficiency level 5 is above the proficient standard for both Year 6 and Year 10.

Exemplar item 8 (proficiency level 5)

Zebras and okapi are African animals.

The table shows how they are classified.

Classification levels	Okapi	Zebra
		
Kingdom	Animalia	Animalia
Phylum	Chordata	Chordata
Class	Mammalia	Mammalia
Order	Artiodactyla (Hooves have two toes on all feet.)	Perissodactyla (Hooves have one or three toes on hind feet.)
Family	Giraffidae	Equidae

At which level of classification would the okapi and zebra have the most in common?

- Kingdom
- Phylum
- Class
- Order
- Family

Give one feature the okapi and zebra would share at this level. (1 mark)

Strand	Science Understanding	**Sub-strand**	Biological sciences		
Cognitive dimension	Knowing and using procedures	**Item type**	Multiple-choice and extended text		
Australian Curriculum content descriptor	Classification helps organise the diverse group of organisms (ACSSU111)	**Item intent**	Uses knowledge of classification hierarchy to identify a feature in common.		
Scale score	680	**Facility Year 6**	N/A	**Facility Year 10**	22%

This item was part of the Zebras set. This item was administered only to Year 10 students. A maximum score of 2 marks could be awarded to students for this with a score of 2 marks illustrating performance at proficiency level 5. This item requires students to identify the level of classification at which 2 animals will have the most in common according to the Linnaean hierarchical system of categorisation and provide a feature that the animals will share at that level. Students who identified “Class” (Option C) as the level of classification the animals will have the most in common and provided a feature common to mammals (have hair or fur, have mammary glands or are milk producing, bear live young or are endothermic) were awarded 2 marks for this item. Twenty-two per cent of Year 10 students achieved the maximum of 2 marks for this item.

Students who were awarded the maximum number of marks for this item demonstrated a thorough understanding of the Linnaean system of classification of organisms and were able to provide a feature in common to mammals. Students who provided a correct response to the multiple-choice element of this item showed an ability to apply scientific principles in a complex context, being a system of classification. The most common incorrect response was “Kingdom” (Option A), the highest rank of classification provided in this item, with 27% of students selecting this option. Selection of the highest rank of classification indicates that students have a limited understanding that the hierarchical nature of the classification system becomes more specific at each level. In this item, the most specific features shared by the given animals will be at the lowest level of classification the animals have in common (Class).

Exemplar item 9 (proficiency level 5+)

The students print a grid of 5 mm squares onto a transparent plastic sheet.

After 12 weeks at the end of the investigation, the sheet is placed over each material. The students count the squares where the material is breaking down.

The table shows their results.

Type of material	Number of squares where the material is breaking down
potato peel	48
cardboard	87
plastic bottle	0
newspaper	63
aluminium foil	0
apple peel	76
polystyrene foam	0

Before the investigation, the students predicted that the food items would be more biodegradable than the other items.

Did the students predict correctly? Give evidence from their results to support your answer.

(2 marks)

Strand	Science Inquiry	**Sub-strand**	Processing, modelling and analysing		
Cognitive dimension	Reasoning, analysing and evaluating	**Item type**	Extended text		
Australian Curriculum content descriptor	Compare data with predictions and use as evidence in developing explanations (ACSIS221)	**Item intent**	Uses evidence from a table of data to explain if a prediction is supported by the results.		
Scale score	769	**Facility Year 6**	4%	**Facility Year 10**	10%

This item was part of the Decomposing inquiry task. This item was administered to both Year 6 and Year 10 students. This item has a maximum score of 2 marks. A score of 2 marks for this item illustrates performance at proficiency level 5 or above. A score of one mark illustrates performance at proficiency level 3. This item requires students to critically analyse a table of data from a given investigation to identify whether a prediction can be supported by the results. Students who identified that there are aspects of the data that can both support and refute the prediction, providing evidence from the table to justify their explanation, were awarded 2 marks for this item. Four per cent of Year 6 students and 10% of Year 10 students achieved 2 marks for this item.

Students who were awarded a maximum score of 2 marks for this item are clearly demonstrating the ability to critically analyse data from an investigation to support or refute a prediction and use information from the table to justify their response. The prediction provided to students is that food items are more biodegradable than the other items tested. The data provided shows that food items are more biodegradable than some of non-food items such as plastic and aluminium foil, but some non-food materials, such as cardboard, are more biodegradable than the food items. A score of one mark was awarded to students who only identified the prediction as correct or incorrect and supported their conclusion with evidence from the data provided. A score of one mark illustrates performance at proficiency level 4, with students demonstrating the ability to draw conclusions consistent with evidence but not able to identify the complexities in the data set in drawing conclusions relating to the given prediction. This item also shows that students' scientific skill proficiency continues to develop from Year 6 to higher levels of competency by Year 10.

Chapter 4: Science literacy achievement

Chapter 4: Science literacy achievement

Chapter highlights

- Nationally, 57% of Year 6 and 54% of Year 10 students achieved the proficient standard in 2023.
- Across jurisdictions, the proportion of Year 6 students achieving the proficient standard ranged from 42% in the Northern Territory and 51% in Tasmania to 59% in Queensland and 69% in the Australian Capital Territory.
- Achievement in science literacy did not change significantly for Year 6 students since 2006 or for Year 10 students since 2018.
- Year 6 students in Queensland, South Australia and Western Australia showed a significant increase in the proportion of students achieving the proficient standard compared to one or more of the early assessment cycles. Together with the Australian Capital Territory, these were the strongest performing jurisdictions.
- Differences in science literacy achievement between male and female students were not statistically significant.
- One out of 3 Indigenous Year 6 students and one out of 4 Indigenous Year 10 students attained the proficient standard. The achievement of Indigenous Year 6 students in 2023 was significantly higher than in 2012 and in 2009.
- Unlike in 2018, Year 6 students speaking only English at home did not outperform students with other language backgrounds.
- Students from major cities had significantly higher achievement than students in regional areas. The difference was small in Year 6 and moderate in Year 10.
- Science achievement was positively correlated with both parental occupation and parental level of education, with about 70% of students with at least one parent in the highest occupation and education groups achieving the proficient standard. This percentage dropped to below 40% for students with parental occupation and education in the lowest category. Generally, achievement for these groups did not change significantly since 2018.

Introduction

In this chapter, overall achievement statistics are shown in terms of percentages of students attaining the proficient standard for Year 6 or Year 10 and average scale scores. Distributions of student achievement are reported as percentages of students in each of the proficiency levels.

Student achievement is reported at the national level, followed by student achievement among the states and territories. In addition, this chapter includes achievement for each of the following population subgroups: gender, Indigenous status, language spoken at home, geographic location and parental occupation and education.

Where applicable, comparisons are made with results from the 2006, 2009, 2012, 2015 and 2018 assessments. Given the change in testing window from October to May, changes in achievement over time need to be interpreted with some caution.

Student achievement at the national level

Almost three-quarters of Year 6 students were in Level 2 and 3, and about two-thirds of Year 10 students were in Level 3 and 4 (see Table 4.1). Level 3 had the highest frequency of Year 6 students and Level 4 had the highest frequency of Year 10 students (see Figure 4.1). Twelve per cent of Year 6 students were in the lowest level, Level 1 and below, while 20% of Year 10 students were in the highest level, Level 5 and above. Given that these percentages are quite high, it is assumed that a substantial number of Year 6 students performed below Level 1 and a substantial number of Year 10 students performed above Level 5. Students who achieved scores above Level 5 may be able to demonstrate additional or more complex skills than those described at Level 5. Students who achieved scores below Level 1 may only be able to demonstrate less complex skills than those described at Level 1.

Table 4.1: Percentages of Year 6 and Year 10 students at each proficiency level in 2023

Proficiency level	Year 6		Year 10	
Level 5 and above	2	(±0.6)	20	(±2.2)
Level 4	16	(±1.5)	34	(±2.7)
Level 3	39	(±2.3)	30	(±2.4)
Level 2	32	(±1.9)	13	(±1.8)
Level 1 and below	12	(±1.9)	3	(±1.3)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

Fifty-seven per cent of Year 6 and 54% of Year 10 students achieved the proficient standard for their year level (see Figure 4.1).

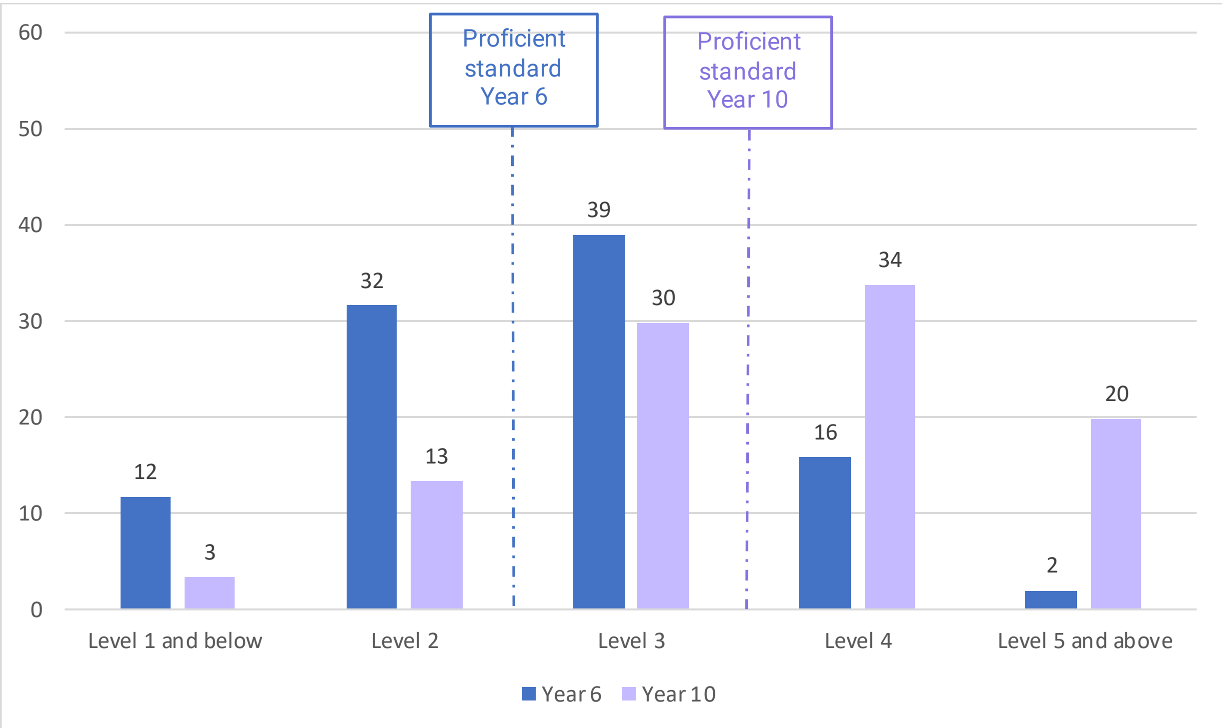


Figure 4.1: Percentages of Year 6 and Year 10 students across proficiency levels in 2023

The Year 6 average scale score was 407 score points, which is near the bottom of Level 3. The Year 10 average was 503 score points, which was close to the bottom of Level 4. Both averages were just above the proficient standard for each year level.

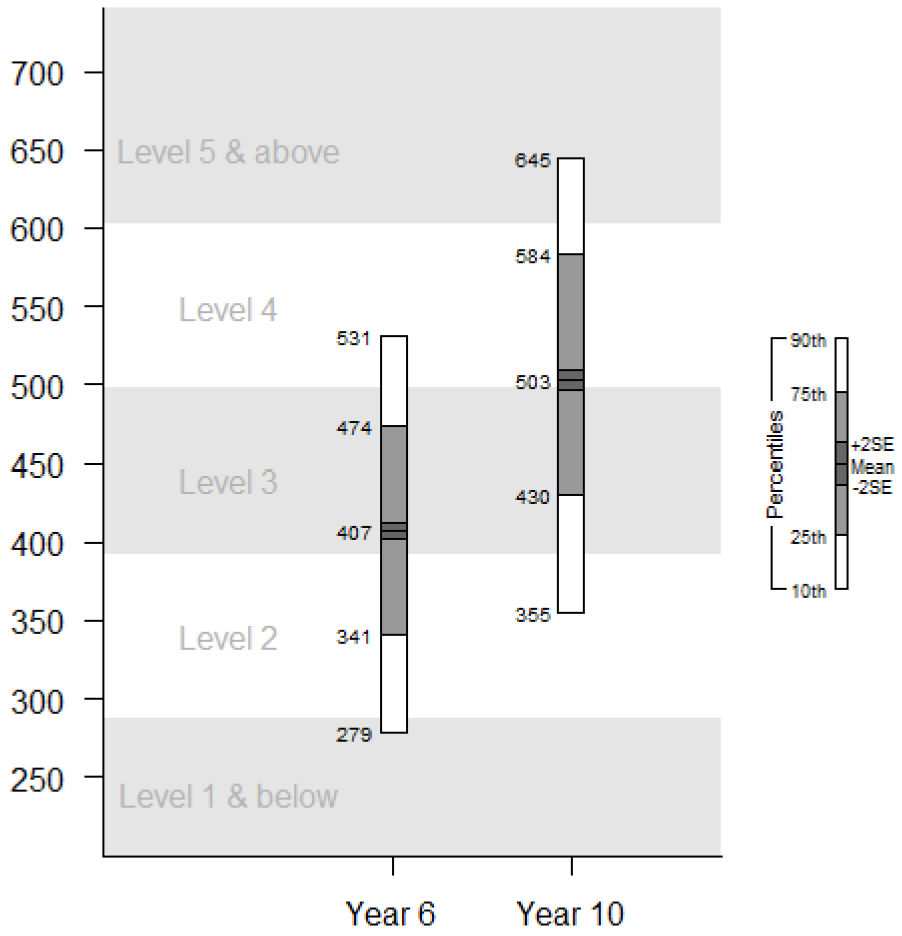


Figure 4.2: NAP–Science Literacy average scale scores and distributions for Year 6 and Year 10 in 2023

Changes in achievement since 2006

The percentage of students attaining the proficient standard was compared to previous cycles, for Year 6 students from 2006 and for Year 10 students from 2018. In the previous cycle, the 2018 results for Year 6 showed a significant increase in students attaining the proficient standard compared to 2012. The percentages in 2023, however, were not significantly different from any of the percentages reported in previous cycles (see Table 4.2).

Table 4.2: Percentages of Year 6 and Year 10 students attaining the proficient standard since 2006

Year	2023	2018	2015	2012	2009	2006
Year 6	57 (±2.5)	58 (±2.4)	55 (±1.8)	51 (±2.0)	52 (±2.2)	54 (±2.1)
Year 10	54 (±2.9)	50 (±2.8)				

Confidence Intervals (1.96 * SE) are reported in brackets.

▲ if significantly higher than in 2023

▼ if significantly lower than in 2023

While the percentage of Year 6 students attaining the proficient standard is comparable to each previous cycle of the program, percentages within proficiency levels can only be compared between 2023 and 2018. The reason for this is that the addition of Year 10 students to the program in 2018 led to a realignment of the levels, which is explained in detail in the NAP—Science Literacy 2018 Technical Report.

The distribution of students across proficiency levels showed a similar pattern in 2023 and 2018 for both year levels (see Table 4.3).

Table 4.3: Percentages of Year 6 and Year 10 students at each proficiency level since 2018

	Proficiency level	2023	2018
Year 6	**Level 5 and above**	2 (±0.6)	2 (±0.6)
	Level 4	16 (±1.5)	17 (±1.5)
	Level 3	39 (±2.3)	39 (±2.2)
	Level 2	32 (±1.9)	30 (±2.0)
	Level 1 and below	12 (±1.9)	12 (±1.4)
Year 10	**Level 5 and above**	20 (±2.2)	16 (±2.1)
	Level 4	34 (±2.7)	33 (±2.7)
	Level 3	30 (±2.4)	31 (±2.7)
	Level 2	13 (±1.8)	15 (±2.2)
	Level 1 and below	3 (±1.3)	5 (±1.5)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

As for the percentages, the average scale score in science literacy did not change significantly over time (see Table 4.4). In 2023, Year 6 students scored, on average, equal to Year 6 students in every cycle since 2006. Year 10 students in 2023 scored, on average, equal to Year 10 students in 2018.

Table 4.4: NAP–Science Literacy average scale scores for Year 6 and Year 10 since 2006

	2023	2018	2015	2012	2009	2006
Year 6	407 (±5.2)	407 (±5.0)	403 (±4.3)	394 (±4.4)	392 (±5.1)	400 (±5.4)
Year 10	503 (±6.9)	490 (±7.3)				

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

Student achievement among the states and territories

Table 4.5 shows the percentage of students attaining the proficient standard in each of the jurisdictions. For Year 6, the percentages ranged from 42% in the Northern Territory and 51% in Tasmania to 59% in Queensland and 69% in the Australian Capital Territory.

Table 4.5: Percentages of Year 6 and Year 10 students attaining the proficient standard nationally and by state and territory in 2023

State/territory	Year 6		Year 10	
NSW	56	(±5.6)	52	(±4.9)
VIC	55	(±5.5)	53	(±5.0)
QLD	59	(±4.6)	-	
SA	58	(±4.9)	-	
WA	58	(±5.2)	57	(±6.6)
TAS	51	(±6.0)	-	
NT	42	(±8.8)	-	
ACT	69	(±8.5)	-	
Aust.	57	(±2.5)	54	(±2.9)

Confidence Intervals (1.96 * SE) are reported in brackets.

Reporting of Year 10 data at the state/territory level is not possible for QLD, SA, Tas, NT or ACT as their school sample design is not representative at their level.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Year 10 results could only be reported for jurisdictions with sufficiently large sample sizes. Fifty-seven per cent of Year 10 students in Western Australia attained the proficient standard, compared to 52% and 53% in New South Wales and Victoria, respectively.

Percentage distributions across proficiency levels are provided in Table 4.6 for each year level, by state or territory. In each jurisdiction, the level with the highest frequency was Level 3 for Year 6 (with the exception of the Northern Territory) and Level 4 for Year 10.

Table 4.6: Percentages of Year 6 and 10 students at each proficiency level nationally and by state and territory in 2023

Year 6										
State/territory	Level 1 and below		Level 2		Level 3		Level 4		Level 5 and above	
NSW	12	(±3.6)	32	(±4.1)	38	(±5.0)	15	(±3.5)	n	
VIC	12	(±4.0)	32	(±4.2)	39	(±4.8)	14	(±3.6)	n	
QLD	10	(±4.1)	31	(±3.9)	39	(±4.3)	17	(±3.4)	n	
SA	12	(±3.8)	30	(±4.1)	39	(±4.6)	17	(±3.8)	n	
WA	11	(±2.7)	31	(±4.2)	39	(±4.9)	18	(±3.8)	n	
TAS	17	(±4.5)	32	(±5.5)	35	(±5.6)	14	(±4.0)	n	
NT	25	(±10.3)	33	(±6.2)	31	(±8.4)	10	(±3.8)	n	
ACT	n		24	(±5.9)	44	(±6.8)	22	(±4.9)	n	
Aust.	12	(±1.9)	32	(±1.9)	39	(±2.3)	16	(±1.5)	2	(±0.6)
Year 10										
State/territory	Level 1 and below		Level 2		Level 3		Level 4		Level 5 and above	
NSW	n		14	(±3.8)	29	(±4.5)	32	(±4.4)	20	(±3.8)
VIC	n		13	(±2.7)	30	(±4.8)	35	(±4.2)	18	(±3.2)
QLD	-		-		-		-		-	
SA	-		-		-		-		-	
WA	n		13	(±4.7)	27	(±5.0)	36	(±5.4)	21	(±5.2)
TAS	-		-		-		-		-	
NT	-		-		-		-		-	
ACT	-		-		-		-		-	
Aust.	3	(±1.3)	13	(±1.8)	30	(±2.4)	34	(±2.7)	20	(±2.2)

Confidence Intervals (1.96 * SE) are reported in brackets.

Results are rounded to the nearest whole number so some totals may appear inconsistent.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

n = too few observations to provide reliable estimates (i.e. there are fewer than 30 students or fewer than 5 schools with valid data).

Table 4.7 shows the average scale score in science literacy for each of the states and territories. For the Year 6 results, states and territories are also compared with each other for statistically significant difference in average achievement (see Table 4.8).

For Year 6, the Australian Capital Territory, Queensland, Western Australia and South Australia performed equally well. New South Wales and Victoria performed less well than the Australian Capital Territory and better than the Northern Territory, but not differently from any of the other jurisdictions.

Table 4.7: NAP–Science Literacy average scale scores nationally and by state and territory for Year 6 and Year 10 in 2023

State/territory	Year 6	Year 10
NSW	405 (±10.1)	497 (±13.3)
VIC	403 (±12.0)	500 (±10.6)
QLD	413 (±11.8)	-
SA	409 (±11.4)	-
WA	410 (±10.0)	509 (±17.2)
TAS	391 (±13.2)	-
NT	359 (±26.6)	-
ACT	432 (±20.7)	-
Aust.	407 (±5.2)	503 (±6.9)

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table 4.8: Pair-wise comparisons of Year 6 students' NAP–Science Literacy average scale scores between the states and territories in 2023

State/territory	Mean scale score	ACT	QLD	WA	SA	NSW	VIC	TAS	NT
ACT	432 (±20.7)		•	•	•	▲	▲	▲	▲
QLD	413 (±11.8)	•		•	•	•	•	▲	▲
WA	410 (±10.0)	•	•		•	•	•	▲	▲
SA	409 (±11.4)	•	•	•		•	•	▲	▲
NSW	405 (±10.1)	▼	•	•	•		•	•	▲
VIC	403 (±12.0)	▼	•	•	•	•		•	▲
TAS	391 (±13.2)	▼	▼	▼	▼	•	•		▲
NT	359 (±26.6)	▼	▼	▼	▼	▼	▼	▼	

Confidence Intervals (1.96 * SE) are reported in brackets.

▲ Mean scale score significantly higher than in comparison state/territory

▼ Mean scale score significantly lower than in comparison state/territory

• Mean scale score not significantly different in comparison state/territory

There was no difference in any Australian jurisdiction between the proportion of students who achieved the proficient standard in 2023 in comparison to the 2018 and 2015 cycles. However, in 3 jurisdictions (Queensland, South Australia and Western Australia), the proportion in 2023 was higher than in at least one cycle of NAP–Science Literacy prior to 2015 (see Table 4.9). These results were accompanied in most cases by similar, statistically significant increases in average scale scores for these jurisdictions (see Table 4.10).

The Northern Territory showed a significant increase in average scale score for Year 6 students between 2018 and 2023. However, given the change in sample design for remote areas in 2023[9], it is likely that this increase is an artefact of sample design and may be apparent only in the 2023 cycle.

Table 4.9: Percentages of Year 6 students attaining the proficient standard nationally and by state and territory since 2006

State/territory	2023	2018	2015	2012	2009	2006
NSW	56 (±5.6)	54 (±5.1)	57 (±3.6)	51 (±4.3)	53 (±5.0)	57 (±4.3)
VIC	55 (±5.5)	56 (±4.8)	54 (±3.8)	51 (±4.7)	55 (±4.6)	58 (±5.0)
QLD	59 (±4.6)	64 (±4.5)	54 (±4.6)	▼ 50 (±3.3)	▼ 49 (±3.8)	▼ 49 (±3.8)
SA	58 (±4.9)	55 (±6.8)	51 (±3.9)	51 (±3.9)	▼ 47 (±5.0)	52 (±4.7)
WA	58 (±5.2)	62 (±5.2)	58 (±3.3)	56 (±4.2)	53 (±4.5)	▼ 47 (±4.7)
TAS	51 (±6.0)	58 (±5.2)	59 (±4.7)	51 (±5.4)	50 (±6.0)	57 (±5.5)
NT	42 (±8.8)	37 (±7.4)	32 (±5.6)	31 (±7.6)	34 (±7.5)	38 (±6.5)
ACT	69 (±8.5)	67 (±6.7)	61 (±5.1)	65 (±5.3)	61 (±4.8)	62 (±5.6)
Aust.	57 (±2.5)	58 (±2.4)	55 (±1.8)	51 (±2.0)	52 (±2.2)	54 (±2.1)

Confidence Intervals (1.96 * SE) are reported in brackets.

▲ if significantly higher than in 2023

▼ if significantly lower than in 2023

Table 4.10: NAP–Science Literacy average scale scores nationally and by state and territory for Year 6 since 2006

State/ territory	2023	2018	2015	2012	2009	2006
NSW	405 (±10.1)	397 (±10.5)	411 (±8.6)	395 (±9.9)	396 (±12.1)	411 (±12.5)
VIC	403 (±12.0)	405 (±10.3)	399 (±8.9)	393 (±9.7)	398 (±9.2)	408 (±10.2)
QLD	413 (±11.8)	426 (±8.5)	398 (±10.6)	392 (±6.4)	▼ 385 (±8.9)	▼ 387 (±8.6)
SA	409 (±11.4)	400 (±15.5)	392 (±8.8)	392 (±7.9)	▼ 380 (±10.4)	392 (±10.0)
WA	410 (±10.0)	415 (±14.5)	408 (±7.5)	406 (±9.5)	393 (±9.6)	▼ 381 (±10.0)
TAS	391 (±13.2)	405 (±14.9)	414 (±11.7)	395 (±12.3)	386 (±13.5)	406 (±12.1)
NT	359 (±26.6)	▼ 302 (±39.2)	320 (±25.6)	319 (±31.1)	326 (±28.6)	325 (±33.7)
ACT	432 (±20.7)	427 (±17.6)	414 (±12.1)	429 (±13.2)	415 (±10.6)	418 (±14.3)
Aust.	407 (±5.2)	407 (±5.0)	403 (±4.3)	394 (±4.4)	392 (±5.1)	400 (±5.4)

Confidence Intervals (1.96 * SE) are reported in brackets.

▲ if significantly higher than in 2023

▼ if significantly lower than in 2023

[9] The sample design for very remote areas changed between 2018 and 2023, aligning the sample design with other national and international assessments. As a result, no comparisons can be made between 2018 and 2023 for remote areas.

For Year 10 at the jurisdictional level, none of the 3 states that opted to report at the jurisdictional level showed a significance increase or decrease in the percentage of students achieving the proficient standard or in average scale score (see Table 4.11 and Table 4.12).

Table 4.11: Percentages of Year 10 students attaining the proficient standard nationally and by state and territory since 2018

State/territory	2023		2018	
NSW	52	(±4.9)	49	(±4.8)
VIC	53	(±5.0)	47	(±5.5)
QLD	-		-	
SA	-		-	
WA	57	(±6.6)	58	(±7.3)
TAS	-		-	
NT	-		-	
ACT	-		-	
Aust.	54	(±2.9)	50	(±2.8)

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table 4.12: NAP–Science Literacy average scale scores nationally and by state and territory for Year 10 since 2018

State/territory	2023		2018	
NSW	497	(±13.3)	486	(±11.8)
VIC	500	(±10.6)	487	(±15.3)
QLD	-		-	
SA	-		-	
WA	509	(±17.2)	515	(±18.7)
TAS	-		-	
NT	-		-	
ACT	-		-	
Aust.	503	(±6.9)	490	(±7.3)

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Student achievement and background characteristics

This section describes science literacy by gender, Indigenous status, language spoken at home, geographic location, parental occupation and parental education.

Differences in achievement by gender since 2006

Differences in science literacy between male and female students were not statistically significant in 2023 nor in any previous cycles, either in percentage attaining the proficient standard or in average scale score (see Table 4.13 and Table 4.14). Neither gender group showed changes in achievement over time.

Table 4.13: Percentages of students attaining the proficient standard by gender since 2006

	Gender	2023	2018	2015	2012	2009	2006
Year 6	Male	57 (±3.2)	57 (±3.0)	54 (±2.1)	52 (±2.6)	52 (±2.6)	55 (±2.5)
	Female	56 (±3.3)	59 (±3.9)	57 (±2.3)	51 (±2.2)	52 (±2.6)	54 (±2.3)
Year 10	Male	54 (±4.3)	49 (±4.4)				
	Female	53 (±3.5)	50 (±3.8)				

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

Table 4.14: NAP–Science Literacy average scale scores by gender since 2006

	Gender	2023	2018	2015	2012	2009	2006
Year 6	Male	410 (±7.1)	405 (±6.7)	398 (±5.1)	394 (±5.6)	393 (±6.0)	402 (±6.4)
	Female	404 (±5.9)	409 (±6.3)	408 (±5.1)	395 (±4.4)	391 (±5.2)	398 (±5.1)
	Difference (M – F)	6 (±7.8)	-4 (±8.3)				
Year 10	Male	503 (±10.1)	485 (±11.4)				
	Female	504 (±7.6)	494 (±8.1)				
	Difference (M – F)	-1 (±11.5)	-9 (±13.4)				

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
Statistically significant differences are in bold font.
Confidence intervals for differences were not reported in cycles prior to 2018.

Differences in achievement by Indigenous status since 2006

One out of 3 Indigenous Year 6 students and one out of 4 Indigenous Year 10 students attained the proficient standard. The achievement gap for Year 6 in average score between Indigenous and non-Indigenous students was significant and large in 2023 and has not changed since 2018 (see Table 4.16). The gap appeared to be larger for Year 10 than for Year 6.

There was no change in the percentage of Indigenous students achieving the proficient standard since 2015 for Year 6 and since 2018 for Year 10 (see Table 4.15). However, the 2023 achievement of Indigenous Year 6 students was significantly higher than in 2012 and in 2009, in terms of both the percentage achieving the proficient standard and the average scale scores. There has been no change in achievement for non-Indigenous students across all cycles, reflected by both the percentage achievement of the proficient standard and the average scale scores.

Table 4.15: Percentages of students attaining the proficient standard by Indigenous status since 2006

	Indigenous status	2023	2018	2015	2012	2009	2006
Year 6	Non-Indigenous students	58 (±2.6)	60 (±2.5)	57 (±1.8)	53 (±2.0)	54 (±2.3)	55 (±2.2)
	Indigenous students	34 (±10.5)	35 (±9.1)	23 (±4.8)	▼20 (±5.8)	▼ 20 (±6.0)	26 (±10.0)
Year 10	Non-Indigenous students	55 (±3.1)	51 (±2.9)				
	Indigenous students	28 (±8.0)	20 (±10.5)				

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

Table 4.16: NAP–Science Literacy average scale scores by Indigenous status since 2006

	Indigenous status	2023	2018	2015	2012	2009	2006
Year 6	Non-Indigenous students	410 (±5.1)	412 (±4.9)	408 (±4.2)	399 (±4.5)	397 (±5.0)	402 (±5.8)
	Indigenous students	344 (±27.9)	339 (±21.8)	315 (±13.7)	▼ 303 (±15.1)	▼ 297 (±16.0)	311 (±29.4)
	Difference (Non-Indigenous – Indigenous)	**66** (±27.7)	**73** (±21.8)				
Year 10	Non-Indigenous students	507 (±6.7)	494 (±7.0)				
	Indigenous students	429 (±19.7)	408 (±37.6)				
	Difference (Non-Indigenous – Indigenous)	**77** (±19.6)	**86** (±37.4)				

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
Statistically significant differences are in bold font.
Confidence intervals for differences were not reported in cycles prior to 2018.

Differences in achievement by language spoken at home since 2009

Table 4.17 and Table 4.18 show that more Year 6 students speaking a language other than English at home achieved the proficient standard in 2023 (58%) than in 2012 (48%) and their average achievement was higher in 2023 (412 score points) than in 2009 (384 score points). While differences with the other previous cycles were not statistically significant, there appears to be a positive long-term trend for this group in science literacy (see Table 4.17). In 2018, students speaking English at home outperformed students speaking other languages at home by 13 score points. This was no longer the case in 2023.

Year 10 students speaking a language other than English at home also showed an increase in average achievement compared to 2018 (512 and 486 score points, respectively).

Table 4.17: Percentages of students attaining the proficient standard by language spoken at home since 2009

	Language spoken at home	2023	2018	2015	2012	2009
Year 6	English	56 (±3.0)	59 (±2.8)	56 (±2.0)	53 (±2.1)	53 (±2.3)
	Language other than English	58 (±4.2)	56 (±5.2)	52 (±3.6)	▼ 48 (±5.4)	49 (±4.9)
Year 10	English	52 (±3.4)	51 (±3.0)			
	Language other than English	58 (±4.5)	49 (±6.6)			

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

Table 4.18: NAP–Science Literacy average scale scores by language spoken at home since 2009

	Language spoken at home	2023	2018	2015	2012	2009
Year 6	English	405 (±6.2)	411 (±6.0)	405 (±4.6)	397 (±4.5)	396 (±4.7)
	Language other than English	412 (±9.3)	398 (±10.5)	396 (±9.3)	389 (±13.7)	▼ 384 (±13.0)
	Difference (English – Other)	-7 (±10.8)	▲ **13** (±12.1)			
Year 10	English	501 (±8.1)	493 (±8.3)			
	Language other than English	512 (±11.6)	▼ 486 (±15.7)			
	Difference (English – Other)	-11 (±13.6)	7 (±17.6)			

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
Statistically significant differences are in bold font.
Confidence intervals for differences were not reported in cycles prior to 2018.

Differences in achievement by geographic location since 2018

Australia's classification for geographic location was changed between 2015 and 2018. Therefore, trends in achievement can only be reported back to 2018. In addition, the sample design for very remote areas changed between 2018 and 2023, aligning the sample design with other national and international assessments. As a result, no comparisons can be made between 2018 and 2023 for remote areas. Furthermore, there were insufficient numbers of participating Year 10 students in remote areas to be reported.

In 2023, almost 60% of Year 6 and Year 10 students in major cities achieved the proficient standard (see Table 4.19). In regional areas, the percentage was still above 50% in Year 6, but dropped to 42% in regional areas in Year 10 and in remote areas for Year 6.

As shown in Table 4.20, students from major cities had significantly higher achievement than students in regional areas. The difference was small in Year 6 and moderate in Year 10. There were no significant changes in achievement of students in major cities or regional areas since 2018.

Table 4.19: Percentages of students attaining the proficient standard by geographic location since 2018

	Geographic location	2023		2018	
Year 6	Major cities	59	(±3.0)	61	(±2.8)
	Regional	51	(±6.2)	54	(±4.5)
	Remote	42	(±11.0)	c	
Year 10	Major cities	58	(±3.8)	53	(±3.5)
	Regional	42	(±6.7)	45	(±5.2)
	Remote	n		c	

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

n = too few observations to provide reliable estimates (i.e. there are fewer than 30 students or fewer than 5 schools with valid data).

c = not comparable because of a difference in sample design between the two cycles.

Table 4.20: NAP–Science Literacy average scale scores by geographic location since 2018

	Geographic location	2023		2018	
Year 6	Major cities	414	(±6.5)	418	(±6.4)
	Regional	390	(±12.3)	392	(±8.6)
	Remote	364	(±30.6)	c	
	Difference (Maj – Reg)	**24**	(±14.7)	**26**	(±11.0)
	Difference (Reg – Rem)	26	(±33.0)	c	
Year 10	Major cities	515	(±8.0)	500	(±8.3)
	Regional	472	(±17.4)	477	(±15.4)
	Remote	n		c	
	Difference (Maj – Reg)	**43**	(±20.7)	**23**	(±18.3)
	Difference (Reg – Rem)	n		c	

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
Statistically significant differences are in bold font.
n = too few observations to provide reliable estimates (i.e. there are fewer than 30 students or fewer than 5 schools with valid data).
c = not comparable because of a difference in sample design between the two cycles.

Differences in achievement by parental occupation since 2018

Results by parental occupation and education groups are not compared to assessment cycles prior to 2018 because of differences in the percentage of missing values. In 2018 and 2023, the percentage of missing values on these variables was below 10%.

In both Year 6 and Year 10, about 70% of students with at least one parent in the highest occupational group (senior managers and professionals) reached the proficient standard (see Table 4.21). This percentage dropped to 41% for Year 6 and 34% for Year 10 with parents in the lowest occupation group.

A similar relationship between parental occupation and achievement can be seen when observing mean achievement scores for each occupation group (see Table 4.22).

There were no significant changes in achievement between 2018 and 2023 for any occupation group in either year level.

Table 4.21: Percentages of students attaining the proficient standard by parental occupation since 2018

	Highest parental occupation	2023		2018	
Year 6	Senior managers and professionals	71	(±3.4)	73	(±3.2)
	Other managers and associate professionals	60	(±4.3)	60	(±4.8)
	Tradespeople & skilled office, sales and service staff	50	(±4.6)	52	(±4.5)
	Machine operators, labourers, hospitality, and related staff	41	(±6.6)	49	(±6.0)
	Not in paid work in last 12 months	33	(±7.9)	43	(±7.3)
Year 10	Senior managers and professionals	70	(±3.7)	70	(±4.1)
	Other managers and associate professionals	59	(±4.9)	56	(±4.8)
	Tradespeople & skilled office, sales and service staff	39	(±5.2)	38	(±4.8)
	Machine operators, labourers, hospitality, and related staff	34	(±6.8)	30	(±7.1)
	Not in paid work in last 12 months	28	(±10.6)	23	(±7.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

Table 4.22: NAP–Science Literacy average scale scores by parental occupation since 2018

	Highest parental occupation	2023		2018	
Year 6	Senior managers and professionals	442	(±5.9)	447	(±7.3)
	Other managers and associate professionals	415	(±8.3)	412	(±8.5)
	Tradespeople & skilled office, sales and service staff	388	(±8.8)	394	(±8.9)
	Machine operators, labourers, hospitality, and related staff	369	(±9.6)	381	(±13.0)
	Not in paid work in last 12 months	349	(±20.7)	365	(±10.9)
Year 10	Senior managers and professionals	546	(±8.4)	541	(±8.6)
	Other managers and associate professionals	516	(±9.3)	506	(±10.8)
	Tradespeople & skilled office, sales and service staff	467	(±11.8)	462	(±11.4)
	Machine operators, labourers, hospitality, and related staff	448	(±16.7)	438	(±16.9)
	Not in paid work in last 12 months	430	(±19.9)	421	(±21.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023

Differences in achievement by parental education since 2018

As noted previously, results by parental education are only reported back to 2018.

Differences in student achievement were observed according to the highest level of education attained by the parents of the student. About 70% of students with at least one parent with a bachelor's degree or above attained the NAP–Science Literacy proficient standard compared to less than 50% of students whose parents' highest education was high school (see Table 4.23). Students at either year level who had at least one parent with a bachelor's degree or above had significantly higher achievement than students whose parents' highest education was at Year 10 or equivalent. In 2023, the difference in achievement between these 2 groups was found to be over 100 scale points, or one standard deviation (see Table 4.24).

Generally, achievement for these groups did not change significantly over time, except for Year 6 students with the highest parental education category of Certificate I to IV, which showed a decline in average scale score.

Table 4.23: Percentages of students attaining the proficient standard by parental education since 2018

	Highest parental education	2023		2018	
Year 6	Bachelor degree or above	71	(±2.6)	72	(±2.9)
	Advanced diploma/diploma	52	(±5.1)	54	(±5.5)
	Certificate I to IV (inc trade cert)	42	(±5.4)	50	(±4.8)
	Year 12 or equivalent	46	(±9.5)	50	(±7.1)
	Year 11 or equivalent	28	(±13.4)	40	(±11.2)
	Year 10 or equivalent*	30	(±12.4)	36	(±7.8)
	Year 9 or equivalent or below	23	(±14.3)		
Year 10	Bachelor degree or above	69	(±2.9)	70	(±3.9)
	Advanced diploma/diploma	46	(±6.4)	48	(±6.0)
	Certificate I to IV (inc trade cert)	37	(±5.3)	33	(±4.5)
	Year 12 or equivalent	41	(±8.1)	41	(±11.3)
	Year 11 or equivalent	28	(±13.4)	21	(±11.9)
	Year 10 or equivalent*	16	(±14.4)	25	(±8.5)
	Year 9 or equivalent or below	22	(±14.4)		

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
* In 2018, this category was reported as 'Year 10 or equivalent or below'.

Table 4.24: NAP–Science Literacy average scale scores by parental education since 2018

	Highest parental education	2023			2018	
Year 6	Bachelor degree or above	441	(±5.2)		443	(±6.5)
	Advanced diploma/diploma	395	(±9.9)		398	(±10.5)
	Certificate I to IV (inc trade cert)	370	(±8.4)	▲	387	(±7.8)
	Year 12 or equivalent	387	(±17.2)		388	(±14.9)
	Year 11 or equivalent	340	(±26.8)		353	(±22.5)
	Year 10 or equivalent*	339	(±22.1)		347	(±16.2)
	Year 9 or equivalent or below	330	(±34.5)			
Year 10	Bachelor degree or above	544	(±7.4)		540	(±8.6)
	Advanced diploma/diploma	484	(±10.9)		488	(±12.2)
	Certificate I to IV (inc trade cert)	461	(±11.8)		454	(±9.6)
	Year 12 or equivalent	467	(±16.2)		462	(±28.6)
	Year 11 or equivalent	425	(±30.5)		431	(±29.2)
	Year 10 or equivalent*	397	(±29.9)		415	(±28.0)
	Year 9 or equivalent or below	415	(±43.6)			

Confidence Intervals (1.96 * SE) are reported in brackets.
▲ if significantly higher than in 2023
▼ if significantly lower than in 2023
* In 2018, this category was reported as 'Year 10 or equivalent or below'.

Chapter 5: Science as a Human Endeavour

Chapter 5: Science as a Human Endeavour

Chapter highlights

- Students in Year 10 who agreed with statements about the nature of science (for example, "Science is about doing experiments") tended to perform better on the NAP–Science Literacy assessment.
- The majority of students had positive attitudes towards science, expressed interest in continuing to engage with science, and stressed the importance of science for society.
- Students who believed that science has a strong influence on society (for example, that science "helps to understand global issues that impact the environment") tended to have higher levels of science literacy.
- Students at both year levels were consistent in their attitudes towards what the scientific process entails (for instance, that science is about "making observations about the world").
- Students in Year 10 and students who had higher levels of science literacy tended to have stronger agreement in their attitudes towards what the scientific process entails.
- Students at both year levels were quite positive about the equality that exists for people of different cultures, people of different gender groups and people of different ages in their involvement with science.
- There were no gender differences in how students perceived equality in science, but Year 6 students perceived greater equality than Year 10 students. In addition, just over half of Year 10 students believed female scientists get as much recognition as male scientists.
- Year 10 students tended to be at least somewhat confident in their own ability to apply critical and creative thinking (for example, "making predictions based on prior evidence"). Those that were more confident tended to have higher achievement scores.

Introduction

After completing the NAP–Science Literacy assessment, students were given a questionnaire that was designed to be completed by most students in about 20 minutes. Student responses to the questionnaire provided rich data about their understanding of scientific knowledge. The content for the questionnaire is guided by the NAP–Science Literacy Assessment Framework (ACARA 2023a) and included questions (typically incorporating a number of items) about their attitudes towards science in general, how much exposure they have to science-related areas and their engagement in scientific-related activities. The content of the questionnaire is included in Appendix D.

The student questionnaire has an extensive history as part of NAP–Science Literacy assessment, first appearing in the 2009 cycle. Much of the content has been modified over the various cycles, reflecting both the changing way in which students learn about science over time, and changes to the Assessment Framework.

This chapter explores the first broad area that is defined in the Contextual Framework chapter of the Assessment Framework: Science as a human endeavour. The chapter will cover topics related to how students perceive science (for example, what do they believe the nature of science is about), their beliefs about the influence of science on society, their perception of the scientific process, their attitudes towards science and their self-efficacy towards science.

Student perceptions of science

One of the 2 sub-strands in the Science as a Human Endeavour strand from the Australian Curriculum: Science is Nature and development of science (ACARA 2023a). The sub-strand lists a range of topics that define the unique nature of what science and scientific knowledge are about, including how inquiry, knowledge and empirical evidence are based on both individual and collaborative investigation.

Several of these concepts were included in a question requiring students to indicate their level of agreement ("Strongly agree", "Agree", "Disagree", "Strongly disagree") with a series of statements about the nature of science. The percentages for each response option (included aggregated agreement) for both Year 6 and Year 10 students are presented in Table 5.1.

Table 5.1: Percentages of perceptions of the nature of science

	Perceptions of the nature of science	Strongly agree		Agree		Disagree		Strongly disagree		% Agreement 2023	
Year 6	Science is about remembering facts.	11	(±1.0)	48	(±1.5)	35	(±1.5)	6	(±0.8)	59	(±1.6)
	Science is about doing experiments.	32	(±1.5)	50	(±1.7)	16	(±1.3)	2	(±0.5)	82	(±1.3)
	Science is finding out about how things work.	46	(±1.6)	50	(±1.6)	3	(±0.6)	1	(±0.3)	96	(±0.7)
	Science is about solving problems.	28	(±1.5)	51	(±1.5)	18	(±1.3)	3	(±0.6)	79	(±1.4)
	Science is about collaborating with others.	21	(±1.6)	51	(±1.6)	24	(±1.4)	4	(±0.6)	72	(±1.5)
	Science is about making enquiries.	25	(±1.6)	58	(±1.9)	14	(±1.3)	3	(±0.7)	83	(±1.4)
Year 10	Science is about remembering facts.	13	(±1.4)	56	(±2.0)	26	(±1.8)	4	(±0.9)	70	(±1.8)
	Science is about doing experiments.	19	(±1.6)	63	(±2.2)	16	(±1.4)	3	(±0.6)	82	(±1.6)
	Science is finding out about how things work.	42	(±2.1)	54	(±2.3)	3	(±0.6)	2	(±0.6)	95	(±1.0)
	Science is about solving problems.	30	(±1.9)	57	(±2.2)	11	(±1.1)	3	(±0.8)	87	(±1.5)
	Science is about collaborating with others.	16	(±1.6)	60	(±2.3)	20	(±1.8)	4	(±0.9)	76	(±2.0)
	Science is about making enquiries.	27	(±1.9)	60	(±2.1)	10	(±1.2)	3	(±0.8)	87	(±1.5)

Confidence Intervals (1.96 * SE) are reported in brackets.

Results are rounded to the nearest whole number so some totals may appear inconsistent.

In general, students tended to express agreement with all the items in this question on the nature of what science is. Almost all students at both year levels agreed that “Science is finding out about how things work (95% to 96% agreement). Although students overall did agree that “Science is about remembering facts” (59% agreement for Year 6, 70% agreement for Year 10), it had the lowest level of agreement out of all the items. Several of these items were last administered in NAP–Science Literacy 2015 to a Year 6 population. Although no direct comparisons have been made, we do note that a similar pattern of general agreement to these statements was also observed in that cycle (see ACARA 2017).

A scale was derived based on all items in this question to compare student perceptions of the nature of science across different subgroups. Item response theory was used to derive weighted likelihood estimates for this index.

Scale scores were transformed to a metric where the national mean score for Year 6 students was 50 with a standard deviation of 10. The scaling analyses and procedures for these items, as well as information about reliabilities, are detailed in the NAP—Science Literacy 2023 Technical Report.

Table 5.2: Average scale scores for perceptions of the nature of science, overall and by gender

Perceptions of the nature of science	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.3)	50.5	(±0.5)	49.4	(±0.4)	**1.1**	(±0.6)
Year 10	50.5	(±0.5)	50.3	(±0.6)	50.7	(±0.7)	-0.3	(±0.9)
Difference (Year 10-Year 6)	0.5	(±0.6)	-0.2	(±0.8)	**1.2**	(±0.8)	**-1.5**	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The scale scores of the index for student perceptions of the nature of science for both male and female students across both year levels are displayed in Table 5.2. Overall, there was no difference in how students responded to these items across year levels. A gender difference was observed for Year 6 students in the way in which students responded to these items (male students expressing higher agreement), but this gender difference did not exist at the Year 10 level.

For the exploration of the association between students’ perceptions of the nature of science and NAP–Science Literacy scale scores, 2 methods of association are reported. The first presents average attitude scale scores for students who are either above the proficient standard for NAP–Science Literacy or below it. This helps to explain whether students with a greater level of science literacy have different attitudes towards the nature of science, in comparison to those with less developed levels of knowledge.

The second method reports the correlation between each attitude of interest and NAP–Science Literacy scale scores. Pearson’s correlation coefficients can assume values between –1 and +1. A positive correlation between the NAP–Science Literacy scale and an attitudinal measure scale would mean that an increase in student achievement corresponds to an increase in the attitudinal scale score. A negative correlation indicates an association in which an increase in one measure corresponds to a decrease in the other measure.

Students above the proficient standard had significantly higher levels of agreement with statements about the nature of science than students below the proficient standard (see Table 5.3), with the exception of female students in Year 6. A difference of 4.5 scale points was observed at the Year 10 level in comparison to a difference of 1.6 scale points at the Year 6 level. Correlations between the perception of the nature of science and science achievement were positive but weak for Year 6 (0.13) and for Year 10 (0.28).

Table 5.3: Average scale scores for perceptions of the nature of science for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	50.7	(±0.4)	51.4	(±0.6)	49.9	(±0.6)
	Below	49.1	(±0.6)	49.3	(±0.8)	48.9	(±0.8)
	Difference	**1.6**	(±0.8)	**2.1**	(±1.0)	1.0	(±1.1)
	Correlation	**0.13**	(±0.04)	**0.14**	(±0.05)	**0.11**	(±0.05)
Year 10	Above	52.2	(±0.5)	52.3	(±0.7)	52.2	(±0.7)
	Below	47.7	(±0.8)	47.2	(±1.2)	48.2	(±0.9)
	Difference	**4.5**	(±1.0)	**5.0**	(±1.6)	**4.0**	(±1.2)
	Correlation	**0.28**	(±0.05)	**0.29**	(±0.07)	**0.27**	(±0.05)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Students were given 2 questions that broadly cover a range of student attitudes towards science including their attitude towards learning science at school, their beliefs about how much science influences our daily lives, and how to discern scientific information from different sources. In these 2 questions, they were asked to indicate their level of agreement with different statements (ranging from "Strongly agree" to "Strongly disagree")[10].

Results presented in Table 5.4 indicate high levels of agreement for the majority of items across both year levels. The statements "Our scientific knowledge is constantly changing" and "Science can help us understand global issues that impact on people and the environment" attracted the most agreement from both Year 6 and Year 10 students. Large majorities agreed that "Science is important because it changes how we live" (89% for Year 6, 88% for Year 10), "Scientific information helps people make informed decisions" (85% for Year 6, 83% for Year 10) and "I follow the advice of the scientific community when making decisions related to health crises (e.g. during the COVID-19 pandemic)" (83% for both year levels). More than 4 out of 5 students at the Year 6 level also agreed that "Science is important for lots of jobs" and more than 4 out of 5 students at the Year 10 level agreed that "Government decisions should be based on scientific evidence where available".

Lower levels of agreement were observed for items more closely related to self-reflection. At both year levels, statements such as "Science is part of my everyday life" (43% agreement at Year 6 level, 54% agreement at Year 10 level), "I learn science topics quickly" (51% agreement at Year 6 level, 49% agreement at Year 10 level) and "I can understand new ideas about science easily" (56% agreement at Year 6 level, 51% agreement at Year 10 level). Fewer than 4 out of 10 Year 10 students indicated that they were considering a science-related career[11].

[10] Although the majority of items were administered to both year levels, only Year 6 students were administered the items "I would like to learn more science at school" and "I think it would be interesting to be a scientist". Similarly, only Year 10 students were administered the items "I want to study one or more science subjects in Years 11 and 12" and "I am considering a science-related career".
[11] Item only administered at Year 10 level.

Table 5.4: Percentages of student attitudes towards science

	Student attitudes towards science	Strongly agree		Agree		Disagree		Strongly disagree		% Agreement	
Year 6	I would like to learn more science at school.	20	(±1.8)	58	(±1.8)	18	(±1.5)	4	(±0.6)	78	(±1.7)
	I think it would be interesting to be a scientist.	13	(±1.1)	46	(±1.7)	30	(±1.5)	10	(±1.0)	60	(±1.8)
	I enjoy doing science.	19	(±1.6)	56	(±2.0)	20	(±1.5)	5	(±0.8)	75	(±1.7)
	I enjoy learning new things in science.	29	(±1.5)	56	(±1.6)	12	(±1.2)	3	(±0.7)	84	(±1.4)
	I learn science topics quickly.	11	(±0.9)	40	(±1.6)	39	(±1.6)	10	(±0.9)	51	(±1.8)
	I can understand new ideas about science easily.	12	(±1.0)	44	(±1.5)	36	(±1.6)	8	(±1.0)	56	(±1.6)
	Science is part of my everyday life.	13	(±1.2)	30	(±1.5)	39	(±1.7)	19	(±1.5)	43	(±1.8)
	Science is important for lots of jobs.	34	(±1.7)	49	(±1.7)	14	(±1.3)	3	(±0.7)	83	(±1.5)
	Science is important because it changes how we live.	43	(±2.0)	46	(±1.9)	8	(±1.1)	3	(±0.6)	89	(±1.4)
	Scientific information helps people make good decisions.	29	(±1.6)	49	(±1.7)	17	(±1.6)	4	(±0.6)	79	(±1.8)
	Scientific information helps people make informed decisions.	26	(±1.6)	59	(±1.7)	12	(±1.1)	3	(±0.6)	85	(±1.3)
	Our scientific knowledge is constantly changing.	43	(±1.6)	49	(±1.4)	6	(±0.8)	2	(±0.5)	92	(±1.0)
	Science can help us understand global issues that impact on people and the environment.	49	(±1.8)	44	(±1.7)	6	(±0.9)	2	(±0.5)	93	(±1.2)
	I follow the advice of the scientific community when making decisions related to health crises (e.g. during the COVID-19 pandemic).	34	(±1.5)	49	(±1.8)	12	(±1.0)	4	(±0.8)	83	(±1.3)
	Government decisions should be based on scientific evidence where available.	23	(±1.4)	51	(±1.5)	22	(±1.4)	5	(±0.8)	74	(±1.5)
	I know where to find scientific information about local and global issues.	18	(±1.4)	48	(±1.6)	27	(±1.5)	7	(±0.9)	66	(±1.7)
	I know how to decide whether to trust online information about a science topic.	23	(±1.6)	52	(±1.5)	20	(±1.4)	5	(±0.9)	75	(±1.6)

(Continued) Table 5.4: Percentages of student attitudes towards science

	Student attitudes towards science	Strongly agree		Agree		Disagree		Strongly disagree		% Agreement	
Year 10	I want to study one or more science subjects in Years 11 and 12.	25	(±2.0)	34	(±2.0)	25	(±1.9)	15	(±1.3)	59	(±2.2)
	I am considering a science-related career.	11	(±1.3)	27	(±1.6)	37	(±2.0)	25	(±1.7)	38	(±2.1)
	I enjoy doing science.	14	(±1.5)	51	(±1.7)	26	(±1.7)	10	(±1.3)	64	(±2.0)
	I enjoy learning new things in science.	18	(±1.6)	58	(±1.8)	16	(±1.4)	8	(±1.2)	76	(±1.7)
	I learn science topics quickly.	9	(±1.1)	41	(±1.8)	36	(±1.9)	14	(±1.3)	49	(±2.1)
	I can understand new ideas about science easily.	10	(±1.2)	42	(±2.0)	37	(±2.0)	11	(±1.1)	51	(±2.2)
	Science is part of my everyday life.	14	(±1.4)	39	(±2.0)	33	(±1.7)	14	(±1.4)	54	(±2.0)
	Science is important for lots of jobs.	27	(±2.0)	52	(±1.9)	16	(±1.5)	6	(±0.9)	78	(±1.6)
	Science is important because it changes how we live.	38	(±2.4)	51	(±2.1)	8	(±1.1)	4	(±1.0)	88	(±1.4)
	Scientific information helps people make good decisions.	26	(±1.8)	51	(±1.9)	17	(±1.4)	6	(±1.1)	77	(±1.6)
	Scientific information helps people make informed decisions.	26	(±2.1)	57	(±2.1)	12	(±1.4)	5	(±0.9)	83	(±1.6)
	Our scientific knowledge is constantly changing.	44	(±2.4)	48	(±2.3)	4	(±0.9)	3	(±0.8)	92	(±1.3)
	Science can help us understand global issues that impact on people and the environment.	46	(±2.6)	46	(±2.5)	4	(±1.0)	3	(±0.8)	92	(±1.4)
	I follow the advice of the scientific community when making decisions related to health crises (e.g. during the COVID-19 pandemic).	31	(±2.3)	52	(±2.2)	11	(±1.3)	6	(±1.2)	83	(±1.6)
	Government decisions should be based on scientific evidence where available.	29	(±1.7)	53	(±1.8)	13	(±1.4)	5	(±0.9)	82	(±1.7)
	I know where to find scientific information about local and global issues.	16	(±1.5)	55	(±1.9)	24	(±1.6)	6	(±1.0)	70	(±1.8)
	I know how to decide whether to trust online information about a science topic.	18	(±1.6)	57	(±1.8)	18	(±1.5)	6	(±1.0)	76	(±1.5)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

The statements presented in Table 5.4 comprise a combination of new material for the current cycle, and older material from previous cycles. They cover a range of different topics related to intentions for future uses of science, and broad attitudes towards science. The last 10 items specifically relate to perceptions of the influence of science, and these items were used to derive a scale. Scale scores comparing Year 6 students with Year 10 students (Table 5.5) revealed no difference in how students perceive influences of science across year levels, both for each gender group and overall.

Table 5.5: Average scale scores for perceptions of the influences of science, overall and by gender

Perceptions of the influences of science	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	50.2	(±0.6)	49.8	(±0.5)	0.4	(±0.7)
Year 10	50.4	(±0.5)	50.2	(±0.7)	50.6	(±0.7)	-0.4	(±1.0)
Difference (Year 10-Year 6)	0.4	(±0.7)	0.0	(±0.9)	0.8	(±0.9)	-0.8	(±1.3)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The relationship between student perceptions of the influence of science and achievement is summarised in Table 5.6. Higher performing students (those who performed at a level above the proficient standard) perceived the influence of science on society to be greater than lower performing students (those who performed below the proficient standard). Large differences and moderate correlations between scale scores and achievement were found at both Year 6 level and Year 10 level for male and female students.

Table 5.6: Average scale scores for perceptions of the influences of science for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	52.6	(±0.5)	53.2	(±0.6)	52	(±0.7)
	Below	46.4	(±0.6)	45.9	(±1.0)	46.9	(±0.6)
	Difference	**6.2**	(±0.7)	**7.3**	(±1.2)	**5.1**	(±0.8)
	Correlation	**0.38**	(±0.03)	**0.41**	(±0.05)	**0.35**	(±0.04)
Year 10	Above	54.3	(±0.6)	54.4	(±0.8)	54.1	(±0.9)
	Below	45.9	(±0.7)	45.2	(±1.0)	46.6	(±1.0)
	Difference	**8.4**	(±0.9)	**9.3**	(±1.3)	**7.5**	(±1.2)
	Correlation	**0.47**	(±0.04)	**0.49**	(±0.05)	**0.45**	(±0.05)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Students were given a question asking them about their level of agreement with various statements on different perspectives on the scientific process (“Strongly agree”, “Agree”, “Disagree”, “Strongly disagree”). Percentage agreement for this question is presented in Table 5.7. In general, students at both year levels had high levels of agreement with each of the 6 statements, with most items attracting “Strongly agree” or “Agree” responses from at least 4 out of 5 students. The exception is for the item “describing patterns and relationships” which only attracted agreement from less than two-thirds of Year 6 students. For every item at each year level, students were most likely to select the “Agree” response in comparison to any other response.

Table 5.7: Percentages of perceptions of the scientific process

	Science is about…	Strongly agree	Agree	Disagree	Strongly disagree	% Agreement 2023
Year 6	making observations about the world.	31 (±1.6)	59 (±1.6)	8 (±0.9)	2 (±0.5)	90 (±1.1)
	asking questions about objects and events.	27 (±1.5)	57 (±1.7)	14 (±1.1)	2 (±0.5)	84 (±1.2)
	making predictions and testing them.	43 (±1.7)	48 (±1.7)	7 (±1.0)	2 (±0.5)	92 (±1.3)
	describing patterns and relationships.	16 (±1.4)	49 (±1.7)	29 (±1.6)	6 (±0.8)	65 (±1.8)
	using evidence to develop explanations.	36 (±1.8)	52 (±1.7)	9 (±0.8)	3 (±0.6)	89 (±1.1)
	building knowledge by trial and error.	39 (±1.8)	47 (±1.9)	11 (±1.1)	3 (±0.6)	86 (±1.3)
Year 10	making observations about the world.	30 (±2.2)	58 (±2.2)	8 (±1.0)	4 (±0.9)	88 (±1.4)
	asking questions about objects and events.	29 (±2.0)	57 (±2.1)	10 (±1.3)	4 (±1.0)	86 (±1.7)
	making predictions and testing them.	35 (±1.9)	55 (±2.3)	6 (±1.0)	4 (±0.9)	91 (±1.5)
	describing patterns and relationships.	28 (±2.0)	56 (±2.2)	11 (±1.3)	4 (±1.0)	84 (±1.8)
	using evidence to develop explanations.	38 (±2.3)	53 (±2.3)	5 (±0.9)	4 (±0.9)	91 (±1.4)
	building knowledge by trial and error.	33 (±2.0)	55 (±2.3)	8 (±1.1)	4 (±0.9)	88 (±1.6)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

The 6 items presented in Table 5.7 were used to derive a scale of student perceptions of the scientific process. Higher scale scores correspond to a perception that science has a greater influence on society. In Table 5.8, it can be observed that students at the Year 10 level had greater agreement with perceptions of the scientific process than students at the Year 6 level, with a small difference of one score point. This was largely driven by differences across the year levels for female students (no difference was observed for male students). A gender difference was observed at the Year 6 level, but not at the Year 10 level.

Table 5.8: Average scale scores for perceptions of the scientific process, overall and by gender

Perceptions of the scientific process	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	50.4	(±0.5)	49.6	(±0.5)	**0.8**	(±0.6)
Year 10	51.0	(±0.6)	50.6	(±0.7)	51.4	(±0.7)	-0.8	(±0.9)
Difference (Year 10-Year 6)	**1.0**	(±0.7)	0.2	(±0.9)	**1.7**	(±0.9)	**-1.6**	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The relationship between perceptions of the scientific process and achievement is explored in Table 5.9. Students with higher scale scores on the perceptions of the scientific process outperformed students who had lower scale scores. This finding was confirmed by both the large differences between students above and below the proficient standard, and with the moderate associations between the scale and the achievement metric. The finding was consistent for both year levels and across gender.

Table 5.9: Average scale scores for perceptions of the scientific process for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	52.6	(±0.5)	53.0	(±0.6)	52.1	(±0.6)
	Below	46.4	(±0.6)	46.5	(±0.8)	46.3	(±0.7)
	Difference	**6.2**	(±0.8)	**6.6**	(±1.1)	**5.8**	(±1.0)
	Correlation	**0.38**	(±0.03)	**0.39**	(±0.04)	**0.36**	(±0.04)
Year 10	Above	55.0	(±0.7)	54.7	(±0.7)	55.2	(±0.9)
	Below	46.2	(±0.8)	45.4	(±1.3)	46.8	(±0.9)
	Difference	**8.8**	(±1.1)	**9.3**	(±1.7)	**8.4**	(±1.3)
	Correlation	**0.46**	(±0.04)	**0.47**	(±0.06)	**0.45**	(±0.05)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Student attitudes towards equality

Gauging young people's perspectives on equality in science is important because it helps to identify and address current barriers to inclusion, paving the way for a more diverse and innovative scientific community. Students were asked to provide their level of agreement ("Strongly agree", "Agree", "Disagree", "Strongly disagree") with a series of statements about science and equality. The statements covered a range of topics to do with gender, multiculturalism and different age groups. The percentages of student responses to these items are presented in Table 5.10.

Most students (at least 4 out of 5 students) agreed (either by selecting "Strongly agree" or "Agree") with all items, with lower agreement observed for the final item ("female scientists get as much recognition as male scientists"). This last item attracted agreement of 69% (Year 6) and 55% (Year 10).

Table 5.10: Percentages of attitudes towards equality in science

	Attitudes towards equality	Strongly agree		Agree		Disagree		Strongly disagree		% Agreement	
Year 6	People from many different countries have made important contributions to science.	49	(±1.9)	45	(±1.8)	4	(±0.7)	1	(±0.5)	94	(±0.8)
	Women and men are both involved in science.	60	(±1.7)	35	(±1.6)	3	(±0.6)	1	(±0.4)	95	(±0.8)
	People from all cultural backgrounds in Australia are involved in science.	43	(±1.7)	45	(±1.6)	10	(±0.9)	2	(±0.6)	88	(±1.1)
	People of all ages are involved in science.	37	(±1.6)	46	(±1.6)	15	(±1.1)	3	(±0.6)	82	(±1.2)
	Women and men are equally skilled in science.	54	(±2.0)	36	(±1.7)	8	(±0.9)	3	(±0.6)	90	(±1.1)
	Female scientists get as much recognition as male scientists.	29	(±1.6)	40	(±1.6)	24	(±1.5)	7	(±0.9)	69	(±1.5)
Year 10	People from many different countries have made important contributions to science.	52	(±2.2)	42	(±2.4)	3	(±0.7)	3	(±0.9)	94	(±1.3)
	Women and men are both involved in science.	52	(±2.1)	40	(±2.2)	4	(±0.8)	3	(±0.9)	93	(±1.4)
	People from all cultural backgrounds in Australia are involved in science.	43	(±2.0)	46	(±2.0)	7	(±1.2)	3	(±0.9)	89	(±1.7)
	People of all ages are involved in science.	37	(±1.8)	48	(±2.1)	12	(±1.2)	4	(±1.1)	84	(±1.6)
	Women and men are equally skilled in science.	49	(±2.0)	40	(±2.1)	7	(±1.0)	5	(±1.1)	89	(±1.6)
	Female scientists get as much recognition as male scientists.	16	(±1.2)	39	(±1.8)	34	(±1.9)	11	(±1.4)	55	(±2.0)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

The 6 items presented in Table 5.10 were used to derive a scale of attitudes towards equality. Table 5.11 shows that there was a difference across year levels in how students perceived equality in relation to science. Year 6 students (male, female and overall) perceived greater equality than did Year 10 students. A difference of 1.4 score points was observed overall. No gender difference was observed in the way students responded to these items (3 of the 6 items reference gender).

Table 5.11: Average scale scores for attitudes towards equality in science, overall and by gender

Attitudes towards equality	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	49.9	(±0.6)	50.1	(±0.5)	-0.2	(±0.7)
Year 10	48.6	(±0.5)	48.4	(±0.7)	48.7	(±0.6)	-0.3	(±0.9)
Difference (Year 10-Year 6)	**-1.4**	(±0.6)	**-1.5**	(±0.9)	**-1.4**	(±0.8)	-0.1	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Table 5.12 presents the relationship between attitudes towards equality scale scores and achievement. Students performing above the proficient standard perceived higher levels of equality, a difference of 5 score points overall. This difference was large for males and moderate in size for females. The correlations between attitudes towards equality and science literacy achievement were moderate for male students and weak for female students at both year levels.

Table 5.12: Average scale scores for attitudes towards equality in science for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	52.0	(±0.4)	52.3	(±0.6)	51.8	(±0.6)
	Below	47.1	(±0.6)	46.4	(±0.9)	47.8	(±0.7)
	Difference	**5.0**	(±0.7)	**5.9**	(±1.1)	**4.0**	(±1.0)
	Correlation	**0.30**	(±0.04)	**0.32**	(±0.05)	**0.28**	(±0.05)
Year 10	Above	51.2	(±0.4)	51.7	(±0.6)	50.7	(±0.6)
	Below	45.4	(±0.8)	44.4	(±1.3)	46.4	(±1.1)
	Difference	**5.8**	(±0.9)	**7.3**	(±1.6)	**4.3**	(±1.3)
	Correlation	**0.34**	(±0.04)	**0.39**	(±0.06)	**0.29**	(±0.06)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Student self-efficacy

Scientific investigation involves complex and changing concepts. Research beginning with Bandura in the 1970s has established the positive influence that self-efficacy can have on a learner's ability to navigate and understand these complexities (Bandura 1977). Students who have higher self-efficacy are likely to engage with more difficult scientific concepts. Year 10 students were asked to provide their level of confidence in undertaking different scientific tasks specifically related to CCT ("Not at all confident", "Not very confident", "Somewhat confident", "Very confident"). Their responses to this question are presented in Table 5.13. For each of the 8 items, more than half of all students expressed that they were "Somewhat confident", and more than 7 out of 10 students indicated that they were either "Somewhat confident" or "Very confident" in their ability to undertake these activities. The pattern of responses to items in this question was similar; the proportion of students who selected either of these 2 responses options varied from 71% to 77% across each of the 8 items.

Table 5.13: Percentages of student self-efficacy to apply critical and creative thinking to problem-solving tasks

	Attitudes towards self-efficacy to apply critical and creative thinking to problem solving tasks	Not at all confident		Not very confident		Somewhat confident		Very confident	
Year 10	Making predictions based on prior evidence	7	(±1.3)	16	(±1.6)	59	(±2.1)	18	(±1.7)
	Identifying what I don't know about a topic, so I understand what I need to learn	5	(±0.9)	20	(±1.7)	54	(±2.1)	21	(±1.8)
	Identifying patterns and making connections between different pieces of information	6	(±1.0)	20	(±1.8)	55	(±2.1)	18	(±1.7)
	Testing different options and monitoring the outcomes	5	(±0.9)	21	(±1.7)	56	(±1.9)	18	(±1.7)
	Thinking about problems from different perspectives	5	(±0.9)	19	(±1.5)	53	(±2.1)	23	(±1.7)
	Working on tasks that require creative thinking	6	(±1.0)	20	(±1.6)	52	(±2.0)	23	(±1.7)
	Questioning the accuracy of the source of information I am receiving	6	(±1.1)	21	(±1.7)	54	(±2.0)	19	(±1.8)
	Explaining where my ideas came from	7	(±1.0)	22	(±1.7)	50	(±1.7)	21	(±1.5)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

The 8 items listed in Table 5.13 were used to derive a scale of student self-efficacy to apply CCT to problem-solving tasks. Scores for this scale are presented for Year 10 students overall and by gender in Table 5.14. No differences were found in scale scores between male and female students.

Table 5.14: Average scale scores for student self-efficacy to apply critical and creative thinking to problem-solving tasks, overall and by gender

Self-efficacy to apply critical and creative thinking to problem solving tasks	All students		Male		Female		Difference (M-F)	
Year 10	50.0	(±0.5)	50.2	(±0.7)	49.8	(±0.5)	0.5	(±0.8)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The relationship between student self-efficacy to apply CCT to problem-solving tasks and achievement is presented in Table 5.15. Students who met the proficient standard had scale scores that were 7 points higher than students who failed to meet the proficient standard. A large difference was also observed for male students (7.3 scale point difference) and female students (6.4 scale point difference). The association between scale score and achievement for all students was 0.40, a moderate association.

Table 5.15: Average scale scores for student self-efficacy to apply critical and creative thinking to problem-solving tasks for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 10	Above	53.1	(±0.4)	53.5	(±0.6)	52.7	(±0.6)
	Below	46.2	(±0.9)	46.2	(±1.3)	46.3	(±0.9)
	Difference	**6.8**	(±1.0)	**7.3**	(±1.4)	**6.4**	(±1.1)
	Correlation	**0.40**	(±0.05)	**0.41**	(±0.07)	**0.39**	(±0.06)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Chapter 6: Teaching and learning in science

Chapter 6: Teaching and learning in science

Chapter highlights

- At a national level, more than two-thirds of Year 6 students reported undertaking science lessons once a week or more, with a similar proportion reporting that their own classroom teacher taught them science. Five per cent of students reported that they never undertook science lessons at school.
- For Year 6 students, there appears to be some variation in reported science lesson frequency among the states and territories.
- There was no significant difference found between male and female students at either year level with respect to the breadth of science topics they reported studying at school.
- For Year 10 students, those with higher science literacy achievement reported having studied a greater breadth of science topics than those with lower achievement. This was true for both male and female students. For Year 6 students, no discernible association between achievement and breadth of science topics studied was found.
- In terms of the perceived clarity of scientific instruction, 82% of Year 6 students and 77% of Year 10 students reported that their teacher explains scientific concepts clearly to their class.
- Less than half of students at either year level reported having "in-depth discussions about science ideas" in their science lessons, with more than 10% of students reporting that they never did this.
- In Year 6, female students reported undertaking activities conducive to CCT in their science lessons more frequently than their male counterparts. In Year 10, there was no discernible difference between the genders reported for this index.
- Year 6 students reported undertaking activities conducive to CCT more frequently than students in Year 10.
- Male students in Year 6 reported higher levels of agreement with statements about their family's support for CCT behaviours than their Year 10 counterparts. This difference between year levels was not apparent for female students.
- Family support for CCT was positively associated with student achievement in science literacy. This was true in both Year 6 and Year 10 and for both male and female students.

Introduction

In evaluating the various factors that influence students' proficiency in science, NAP–Science Literacy considers the ways in which the teaching and learning of science exposes students to scientific concepts and ways of thinking, both at school and outside of school. At a fundamental level, this is examined in this chapter by looking at the reported frequency and content coverage of students' science lessons. This aspect is further explored by examining students' exposure to science-related activities that are conducive to CCT. This includes the frequency with which students report brainstorming ideas, planning and carrying out investigations, and having in-depth discussions about scientific ideas with peers during their science lessons.

The nexus between science literacy and CCT is also examined by looking at the extent to which students feel supported by their family to engage in activities related to CCT outside of school.

By exploring these diverse aspects of the teaching and learning of science, and with a particular focus on CCT, this chapter discusses the nuanced ways in which students interact with and internalise scientific knowledge. Furthermore, for each of the contextual scales presented, the ways in which this scale interacts with students' science literacy proficiency is examined.

To compare the extent of students' exposure to science across different subgroups, the following 3 scaled indices were derived:

- student reports of science topics studied at school
- student reports of exposure to activities conducive to CCT in science lessons
- family support for CCT.

For each index, average scale scores were compared between year levels and gender groups, and tests of significance were undertaken to determine whether the difference was statistically significant. Average questionnaire scale scores of students above and below the NAP–Science Literacy proficient standard were then examined to determine the nature of the relationship between each index and student achievement in the NAP–Science Literacy assessment.

Availability of science at school

Year 6 students were asked how often they have science lessons at school. Given the lack of clearly delineated science periods in many primary school settings, the following definition of a science lesson was provided to students:

"A science lesson is a lesson with any teacher where you explore how and why things happen. In science lessons, you do experiments, collect information, or talk about scientific ideas."

Table 6.1 provides the frequency with which Year 6 students reported undertaking science lessons at school, both at a national level and disaggregated by state/territory.

Table 6.1: Percentages of Year 6 students reporting undertaking science lessons at school, nationally and by state and territory

State/territory	More than once a week		Once a week		Less than once a week, but more than once a month		Once a month or less		Never	
NSW	14	(±5.1)	54	(±5.7)	22	(±4.1)	7	(±2.5)	3	(±1.4)
VIC	10	(±4.6)	36	(±7.9)	19	(±3.9)	21	(±5.2)	14	(±3.9)
QLD	45	(±9.4)	43	(±10.5)	8	(±2.4)	3	(±0.8)	1	(±0.8)
SA	28	(±7.9)	53	(±7.1)	12	(±2.9)	6	(±2.8)	2	(±1.4)
WA	23	(±8.4)	64	(±9.1)	6	(±2.5)	4	(±1.5)	3	(±2.2)
TAS	23	(±5.1)	37	(±6.3)	25	(±3.7)	11	(±4.7)	4	(±1.9)
NT	17	(±5.7)	52	(±8.9)	11	(±3.4)	13	(±5.1)	7	(±4.4)
ACT	31	(±14.4)	35	(±8.6)	21	(±8.6)	11	(±6.9)	2	(±1.5)
Aust.	22	(±2.9)	48	(±3.6)	16	(±1.8)	9	(±1.5)	5	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

At a national level, 70% of Year 6 students reported undertaking science lessons once a week or more, with 5% reporting that they never undertook science lessons at school.

At a state and territory level, there appears to be some variation between the groups with respect to science lesson frequency. For instance, 45% of Year 6 students in Queensland reported undertaking science lessons more than once a week, while this figure is only 10% for Victorian students. On the other end of the spectrum, a total of 14% of Year 6 students from Victoria reported never having a science lesson, with only 1% of students from Queensland in this category.

Science topics studied at school

The NAP–Science Literacy questionnaire asked students to report on which science topics they studied at school. Both Year 6 and Year 10 students were asked to indicate either "Yes" or "No" to each of the following content areas:

- Earth sciences – for example, weather, soil, rocks, using Earth's resources
- Space (astronomy) – for example, galaxies, objects in space including the planets, Sun and Moon
- Forces and motion – for example, how toys and other machines move and work
- Energy, forms and transfer – for example, electricity, heat, light, sound, magnets
- Living things – for example, how animals and plants survive in their environment, food chains and webs, ecosystems
- Multicellular systems – for example, the human body, cells, tissues, organs, body systems
- Diversity and evolution – for example, how living things change over time
- States of matter – for example, changes to materials (solids, liquids and gases), processes of change such as melting, evaporation
- Properties of matter – characteristics of materials such as density, mass, volume, melting point, hardness, elasticity

These science topics represent the essential content that students encounter in their science education through the Australian Curriculum: Science. The national and state/territory frequencies of Year 6 and Year 10 student responses are provided in Table 6.2.

At a national level, the frequency with which Year 6 students reported studying each of these science topics ranged from 68% ("Diversity and evolution") to 88% ("Earth sciences"). The exception to this was for the topic "Multicellular systems", with fewer than half of Year 6 students (41%) reporting that they studied this topic.

When examining the data at the jurisdictional level for Year 6, there appears to be little variation between the states and territories with respect to students' reported frequencies for each of the science topics. However, percentages for Victorian students in Year 6 seem to trend toward the lower end of the range for many of the topics. This is particularly the case for the "Properties of matter" topic, which 61% of Victorian students reported studying at school, approximately 10 percentage points lower than the national figure of 71%.

For Year 10, close to 90% of students reported studying each of the listed science topics. The notable exceptions to this were for the "Space (astronomy)" topic at 74% and "Diversity and evolution" at 67%. At the state level, there appears to be only a small amount of variation between the 3 reportable states, New South Wales, Victoria and Western Australia. However, for the "Space (astronomy)" topic, 64% of Year 10 students from Victoria reported studying this topic, while 78% of students from both New South Wales and Western Australia reported having studied this content.

Table 6.2: Percentages of student reports of science topics studied at school, nationally and by state and territory

State/territory	Earth sciences - for example, weather, soil, rocks, using Earth's resources	Space (astronomy) - for example, galaxies, objects in space including the planets, Sun and Moon	Forces and motion - for example, how toys and other machines move and work	Energy, forms and transfer - for example, electricity, heat, light, sound, magnets	Living things - for example, how animals and plants survive in their environment, food chains and webs, ecosystems	Multicellular systems - for example, the human body, cells, tissues, organs, body systems	Diversity and evolution - for example, how living things change over time	States of matter - for example, changes to materials (solids, liquids and gases), processes of change such as melting, evaporation	Properties of matter - characteristics of materials such as density, mass, volume, melting point, hardness, elasticity
Year 6									
NSW	89 (±2.2)	80 (±5.4)	75 (±3.6)	85 (±2.4)	84 (±2.9)	40 (±4.9)	68 (±4.5)	86 (±2.6)	71 (±3.3)
VIC	80 (±4.3)	73 (±5.1)	62 (±4.8)	75 (±4.9)	79 (±5.5)	43 (±6.9)	63 (±4.3)	76 (±5.1)	61 (±4.4)
QLD	92 (±2.2)	85 (±3.6)	74 (±3.6)	89 (±2.3)	85 (±2.8)	40 (±5.1)	71 (±3.7)	93 (±2.0)	81 (±2.9)
SA	89 (±2.6)	84 (±3.4)	71 (±4.4)	84 (±3.8)	85 (±4.3)	46 (±5.5)	67 (±3.3)	87 (±3.6)	70 (±4.1)
WA	93 (±2.2)	88 (±2.5)	70 (±3.2)	87 (±2.9)	85 (±2.9)	39 (±5.0)	70 (±3.8)	89 (±2.5)	74 (±3.7)
TAS	86 (±3.0)	81 (±2.9)	63 (±5.5)	81 (±4.2)	82 (±4.0)	43 (±4.6)	69 (±3.9)	84 (±4.1)	71 (±4.4)
NT	84 (±4.8)	74 (±5.8)	61 (±6.0)	78 (±5.2)	83 (±4.9)	50 (±7.7)	68 (±5.0)	80 (±5.5)	72 (±5.6)
ACT	88 (±3.3)	83 (±3.4)	69 (±8.2)	81 (±5.2)	84 (±3.9)	43 (±9.2)	70 (±7.4)	87 (±5.9)	74 (±5.1)
Aust.	88 (±1.4)	81 (±2.3)	71 (±1.9)	83 (±1.6)	83 (±1.8)	41 (±2.7)	68 (±2.0)	85 (±1.6)	71 (±1.7)
Year 10									
NSW	93 (±2.4)	78 (±3.9)	88 (±2.9)	94 (±2.8)	93 (±2.3)	86 (±2.7)	67 (±5.3)	92 (±2.9)	88 (±2.3)
VIC	85 (±2.8)	64 (±6.4)	83 (±3.2)	92 (±3.7)	92 (±2.5)	87 (±3.3)	60 (±4.6)	91 (±2.5)	82 (±3.7)
QLD	-	-	-	-	-	-	-	-	-
SA	-	-	-	-	-	-	-	-	-
WA	93 (±1.5)	78 (±4.8)	86 (±3.6)	93 (±1.8)	92 (±2.3)	90 (±2.1)	66 (±4.9)	92 (±2.2)	87 (±3.2)
TAS	-	-	-	-	-	-	-	-	-
NT	-	-	-	-	-	-	-	-	-
ACT	-	-	-	-	-	-	-	-	-
Aust.	91 (±1.3)	74 (±2.4)	86 (±1.6)	93 (±1.5)	93 (±1.3)	88 (±1.6)	67 (±2.4)	93 (±1.4)	86 (±1.3)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.
- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

As outlined in the introduction to this chapter, “Student reports of science topics studied at school” was one of 3 scaled indices that were developed on the theme of teaching and learning in science. Table 6.3 presents the average scale scores for this index, by year level and gender.

In all other contextual scales derived in this report where there are data at both Year 6 and Year 10 levels, the scale is transformed to a metric where data from the Year 6 level has a mean of 50 and a standard deviation of 10, and comparisons can be made between Year 6 and Year 10 scale scores. However, it was decided that due to the different nature of science literacy education at primary level (where science is likely taught by the general class teacher) and secondary level (where science is likely taught by subject-specialist teachers), this question has different meaning to students at both year levels. Therefore, the data for this question were scaled separately, making comparisons of scale scores between year levels not possible. Looking at the difference in scale scores between genders for each year level, we can see that any deviations from the mean of 50 are minimal. This means that there is no significant difference between male and female students at either year level with respect to the breadth of science topics they report studying at school.

Table 6.3: Average scale scores for student reports of science topics studied at school, overall and by gender

Science topics studied at school	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	50.0	(±0.5)	50.0	(±0.5)	0.0	(±0.7)
Year 10	50.0	(±0.5)	50.2	(±0.7)	49.8	(±0.5)	0.3	(±0.9)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The relationship between students’ science literacy achievement and the number of science topics they report having studied at school is shown in Table 6.4. For Year 6 students, there is no difference in scale scores for this index between those students above and below the proficient standard. While there is a significant correlation between this index and achievement, it is negligible.

At a Year 10 level, the situation differs. For these students, significantly higher scale scores for this index were apparent for students above the proficient standard compared with those below it. This means that Year 10 students with higher science literacy achievement reported having studied a greater breadth of science topics than those with lower NAP–Science Literacy achievement. This was true for both male and female students, with a difference of 3.8 and 2.7 scale points, respectively. The association between the index and achievement was significant but weak.

Table 6.4: Average scale scores for student reports of science topics studied at school for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	50.2	(±0.5)	50.4	(±0.7)	50.0	(±0.6)
	Below	49.7	(±0.6)	49.4	(±1.0)	50.0	(±0.9)
	Difference	0.5	(±0.8)	1.0	(±1.3)	0.0	(±1.0)
	Correlation	**0.04**	(±0.04)	**0.06**	(±0.06)	0.02	(±0.05)
Year 10	Above	51.5	(±0.5)	51.9	(±0.7)	51.1	(±0.7)
	Below	48.2	(±0.8)	48.1	(±1.3)	48.4	(±0.9)
	Difference	**3.3**	(±1.0)	**3.8**	(±1.5)	**2.7**	(±1.1)
	Correlation	**0.24**	(±0.06)	**0.26**	(±0.08)	**0.21**	(±0.06)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Classroom exposure to science

Effective classroom practices in science foster the critical thinking and problem-solving skills that are vital for students to understand and apply scientific concepts. To more fully explore the extent to which students are exposed to science in the classroom, students were asked whether they agreed (either “Yes” or “No”) with the statements provided in Table 6.5. These items were intended to measure students’ exposure to enriching and experiential learning while also exploring how students evaluate the clarity of pedagogical practice in their classroom.

This collection of items does not form an index but reporting the percentages of students responding with “Yes” to each of these statements can provide a more comprehensive picture of students’ perceived exposure to science at school at a national level.

For Year 6 students, 68% of students reported that their own classroom teacher teaches them science. Less than one quarter of students at either Year 6 or Year 10 reported that their teacher invites visitors to talk about science topics to their class, while 38% (Year 6) and 20% (Year 10) of students report that they go on science-related excursions. In terms of the perceived clarity of scientific instruction, 82% of Year 6 students and 77% of Year 10 students report that their teacher explains scientific concepts clearly to their class.

Table 6.5: Percentages of student reports of classroom exposure to science

	Classroom exposure to science	% Yes
Year 6	My classroom teacher teaches science to our class.*	68 (±3.5)
	My teacher invites visitors to school to talk about science topics.	25 (±2.7)
	Our class goes on excursions related to the science topics we are learning about.	38 (±2.7)
	My teacher can explain scientific concepts clearly.	82 (±1.8)
Year 10	My teacher invites visitors to school to talk about science topics.	21 (±2.0)
	Our class goes on excursions related to the science topics we are learning about.	20 (±2.4)
	My teacher can explain scientific concepts clearly.	77 (±1.9)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.
*This item was administered to Year 6 students only.

Student reports of exposure to activities conducive to critical and creative thinking in science lessons

The questionnaire also asked students to consider the frequency with which they undertook certain activities in their science lessons at school. Given the linkages with the Australian Curriculum general capabilities outlined in the NAP–Science Literacy 2023 Assessment Framework, the list of activities posed to students in the questionnaire was specifically developed to include tasks that were conducive to CCT. These activities, together with the frequency of student responses for each category ("Never", "Sometimes", "Mostly" and "Always") are presented in Table 6.6. The final column "% Mostly or always" was computed after the data collection phase by collapsing the "Mostly" and "Always" categories.

Most Year 6 students regularly undertook a variety of activities conducive to CCT in their science lessons. The most frequently reported CCT-related activity was being encouraged to "explain the reasons why I did something", with 71% of Year 6 students reporting that they mostly or always did this in their science lessons. This was closely followed by "My teacher encourages me to think through all the different options when making decisions" at 69%. On the other end of the spectrum, only 49% of Year 6 students reported having "in-depth discussions about science ideas" in their science lessons, with 12% of students reporting that they never did this.

For Year 10 students, responses ranged from 65% reporting that they mostly or always used a computer or tablet for research into science-related topics, to 39% reporting that their teacher mostly or always asked them to "brainstorm ideas" in their science classes. Fifteen per cent reported never having "in-depth discussions about science ideas" in class, while 17% reported never getting to "plan and carry out" their own investigations.

Table 6.6: Percentages of student reports of exposure to activities conducive to critical and creative thinking

	Exposure to activities conducive to critical and creative thinking	Never		Sometimes		Mostly		Always		% Mostly or always	
Year 6	My teacher asks us to brainstorm ideas.	6	(±1.0)	38	(±1.7)	40	(±1.8)	17	(±1.4)	57	(±1.8)
	My teacher helps me identify patterns between different pieces of information.	8	(±1.0)	37	(±1.9)	38	(±1.7)	17	(±1.3)	55	(±1.9)
	My teacher encourages me to explain the reasons why I did something.	6	(±0.9)	23	(±1.5)	36	(±1.6)	35	(±1.9)	71	(±1.6)
	My teacher encourages me to think through all the different options when making decisions.	6	(±0.8)	25	(±1.4)	37	(±1.5)	32	(±1.7)	69	(±1.6)
	I get to plan and carry out my own investigations.	12	(±1.1)	38	(±1.7)	33	(±1.6)	17	(±1.4)	50	(±1.7)
	I use a computer or tablet for research into science-related topics.	9	(±1.3)	30	(±1.9)	35	(±1.8)	26	(±1.7)	60	(±2.3)
	Our class has in-depth discussions about science ideas.	12	(±1.4)	39	(±1.9)	32	(±2.0)	17	(±1.6)	49	(±2.4)
	We work in groups to carry out investigations.	6	(±0.8)	33	(±2.0)	41	(±1.9)	20	(±1.6)	61	(±2.1)
Year 10	My teacher asks us to brainstorm ideas.	12	(±1.4)	49	(±2.4)	29	(±2.0)	10	(±1.3)	39	(±2.3)
	My teacher helps me identify patterns between different pieces of information.	10	(±1.4)	34	(±2.4)	40	(±2.0)	15	(±1.6)	55	(±2.4)
	My teacher encourages me to explain the reasons why I did something.	12	(±1.3)	28	(±1.8)	38	(±1.9)	23	(±1.6)	60	(±2.1)
	My teacher encourages me to think through all the different options when making decisions.	11	(±1.2)	29	(±1.8)	38	(±2.0)	22	(±2.0)	60	(±2.0)
	I get to plan and carry out my own investigations.	17	(±1.6)	39	(±2.1)	32	(±1.8)	13	(±1.5)	44	(±2.1)
	I use a computer or tablet for research into science-related topics.	10	(±1.4)	25	(±1.9)	34	(±1.9)	31	(±2.3)	65	(±2.4)
	Our class has in-depth discussions about science ideas.	15	(±1.4)	36	(±2.3)	31	(±1.7)	18	(±1.9)	49	(±2.2)
	We work in groups to carry out investigations.	8	(±1.2)	28	(±1.9)	37	(±1.8)	27	(±2.0)	64	(±2.2)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

As explained earlier in this chapter, a scaled index was developed on students' exposure to activities conducive to CCT using the items outlined in Table 6.6. Again, the resulting scale scores for this index were standardised, with the mean score for Year 6 students set to 50. Table 6.7 provides the average scale scores for this index by year level and gender.

In Year 6, female students reported undertaking these CCT activities more frequently than their male counterparts, with a small, significant 1.2 scale point difference observed between the 2 groups of students. In Year 10, there was no discernible difference between the genders reported for this index.

With respect to reported differences between the year levels, a significant and small difference was noted for both male (-1.4 scale points) and female (-1.9 scale points) students. This means that for male and female students, Year 6 students reported undertaking activities conducive to CCT more frequently than those in Year 10.

Table 6.7: Average scale scores for exposure to activities conducive to critical and creative thinking, overall and by gender

Exposure to activities conducive to critical and creative thinking	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	49.4	(±0.6)	50.6	(±0.5)	**-1.2**	(±0.7)
Year 10	48.4	(±0.5)	48.0	(±0.7)	48.7	(±0.7)	-0.7	(±0.9)
Difference (Year 10-Year 6)	**-1.6**	(±0.7)	**-1.4**	(±0.9)	**-1.9**	(±0.9)	0.4	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The relationship between students' science literacy achievement and the reported frequency with which they take part in CCT-related activities in science lessons is shown in Table 6.8. For Year 6 students, there was a significant scale score difference for this index between students above and below the proficient standard (2.9 scale point difference), and this finding was true for both male (3.3 scale point difference) and female students (2.5 scale point difference). This means that Year 6 students achieving above the proficient standard reported more frequent exposure to these CCT activities in their science lessons than did students achieving below the standard. The strength of the association between science literacy achievement and exposure to CCT activities in science lessons was significant but weak (0.17).

For Year 10 students, science literacy achievement and exposure to CCT activities in science lessons were again found to be positively associated with each other. Those achieving above the proficient standard reported more frequent exposure to CCT activities in the classroom than those below the standard, and this difference was moderate in size for both male and female students. The strength of the association was significant for all students, with a weak correlation observed for male students (0.21) and for female students (0.15).

Table 6.8: Average scale scores for exposure to activities conducive to critical and creative thinking for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	51.2	(±0.5)	50.8	(±0.7)	51.7	(±0.6)
	Below	48.3	(±0.7)	47.4	(±1.0)	49.2	(±0.9)
	Difference	**2.9**	(±0.8)	**3.3**	(±1.1)	**2.5**	(±1.1)
	Correlation	**0.17**	(±0.04)	**0.18**	(±0.05)	**0.16**	(±0.05)
Year 10	Above	50.0	(±0.6)	49.8	(±0.8)	50.1	(±0.9)
	Below	46.4	(±0.9)	45.8	(±1.3)	47.1	(±1.0)
	Difference	**3.5**	(±1.1)	**4.0**	(±1.6)	**3.1**	(±1.4)
	Correlation	**0.18**	(±0.05)	**0.21**	(±0.07)	**0.15**	(±0.06)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Home environment for critical and creative thinking

Learning about science is not limited to the classroom or school environment. Environmental influences from the home environment are expected to have an impact on students' approach to studying scientific concepts. Given the significance of the association between science literacy achievement and students' exposure to activities conducive to CCT at school, it is interesting to explore the extent to which students feel supported in thinking critically and creatively at home. Students were asked to indicate their level of agreement with several statements about family encouragement of CCT-related behaviours, as outlined in Table 6.9.

Family support for critical and creative thinking

Across both year levels, students tended to report broad family encouragement to "explain my reasons for doing something" (84% for Year 6, 81% for Year 10) and to "look at the different parts of a problem to help me solve it" (84% for Year 6, 80% for Year 10). The behaviour that students reported the least family encouragement for was to "question information I find on the internet or TV" with agreement from 66% of Year 6 students and 68% of Year 10 students.

Table 6.9: Percentages of family support for critical and creative thinking

	My family encourage me to ...	Strongly agree		Agree		Disagree		Strongly disagree		% Agreement	
Year 6	come up with creative solutions to solving problems.	28	(±1.7)	55	(±1.7)	13	(±1.1)	4	(±0.8)	83	(±1.3)
	question information I find on the internet or TV.	18	(±1.2)	49	(±1.6)	27	(±1.6)	6	(±0.8)	66	(±1.5)
	consider situations from different perspectives.	24	(±1.5)	55	(±1.7)	17	(±1.1)	4	(±0.7)	79	(±1.4)
	consider the source of information.	23	(±1.4)	55	(±1.8)	17	(±1.4)	5	(±0.8)	78	(±1.6)
	explain my reasons for doing something.	30	(±1.7)	53	(±1.8)	12	(±1.0)	4	(±0.8)	84	(±1.3)
	look at the different parts of a problem to help me solve it.	31	(±1.5)	52	(±1.8)	12	(±1.2)	4	(±0.8)	84	(±1.5)
Year 10	come up with creative solutions to solving problems.	20	(±1.7)	58	(±2.1)	16	(±1.3)	6	(±1.1)	77	(±1.7)
	question information I find on the internet or TV.	18	(±1.5)	49	(±1.8)	25	(±1.9)	8	(±1.1)	68	(±2.0)
	consider situations from different perspectives.	24	(±1.7)	55	(±1.8)	14	(±1.3)	6	(±1.0)	79	(±1.7)
	consider the source of information.	20	(±1.8)	55	(±2.0)	18	(±1.5)	7	(±1.3)	75	(±1.9)
	explain my reasons for doing something.	25	(±2.1)	56	(±2.2)	13	(±1.4)	6	(±1.0)	81	(±1.7)
	look at the different parts of a problem to help me solve it.	24	(±1.9)	56	(±1.9)	13	(±1.4)	7	(±1.1)	80	(±1.8)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

Average scale scores for the index developed on family support for CCT are presented in Table 6.10. A small but significant difference was found between male students and for students overall in Year 6 and Year 10, with the younger cohort reporting higher levels of agreement with the statements presented in Table 6.9 than their Year 10 counterparts. This difference between year levels was not apparent for female students.

When looking at the scale scores for this index within each year level, there was no discernible difference between male and female students at either Year 6 or Year 10 with respect to the encouragement they report receiving for engaging in CCT behaviours.

Table 6.10: Average scale scores for family support for critical and creative thinking, overall and by gender

Family support for critical and creative thinking	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	50.1	(±0.6)	49.9	(±0.5)	0.1	(±0.7)
Year 10	49.0	(±0.5)	48.6	(±0.7)	49.4	(±0.7)	-0.8	(±1.0)
Difference (Year 10-Year 6)	**-1.0**	(±0.6)	**-1.4**	(±0.9)	-0.5	(±0.9)	-0.9	(±1.2)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Table 6.11 shows how students' reported level of family support for CCT interacts with science literacy achievement. At a Year 6 level, significantly higher scale scores for this index were apparent for students above the proficient standard. This means that family support for CCT is positively associated with Year 6 student achievement in science literacy. This was true for male and female students, with significant but weak correlations for both groups (0.21).

For Year 10 students, the positive association between reported family support for CCT behaviours and science literacy achievement was more pronounced. The difference between average scale scores for this index and those students above and below the proficient standard was large and significant for both male students (5.7 scale point difference) and female students (6 scale point difference). The strength of the association was moderate for all students (0.32).

Table 6.11: Average scale scores for family support for critical and creative thinking for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	51.3	(±0.5)	51.4	(±0.7)	51.2	(±0.7)
	Below	48.2	(±0.6)	48.0	(±0.9)	48.3	(±0.8)
	Difference	**3.1**	(±0.8)	**3.4**	(±1.1)	**2.9**	(±1.1)
	Correlation	**0.21**	(±0.04)	**0.21**	(±0.06)	**0.21**	(±0.05)
Year 10	Above	51.7	(±0.6)	51.2	(±0.8)	52.2	(±0.9)
	Below	45.8	(±0.9)	45.5	(±1.2)	46.1	(±1.1)
	Difference	**5.9**	(±1.1)	**5.7**	(±1.6)	**6.0**	(±1.3)
	Correlation	**0.32**	(±0.04)	**0.30**	(±0.06)	**0.34**	(±0.05)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Chapter 7: Student engagement with science

Chapter 7: Student engagement with science

Chapter highlights

- Year 10 students who more frequently participated in science-related activities outside of school (for example, “Talk about science with my family”) tended to perform better on the NAP–Science Literacy assessment.
- A large proportion of both Year 6 and Year 10 students tended to frequently or often participate in some science-related activities at home, including “Talk about science with family”, “Watch television or stream content related to science” and “’Like someone else’s content on science-related topics on the internet or social media”.
- Students reported frequently or often participating in some science-related activities at school, including “Watch television or stream content about science” and “Read physical and digital books, newspapers or articles about science”.
- Year 10 students who more frequently participated in science-related activities at school tended to have higher levels of science literacy.
- Students in Year 6 were more likely to participate in science-related activities outside of school than Year 10 students. Conversely, students in Year 10 were more likely to participate in science-related activities at school than their Year 6 counterparts.
- Outside of school, most students participated in CCT activities (for example, “Come up with my own activities to entertain myself”) at least sometimes.
- Year 10 students who more frequently participated in CCT activities tended to have higher levels of science literacy.

Introduction

This chapter continues the examination of data from the NAP–Science Literacy questionnaire, looking at one of the 3 broad areas of the Contextual Framework: Student engagement with science. Students reported on the frequency with which they undertook activities related to science (at school as well as outside of school) and CCT (outside of school).

To compare student engagement with science and CCT across different subgroups, 3 scaled indices were derived:

- experiences of science-related activities outside of school
- experiences of science-related activities at school
- participation in CCT activities outside of school.

This chapter provides additional context for student achievement in the NAP–Science Literacy assessment by comparing the average questionnaire scale scores for these 3 indices between students who are above and below the NAP–Science Literacy proficient standard. The correlation between NAP–Science Literacy scale scores and each of the 3 scaled contextual indices is also examined in this chapter.

Experiences of science-related activities

Engaging in science activities both at school and at home helps to spark curiosity and passion for science, leading to a deeper, more personal connection with the subject. This exposure to real-world scientific challenges and the opportunity to see the relevance of science in everyday life not only enhances practical understanding but also fosters an appreciation of science's impact on our daily experiences.

In a series of questions seeking to gather information about student engagement with science, students from both Year 6 and Year 10 were asked how often they participated in science-related activities outside of school: "Frequently (more than 2 times a week)", "Often (1 or 2 times a week)", "Sometimes (less than once a week)" or "Never". The percentages for each response option for both Year 6 and Year 10 students are presented in Table 7.1.

Table 7.1: Percentages for experiences of science-related activities outside of school

	Experiences of science-related activities outside of school	Frequently (more than 2 times a week)		Often (1 or 2 times a week)		Sometimes (less than once a week)		Never		% Frequently or often	
Year 6	Watch television or stream content about science-related topics	10	(±1.0)	19	(±1.3)	38	(±1.8)	33	(±1.7)	29	(±1.5)
	Read physical or digital books, newspapers or articles about science	8	(±1.0)	16	(±1.3)	35	(±1.5)	41	(±1.7)	24	(±1.6)
	Listen to podcasts, audiobooks or radio on science-related topics	6	(±0.8)	12	(±1.3)	26	(±1.4)	57	(±1.7)	18	(±1.5)
	Talk about science with my friends	4	(±0.8)	15	(±1.3)	32	(±1.7)	48	(±2.0)	20	(±1.4)
	Talk about science with my family	10	(±0.9)	20	(±1.2)	33	(±1.5)	37	(±1.8)	30	(±1.5)
	Post or share content about science-related topics on the internet or social media	2	(±0.5)	5	(±0.7)	12	(±1.0)	81	(±1.4)	7	(±0.9)
	Contribute to existing discussions about science-related topics on the internet or social media	4	(±0.7)	10	(±1.2)	20	(±1.4)	66	(±1.6)	14	(±1.2)
	'Like' someone else's content on science-related topics on the internet or social media	9	(±1.0)	16	(±1.2)	25	(±1.5)	49	(±1.8)	26	(±1.6)

(Continued) Table 7.1: Percentages for experiences of science-related activities outside of school

	Experiences of science-related activities outside of school	Frequently (more than 2 times a week)	Often (1 or 2 times a week)	Sometimes (less than once a week)	Never	% Frequently or often
Year 10	Watch television or stream content about science-related topics	8 (±0.9)	16 (±1.4)	40 (±1.8)	36 (±2.1)	24 (±1.7)
	Read physical or digital books, newspapers or articles about science	3 (±0.6)	12 (±1.3)	31 (±1.7)	54 (±2.1)	15 (±1.4)
	Listen to podcasts, audiobooks or radio on science-related topics	2 (±0.6)	8 (±1.0)	22 (±1.6)	68 (±2.0)	10 (±1.3)
	Talk about science with my friends	5 (±0.8)	18 (±1.8)	34 (±2.0)	43 (±2.5)	23 (±2.0)
	Talk about science with my family	8 (±1.0)	21 (±1.6)	32 (±1.7)	39 (±2.3)	28 (±1.9)
	Post or share content about science-related topics on the internet or social media	2 (±0.5)	5 (±1.0)	15 (±1.5)	78 (±2.1)	7 (±1.2)
	Contribute to existing discussions about science-related topics on the internet or social media	3 (±0.6)	8 (±1.1)	20 (±1.5)	70 (±2.0)	11 (±1.4)
	'Like' someone else's content on science-related topics on the internet or social media	9 (±1.0)	20 (±1.6)	29 (±1.8)	42 (±2.3)	28 (±1.9)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

As can been seen in Table 7.1, substantial proportions of students never undertook each of these activities outside of school (roughly between 30% and 80%). The most common activities undertaken by Year 6 students (frequently or often) were “Talk about science with my family” (30%), “Watch television or stream content about science-related topics” (29%), “'Like' someone else’s content on science-related topics on the internet or social media” (26%) and “Read physical or digital books, newspapers or articles about science-related topics” (24%). Year 6 students were least likely to “Post or share content about science-related topics on the internet or social media” with 81% responding they never did this. This may be partly attributed to limited access to social media for students of this age.

Similarly, Year 10 students report that they frequently or often "Talk about science with my family" (28%), "'Like' someone else's content on science-related topics on the internet or social media" (28%), and "Watch television or stream content about science-related topics" (24%). The majority of Year 10 students never "Post or share content about science-related topics on the internet or social media" (78%).

In addition to science-related activities at home, Year 6 and Year 10 students were asked how often they participated in science-related activities at school: "Frequently (more than 2 times a week)", "Often (1 or 2 times a week)", "Sometimes (less than once a week)" or "Never". Table 7.2 shows the percentages for each response option (including aggregated responses for "Frequently" or "Often") for both Year 6 and Year 10 students.

Table 7.2: Percentages for experiences of science-related activities at school

	Experiences of science-related activities at school	Frequently (more than 2 times a week)		Often (1 or 2 times a week)		Sometimes (less than once a week)		Never		% Frequently or often	
Year 6	Watch television or stream content about science-related topics	7	(±0.9)	28	(±1.5)	38	(±1.8)	27	(±1.4)	35	(±1.8)
	Read physical or digital books, newspapers or articles about science	6	(±0.9)	22	(±1.4)	35	(±1.9)	37	(±1.7)	28	(±1.7)
	Talk about science with my friends	5	(±0.8)	15	(±1.2)	33	(±1.4)	47	(±1.8)	21	(±1.4)
Year 10	Watch television or stream content about science-related topics	10	(±1.2)	27	(±1.6)	35	(±1.7)	28	(±2.1)	37	(±2.1)
	Read physical or digital books, newspapers or articles about science	9	(±1.2)	22	(±1.7)	30	(±1.9)	39	(±2.1)	31	(±2.1)
	Talk about science with my friends	9	(±1.2)	22	(±1.5)	34	(±1.8)	36	(±2.1)	31	(±1.9)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

Results show that across the science-related activities, both Year 6 and Year 10 students were most likely to frequently or often "Watch television or stream content about science-related content" (35% and 37% respectively). Between one quarter and half of the students reported never engaging in each of these science-related activities at school.

Scales were derived to examine student experiences of science-related activities outside of school and at school. The "Outside of school" scale was based on all 8 items from Table 7.1, while the "At school" scale was based on all 3 items from Table 7.2. Higher scale scores correspond to more frequent experiences of science-related activities. Average scale scores of the indices for experiences of science-related activities outside of school and at school are shown in Table 7.3, for male and female students across both year levels. As each scale was derived separately, no comparisons can be made between the 2 separate scales.

Table 7.3: Average scale scores for experiences of science-related activities at school and outside of school, overall and by gender

		All students		Male		Female		Difference (M-F)	
Outside of school	Year 6	50.0	(±0.4)	50.3	(±0.5)	49.7	(±0.4)	**0.6**	(±0.6)
	Year 10	48.5	(±0.5)	48.8	(±0.7)	48.1	(±0.7)	0.7	(±0.9)
	Difference (Year 10-Year 6)	**-1.5**	(±0.6)	**-1.5**	(±0.8)	**-1.6**	(±0.8)	0.2	(±1.0)
At school	Year 6	50.0	(±0.4)	49.8	(±0.5)	50.2	(±0.5)	-0.4	(±0.7)
	Year 10	51.3	(±0.6)	50.2	(±0.7)	52.3	(±0.7)	**-2.2**	(±0.9)
	Difference (Year 10-Year 6)	**1.3**	(±0.7)	0.4	(±0.9)	**2.1**	(±0.9)	**-1.8**	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Year 6 students were more likely to report participating in science-related activities outside of school compared to Year 10 students (Table 7.3). Furthermore, at Year 6, a gender difference was observed with males being more likely to experience science-related activities outside of school, but not at school.

Conversely, Year 10 students were more likely to participate in science-related activities at school compared to Year 6 students. Additionally, a gender difference was observed for Year 10 students with females being more likely to participate in science-related activities at school, but not outside of school. The difference between year levels of this gender difference (-0.4 scale points at Year 6 compared to -2.2 scale points at Year 10) was significant.

The relationship between student experiences of science-related activities at school and outside of school is summarised in Table 7.4. At Year 10, students above the proficient standard had higher scale scores on participation in science-related activities both at school and outside of school than students below the proficient standard. This finding was confirmed by the large differences in scale scores between Year 10 students above and below the proficient standard, with weak or moderate associations observed between each of the 2 scales and the achievement metric.

At the Year 6 level, students above the proficient standard also reported greater participation in science-related activities both outside of school and at school than students below the proficient standard. However, while the correlation between these scales and achievement was significant overall, in contrast to the Year 10 students, the strength of the associations was either weak or negligible.

Table 7.4: Average scale scores for experiences of science-related activities at school and outside of school for students above and below the proficient standard

		Outside of school			At school		
	Proficient standard	All students	Male	Female	All students	Male	Female
Year 6	Above	50.4 (±0.4)	51.0 (±0.6)	49.9 (±0.6)	51.1 (±0.4)	51.0 (±0.6)	51.1 (±0.6)
	Below	49.4 (±0.6)	49.3 (±0.9)	49.5 (±0.7)	48.5 (±0.6)	48.1 (±0.9)	48.9 (±0.8)
	Difference	**1.0** (±0.7)	**1.7** (±1.1)	0.4 (±1.0)	**2.6** (±0.7)	**3.0** (±1.0)	**2.2** (±0.9)
	Correlation	**0.07** (±0.04)	**0.09** (±0.05)	0.04 (±0.05)	**0.15** (±0.04)	**0.15** (±0.05)	**0.16** (±0.05)
Year 10	Above	51.0 (±0.6)	51.3 (±0.8)	50.6 (±0.8)	54.3 (±0.7)	53.1 (±0.9)	55.5 (±0.9)
	Below	45.5 (±0.9)	45.8 (±1.2)	45.2 (±1.0)	47.7 (±0.8)	46.6 (±1.1)	48.6 (±1.0)
	Difference	**5.5** (±1.0)	**5.6** (±1.5)	**5.5** (±1.3)	**6.6** (±1.0)	**6.4** (±1.5)	**6.9** (±1.2)
	Correlation	**0.29** (±0.05)	**0.27** (±0.06)	**0.30** (±0.06)	**0.33** (±0.04)	**0.32** (±0.07)	**0.36** (±0.04)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Critical and Creative Thinking activities

As the current cycle of NAP–Science Literacy incorporated the CCT general capability, the questionnaire for the first time included an additional question on students' participation in activities related to this area. Students from both Year 6 and Year 10 were asked how often ("Never", "Sometimes", "Mostly" or "Always") they participated in activities that involved CCT outside of school. Table 7.5 presents the percentages for each response option for both Year 6 and Year 10 students.

Table 7.5: Percentages for participation in activities outside of school related to critical and creative thinking

	Participation in CCT activities outside school	Never		Sometimes		Mostly		Always		% Mostly or always	
Year 6	Do activities which require creative solutions	12	(±1.3)	47	(±1.8)	28	(±1.7)	12	(±1.2)	40	(±1.9)
	Participate in problem solving activities	14	(±1.2)	41	(±1.7)	31	(±1.9)	14	(±1.3)	44	(±2.0)
	Come up with my own activities to entertain myself	12	(±1.2)	36	(±1.8)	32	(±1.8)	20	(±1.5)	52	(±2.1)
	Develop new ways to solve problems	13	(±1.2)	43	(±1.6)	30	(±1.8)	14	(±1.3)	44	(±1.9)
	Debate topics with my family or friends	21	(±1.6)	39	(±1.5)	24	(±1.4)	16	(±1.1)	40	(±1.7)
Year 10	Do activities which require creative solutions	13	(±1.6)	47	(±1.9)	28	(±1.9)	12	(±1.5)	40	(±2.0)
	Participate in problem solving activities	19	(±1.7)	44	(±1.8)	27	(±1.8)	10	(±1.3)	37	(±2.1)
	Come up with my own activities to entertain myself	15	(±1.4)	37	(±1.9)	31	(±1.9)	17	(±1.3)	48	(±2.2)
	Develop new ways to solve problems	17	(±1.5)	45	(±1.6)	27	(±1.7)	12	(±1.3)	38	(±2.0)
	Debate topics with my family or friends	18	(±1.5)	40	(±2.0)	25	(±1.8)	17	(±1.6)	42	(±2.2)

Confidence Intervals (1.96 * SE) are reported in brackets.
Results are rounded to the nearest whole number so some totals may appear inconsistent.

As can be seen in Table 7.5, students tended to participate in each of these types of activities sometimes or mostly. They were more likely to indicate that they mostly or always “Come up with my own activities to entertain myself” (52% Year 6 and 48% at Year 10). On average, the proportion of students who mostly or always participated in the other CCT activities ranged between 37% and 44% at each year level.

The 5 items relating to participation in CCT activities outside school were used to derive a scale to compare participation in activities outside of school related to CCT. Item response theory was used to derive weighted likelihood estimates for this index. Higher scale scores correspond to more frequent participation in activities outside of school that related to CCT.

Table 7.6: Average scale scores for participation in activities outside of school related to critical and creative thinking, overall and by gender

Participation in CCT activities outside of school	All students		Male		Female		Difference (M-F)	
Year 6	50.0	(±0.4)	49.6	(±0.6)	50.4	(±0.5)	**-0.7**	(±0.7)
Year 10	49.0	(±0.5)	49.0	(±0.7)	49.0	(±0.6)	0.0	(±0.8)
Difference (Year 10-Year 6)	**-1.0**	(±0.7)	-0.6	(±0.9)	**-1.3**	(±0.8)	0.7	(±1.1)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

The scale scores for the index for student participation in activities outside of school related to CCT for both males and females and across both year levels are shown in Table 7.6. Overall, students in Year 6 were more likely to report participating in activities related to CCT outside of school than Year 10 students. The significant gender difference for Year 6 students was negligible in size.

The relationship between student participation in activities related to CCT outside of school and achievement is summarised in Table 7.7.

Table 7.7: Average scale scores for participation in activities outside of school related to critical and creative thinking for students above and below the proficient standard

	Proficient standard	All students		Male		Female	
Year 6	Above	51.1	(±0.5)	50.8	(±0.8)	51.4	(±0.6)
	Below	48.5	(±0.7)	47.9	(±1.0)	49.0	(±0.8)
	Difference	**2.6**	(±0.9)	**2.8**	(±1.3)	**2.4**	(±1.0)
	Correlation	**0.16**	(±0.04)	**0.17**	(±0.06)	**0.15**	(±0.04)
Year 10	Above	51.0	(±0.6)	51.0	(±0.8)	51.0	(±0.8)
	Below	46.6	(±0.9)	46.6	(±1.2)	46.7	(±1.0)
	Difference	**4.4**	(±1.0)	**4.4**	(±1.4)	**4.4**	(±1.3)
	Correlation	**0.23**	(±0.05)	**0.23**	(±0.07)	**0.22**	(±0.06)

Confidence Intervals (1.96 * SE) are reported in brackets.
Statistically significant differences are in bold.

Table 7.7 shows higher performing students (above the proficient standard) were more likely to participate in CCT activities outside of school than lower performing students (below the proficient standard). A consistent pattern was observed across gender groups, and the associations between scale scores and achievement were weak at the Year 6 level (0.16) and at the Year 10 level (0.23).

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Appendices

Appendix A: Ordered map of NAP–Science Literacy 2023 items

Table A1: Ordered map of NAP-Science Literacy 2023 items

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	1100	5	Analyses information to identify data required to support a conclusion.	Processing, modelling and analysing
10	1035	5	Explains how forces and energy contribute to maglev trains travelling very fast.	Physical sciences
10	893	5	Suggests reasons for an outlier result in a given investigation.	Processing, modelling and analysing
10	879	5	Applies knowledge of osmosis to a real-life situation.	Use and influence of science
10	857	5	Compares plant and animal cells.	Biological sciences
10	855	5	Uses data to explain the impact of an investigation on a real-world application.	Use and influence of science
10	853	5	Describes strategies to improve the design of an investigation.	Planning and conducting
10	847	5	Explains that a lamp will act as a uniform light source for photosynthesis in an investigation.	Chemical sciences
10	839	5	Recalls the organelle in plants responsible for photosynthesis.	Biological sciences
10	839	5	Describes how air molecules behave when heated.	Physical sciences
10	836	5	Uses density measurements to determine the composition of an object.	Planning and conducting
10	825	5	Identifies multiple roles that friction plays in a system.	Physical sciences
10	817	5	Compares and contrasts the circulatory systems of humans and fish.	Biological sciences
10	812	5	Identifies the pathway of oxygen when reacted with propane.	Chemical sciences
10	811	5	Explains the reason for cyclical changes in atmospheric carbon dioxide.	Earth and space sciences
10	807	5	Justifies a decision by drawing conclusions that are supported by data from a graph.	Physical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	806	5	Completes a diagram showing the position of Earth during various seasons.	Earth and space sciences
10	802	5	Explains why a syringe allows for more accurate measurements to be made in an investigation than other strategies.	Evaluating
6/10 link	799	5	Explains how given equipment allows more accurate measurements.	Evaluating
6/10 link	798	5	Identifies the relationship between insulation and carbon dioxide emissions.	Use and influence of science
10	796	5	Describes structure of elemental metals	Chemical sciences
10	790	5	Describes the net force on objects.	Physical sciences
6/10 link	788	5	Evaluates limitations in an experimental design.	Planning and conducting
10	782	5	Predicts and provides scientific rationale to explain the effect of the Earth's and the Moon's gravity on pendulum motion.	Nature and development of science
6/10 link	780	5	Designs a fair investigation to test a variable.	Planning and conducting
10	779	5	Identifies the reactions that can produce hydrogen gas.	Chemical sciences
6	779	5	Uses information from a table of data to explain how a scientific model represents a real-life context.	Nature and development of science
10	773	5	Uses data to explain why a solution to urban heating is effective.	Use and influence of science
10	770	5	Explains the effect of an unbalanced salt solution on red blood cells.	Use and influence of science
6/10 link	769	5	Uses evidence from a table of data to explain if a prediction is supported by the results.	Evaluating
10	766	5	Identifies that a small degree of axis tilt is unlikely to result in seasons.	Earth and space sciences
10	761	5	Correlates actions of a scientific process with steps of inquiry method.	Nature and development of science
6/10 link	753	5	Evaluates the benefits to insulation in different climates.	Use and influence of science
6	752	5	Applies scientific understanding of a concept on Earth to the concept on the Moon.	Physical sciences
10	748	5	Identifies the opposing forces of gravity and air resistance acting on an object.	Physical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	747	5	Explains how salt water can cause changes in plant cells.	Biological sciences
10	747	5	Analyses graphical data to support a scientific claim.	Earth and space sciences
10	744	5	Identifies how the use of equipment controls variables in an investigation.	Planning and conducting
10	742	5	Identifies changes in air density to create lift in a balloon.	Physical sciences
6/10 link	730	5	Justifies why organic material should not be placed into landfill sites.	Use and influence of science
10	725	5	Relates conditions on Mars to environmental phenomena.	Earth and space sciences
6	718	5	Identifies the producers in a food web.	Biological sciences
10	717	5	Draws conclusions that are supported by data from a graph.	Physical sciences
10	710	5	Evaluates information to identify data that can support a conclusion.	Processing, modelling and analysing
6	708	5	Identifies and describes different properties of plastics.	Chemical sciences
10	708	5	Identifies factors that generate urban heat sinks.	Use and influence of science
10	706	5	Selects objects for a model that best represent real-life objects, providing justification for each choice.	Processing, modelling and analysing
6	703	5	Explains the impact of strategies to produce resources sustainably.	Use and influence of science
6/10 link	700	5	Designs an investigation or explains the impact of variables on an investigation.	Planning and conducting
10	696	5	Identifies a solution to an engineering design problem using evidence.	Processing, modelling and analysing
10	692	5	Applies an experimental method in a different context.	Evaluating
10	691	5	Understands that a line graph represents the relationship between 2 variables.	Evaluating
10	690	5	Identifies a benefit to using helium rather than hydrogen gas in balloons.	Use and influence of science
10	689	5	Identifies conclusions that can be drawn from information in a graph.	Processing, modelling and analysing
10	688	5	Orders the processes involved in the formation of a water body from a glacier.	Earth and space sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	686	5	Identifies the electrical components needed to build a circuit with an electromagnet.	Physical sciences
6/10 link	681	5	Explains the function of a device used in a field study.	Biological sciences
10	680	5	Uses knowledge of classification hierarchy to identify a feature in common.	Biological sciences
10	680	5	Explains how forces or energy contribute to maglev trains travelling very fast.	Physical sciences
6	679	5	Identifies variables when conducting scientific investigations.	Planning and conducting
6/10 link	674	5	Identifies one limitation in an experimental design.	Planning and conducting
10	671	5	Describes a strategy to improve the design of an investigation.	Planning and conducting
6/10 link	670	5	Identifies the effect of insulation in heating and cooling a house.	Use and influence of science
10	669	5	Selects the most accurate piece of equipment to measure volume.	Planning and conducting
10	665	5	Recognises that matter can change states with heat and that gases have mass.	Chemical sciences
6	662	5	Identifies the order of crater formation based on observations.	Processing, modelling and analysing
10	661	5	Explains the motion and arrangement of particles of solids and liquids.	Chemical sciences
10	661	5	Explains whether a material undergoes a reversible or irreversible change.	Chemical sciences
6/10 link	658	5	Analyses graphical data to determine locations of deforestation in Borneo.	Processing, modelling and analysing
6	656	5	Identifies organisms that have more than one role in an ecosystem.	Biological sciences
10	652	5	Understands that heat travels faster through metal than through wood.	Physical sciences
10	650	5	Compares the orbit lengths for Earth and Earth's Moon.	Earth and space sciences
10	650	5	Classifies rubbish as recyclable or non-recyclable.	Use and influence of science
10	644	5	Identifies the producers in a food web.	Biological sciences
10	643	5	Recognises that photosynthesis increases atmospheric oxygen.	Chemical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	643	5	Evaluates conclusions from an investigation to identify and explain an incorrect conclusion.	Evaluating
6/10 link	642	5	Draws conclusions from tabulated data.	Processing, modelling and analysing
10	639	5	Draws a conclusion that is consistent with evidence from an investigation.	Processing, modelling and analysing
10	639	5	Identifies the advantages of asexual reproduction in sharks.	Biological sciences
6/10 link	639	5	Explains the purpose of information when communicating scientific results.	Communicating
10	639	5	Identifies considerations before implementation of a scientific practice.	Use and influence of science
6	636	5	Identifies and describes a property of plastics.	Chemical sciences
6	636	5	Explains the importance of controlling variables to ensure a fair test.	Planning and conducting
10	635	5	Predicts and explains the relative motions of trains in a vacuum or air-filled tunnel.	Physical sciences
6	632	5	Determines the controlled variables in an investigation.	Planning and conducting
10	629	5	Uses data to explain the outcome of an investigation on a real-world application.	Use and influence of science
6	626	5	Identifies variables that will affect the outcome of a fair test.	Planning and conducting
10	625	5	Describes a scientific model representing a chemical compound.	Chemical sciences
10	619	5	Identifies variables to be controlled in a given investigation.	Planning and conducting
10	619	5	Identifies that space exploration is the result of collaboration across organisations.	Nature and development of science
10	618	5	Identifies variables when conducting scientific investigations.	Planning and conducting
6	617	5	Identifies the role of a spider in its ecosystem.	Biological sciences
10	616	5	Relates industrial processes to modern technology.	Use and influence of science
6	616	5	Identifies the force acting against direction of motion.	Physical sciences
6/10 link	615	5	Identifies a change in force that causes a perch to break.	Physical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	614	5	Explains how a property of stone influences its use.	Earth and space sciences
6/10 link	614	5	Evaluates properties that would be unsuitable for a given purpose.	Evaluating
10	613	5	Identifies data that supports a solution to effective urban heating.	Use and influence of science
6/10 link	612	5	Identifies features that help orangutangs use implements.	Biological sciences
6	611	5	Selects the variables that will be held constant in an investigation.	Planning and conducting
6	608	5	Selects the correct variables to ensure a fair test.	Planning and conducting
6	605	5	Provides a reason why an investigation may not be fair.	Planning and conducting
6/10 link	603	5	Identifies the changes that decomposers cause on organic matter.	Biological sciences
10	601	4	Identifies evidence to support the occurrence of asexual reproduction in a shark.	Biological sciences
10	601	4	Matches each force acting on a maglev train with the source of the force.	Physical sciences
6	601	4	Classifies organisms according to their role in an ecosystem.	Biological sciences
6/10 link	598	4	Identifies ways to increase recycling of plastic bags.	Use and influence of science
6/10 link	596	4	Selects the graphs that correctly display data from a table.	Processing, modelling and analysing
10	594	4	Completes the word equation for photosynthesis.	Chemical sciences
6/10 link	594	4	Interprets results from an investigation to identify impacts of plants on water runoff.	Evaluating
6/10 link	593	4	Understands that materials have bulk properties.	Chemical sciences
6	593	4	Explains with data why a prediction does not agree with results.	Evaluating
10	591	4	Classifies environmental features as abiotic or biotic.	Biological sciences
6/10 link	591	4	Predicts the impact of a population change on 2 organisms in a food web.	Biological sciences
10	589	4	Sequences the steps in the formation of an artificial glacier.	Use and influence of science
6/10 link	588	4	Orders the steps to explain how solar panels work.	Use and influence of science

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	588	4	Identifies how the properties of slime can be applied to improve other objects.	Use and influence of science
6/10 link	586	4	Constructs a food chain from a food web.	Biological sciences
6	586	4	Explains the impact of one strategy to produce resources sustainably.	Use and influence of science
10	583	4	Identifies a correctly balanced chemical equation	Chemical sciences
10	582	4	Evaluates a new experimental design to explain how error is reduced.	Evaluating
10	582	4	Extracts a value from a line graph.	Processing, modelling and analysing
6	582	4	Sequences the steps in an investigation.	Planning and conducting
10	581	4	Identifies the process of heat transfer in hot air balloons.	Physical sciences
10	581	4	Identifies the relative motions of trains in a vacuum or air-filled tunnel.	Physical sciences
10	580	4	Predicts the effect of the Earth's and the Moon's gravity on pendulum motion.	Nature and development of science
10	580	4	Describes the flow of energy through a food web.	Biological sciences
10	579	4	Selects objects for a model that best represent real-life objects, providing justification for one choice.	Processing, modelling and analysing
10	579	4	Explains the benefits of both removing and retaining an endangered species from its natural habitat.	Use and influence of science
10	577	4	Identifies a pattern in graphical data to support a scientific claim.	Earth and space sciences
6	577	4	Identifies variables to be kept the same in a given investigation.	Planning and conducting
6	575	4	Classifies rubbish as recyclable or non-recyclable.	Use and influence of science
10	575	4	Identifies a single role that friction plays in a system.	Physical sciences
10	574	4	Identifies the treatment required to conduct a controlled experiment.	Planning and conducting
10	574	4	Explains the impact of shape on the speeds it swings on a pendulum.	Processing, modelling and analysing
6/10 link	573	4	Identifies when light is being refracted and reflected.	Physical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	570	4	Predicts the impact of a population change on one organism in a food web.	Biological sciences
10	568	4	Understands infrared radiation is heat and will interfere with a detector in space.	Physical sciences
10	567	4	Identifies the presence of an outlier in a set of data.	Processing, modelling and analysing
6/10 link	567	4	Suggests one possible reason for a described experimental design.	Nature and development of science
10	566	4	Interprets a phylogenetic diagram to draw conclusions.	Biological sciences
10	564	4	Recognises that a sieve separates items by size.	Chemical sciences
6/10 link	563	4	Identifies the function of leaves for a plant.	Biological sciences
6	563	4	Orders the closest 4 planets orbiting the Sun.	Earth and space sciences
6/10 link	561	4	Identifies factors that affect the rate of decomposition of materials.	Planning and conducting
10	561	4	Draws a conclusion from an investigation.	Processing, modelling and analysing
6/10 link	561	4	Classifies the variables in a given investigation.	Planning and conducting
10	560	4	Identifies the independent variable in an investigation.	Planning and conducting
10	556	4	Identifies a source of experimental error.	Evaluating
10	556	4	Understands the processes involved in cycling carbon.	Earth and space sciences
10	556	4	Uses scales to identify the diagram that is consistent with the sowing instructions.	Planning and conducting
6	555	4	Identifies that light is refracted as it moves through a lens.	Physical sciences
10	554	4	Identifies the formula for calcium carbonate.	Chemical sciences
6	552	4	Identifies patterns in graphical data.	Processing, modelling and analysing
10	552	4	Identifies a limitation of a scientific investigation.	Planning and conducting
6	551	4	Understands that scientific knowledge is used by communities to identify problems.	Use and influence of science
6	551	4	Identifies how a scientific model represents a real-life context.	Nature and development of science

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	551	4	Explains a limitation of a suggested method of monitoring an investigation and proposes an alternative, providing justification for the choice.	Planning and conducting
10	550	4	Understands the impact of changes to a surface on friction.	Physical sciences
10	550	4	Organises information in a Venn diagram.	Processing, modelling and analysing
6/10 link	550	4	Draws conclusions from tabulated results.	Evaluating
10	549	4	Identifies the independent variable for a given investigation.	Planning and conducting
10	549	4	Identifies the equipment used to control variables in an investigation.	Planning and conducting
10	548	4	Defines an energy transformation.	Physical sciences
6/10 link	547	4	Applies knowledge of the effects of glacier melting on Earth systems.	Use and influence of science
6	546	4	Identifies a strategy to improve an experimental design.	Evaluating
10	543	4	Identifies the balanced forces on a stationary object.	Physical sciences
6	541	4	Explains how adaptations of a bee help in its environments.	Biological sciences
6/10 link	541	4	Describes and provides rationale for an appropriate order of testing.	Planning and conducting
10	541	4	Identifies level of classification of 2 animals with common features.	Biological sciences
10	540	4	Explains either the motion or arrangement of particles of solids and liquids.	Chemical sciences
6/10 link	539	4	Identifies the location to simulate bird weight on a perch.	Questioning and predicting
10	538	4	Understands that a magnet can repel another magnet.	Physical sciences
10	536	4	Recognises that the presence of a moon is required for solar and lunar eclipses.	Earth and space sciences
6/10 link	536	4	Identifies the controlled variables in an investigation.	Planning and conducting
6	535	4	Understands that reflected light bounces off an object.	Physical sciences
6/10 link	535	4	Identifies the cause of night and day.	Earth and space sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6	535	4	Understands that heat travels faster through metal than through wood.	Physical sciences
10	534	4	Identifies the type of rock formed from sediments.	Earth and space sciences
6	532	4	Explains the pattern of apparent movement of stars and planets during a night.	Earth and space sciences
6	531	4	Explains the importance of measuring 2 dependent variables in an investigation.	Planning and conducting
10	531	4	Uses diagrams to show the arrangement of magnets for a maglev train and tracks.	Physical sciences
10	529	4	Identifies that matter can change states with heat.	Chemical sciences
6	527	4	Justifies a decision about controlling a variable to repeat an experiment.	Planning and conducting
6	526	4	Uses data to predict results.	Evaluating
10	525	4	Uses information from a rock layer diagram to order the ages of fossils.	Communicating
6/10 link	525	4	Selects 2 benefits for society from space research.	Use and influence of science
6	525	4	Identifies variables to be controlled in a fair test.	Planning and conducting
10	525	4	Identifies the body systems shown in a diagram.	Biological sciences
10	523	4	Identifies a gas that would not be produced in a given chemical reaction.	Chemical sciences
10	522	4	Identifies planet rotation as requirement for day and night to occur.	Earth and space sciences
6/10 link	522	4	Uses evidence from a table of data to identify whether a prediction is supported.	Evaluating
10	521	4	Provides relevant data from a graph as evidence for a conclusion.	Processing, modelling and analysing
6/10 link	518	4	Explains why organic material should not be placed into landfill sites.	Use and influence of science
10	518	4	Sequences the steps in a scientific investigation.	Planning and conducting
10	517	4	Identifies a source of error in an investigation.	Planning and conducting
10	516	4	Understands that forces or energy contribute to maglev trains travelling very fast.	Physical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	516	4	Identifies a syringe as more appropriate to use in an investigation than other strategies.	Evaluating
10	516	4	Identifies a reason for mosquitoes laying large numbers of eggs.	Biological sciences
10	514	4	Sequences the steps in an investigation.	Planning and conducting
6	514	4	Identifies that rock has insulating properties to the lava below.	Chemical sciences
10	514	4	Identifies the role of seaweed in ecosystems.	Biological sciences
6	513	4	Correlates a prediction with the evidence produced from an experiment.	Processing, modelling and analysing
6	513	4	Identifies variables to be measured to make an informed conclusion.	Planning and conducting
10	512	4	Orders the steps of a scientific investigation.	Planning and conducting
6	511	4	Considers advances over time that assist in monitoring of lava flow.	Use and influence of science
10	511	4	Identifies a specific section of a distance-time graph.	Processing, modelling and analysing
6/10 link	510	4	Provides relevant data as evidence to explain a prediction that was not supported.	Evaluating
10	510	4	Identifies the scientific question for an investigation.	Questioning and predicting
10	509	4	Recognises that salt is soluble in water and flour is not.	Chemical sciences
6	509	4	Explains an advantage of a parasite not killing its host.	Biological sciences
10	506	4	Identifies whether a material undergoes a reversible or irreversible change.	Chemical sciences
6/10 link	505	4	Converts centimetres to millimetres.	Processing, modelling and analysing
6/10 link	505	4	Constructs an energy flow diagram to represent energy transformations in a system.	Physical sciences
6/10 link	505	4	Explains a limitation of a suggested method of monitoring an investigation and proposes an alternative.	Planning and conducting
6/10 link	504	4	Draws a conclusion based on data in a table.	Evaluating

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	503	4	Identifies a way to improve the reliability of results in an investigation.	Evaluating
6/10 link	503	4	Identifies an advantage and disadvantage in an alternative investigation design.	Planning and conducting
10	500	4	Calculates missing data in a table from given values.	Processing, modelling and analysing
6/10 link	498	4	Recognises the effect of freezing water within rocks.	Earth and space sciences
10	497	3	Explains one benefit of either retaining or removing an endangered species from its natural habitat.	Use and influence of science
10	496	3	Selects the most suitable measuring device for an investigation.	Planning and conducting
6/10 link	496	3	Identifies that given equipment allows more accurate measurements.	Evaluating
6/10 link	495	3	Understands the environmental impacts of human activity.	Use and influence of science
10	495	3	Describes the relative amounts of energy required to maintain a constant speed.	Physical sciences
6	495	3	Sequences events that could result as a consequence of marine debris.	Use and influence of science
6	495	3	Identifies similarities between the life cycles of animals.	Biological sciences
6	494	3	Identifies equipment used to measure the size of a force.	Planning and conducting
6	494	3	Determines the depth of a crater using digital tools.	Planning and conducting
6/10 link	494	3	Draws a link between the processes of decomposing and recycling.	Use and influence of science
10	492	3	Explains the importance of controlling variables to ensure a fair test.	Planning and conducting
6/10 link	492	3	Identifies the variable that will be changed in the investigation.	Processing, modelling and analysing
10	492	3	Uses a diagram to sequence the processes that occur to form limestone caves.	Earth and space sciences
6	492	3	Identifies and justifies whether a prediction is supported by results.	Evaluating
6	491	3	Identifies how a mangrove adaptation benefits its survival.	Biological sciences
6	490	3	Defines the arrows shown in food chains and food webs.	Biological sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	489	3	Identifies that a state of change occurs during melting.	Chemical sciences
10	489	3	Identifies the cause of night and day.	Earth and space sciences
6/10 link	489	3	Extracts data from tabulated results to explain a conclusion.	Evaluating
6	488	3	Interprets patterns to identify daily change in Moonrise and Moonset times.	Earth and space sciences
10	488	3	Explains an observation based on scientific knowledge of chemical reactivity.	Chemical sciences
6	486	3	Applies information in a diagram to another example.	Processing, modelling and analysing
6	486	3	Identifies an assumption made in a scientific study.	Evaluating
6	486	3	Understands that a magnet can repel another magnet.	Physical sciences
6	484	3	Identifies a way to reduce the environmental impacts of plastics.	Use and influence of science
10	484	3	Describes how adaptations provided different ways to help a marsupial lion to survive.	Biological sciences
6/10 link	483	3	Evaluates the effectiveness of insulation solutions.	Use and influence of science
10	480	3	Converts metres to centimetres.	Planning and conducting
6/10 link	480	3	Identifies the consumers in a food web.	Biological sciences
6	478	3	Identifies how design features alter the forces acting on an object.	Physical sciences
6	476	3	Determines the speed of particles in objects in different states.	Chemical sciences
6/10 link	475	3	Identifies the mechanism by which a reflective material provides insulation.	Physical sciences
10	475	3	Describes the contribution of different scientists to scientific research on Mars.	Nature and development of science
10	474	3	Identifies a way to improve reliability in an investigation.	Evaluating
6	474	3	Identifies a source of experimental error.	Evaluating
6	473	3	Identifies an incorrect prediction using data from a table.	Evaluating

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	472	3	Identifies the step in an investigation where variables are controlled to create a fair test.	Planning and conducting
6/10 link	472	3	Provides a partial explanation of the function of a device used in a field study.	Biological sciences
10	471	3	Identifies that gravitational force causes moons to orbit a planet.	Physical sciences
6/10 link	469	3	Interprets results from an investigation to identify a single impact of plants on water runoff.	Evaluating
10	469	3	Identifies that heat travels through space by radiation.	Physical sciences
10	468	3	Selects objects for a model that best represent real-life objects.	Processing, modelling and analysing
6/10 link	467	3	Identifies a suitable change to an experimental design.	Evaluating
6	466	3	Classifies variables in an investigation.	Planning and conducting
6	465	3	Describes a factor for consideration in a disaster prevention plan.	Use and influence of science
6	463	3	Extrapolates data from a table.	Processing, modelling and analysing
6	463	3	Identifies a strategy to control a variable when repeating an experiment.	Planning and conducting
6	463	3	Identifies the processes that result in an object being seen as green.	Physical sciences
6	462	3	Classifies the variables in an investigation.	Planning and conducting
10	460	3	Uses relevant data from a graph to determine that the results do not support a prediction.	Processing, modelling and analysing
6	459	3	Classifies variables in an investigation.	Planning and conducting
6	457	3	Identifies a prediction for a given investigation.	Questioning and predicting
6	457	3	Selects information to communicate the outcome of an investigation on a poster report for a school event.	Communicating
6/10 link	455	3	Identifies a parasitic relationship between 2 organisms.	Biological sciences
10	453	3	Suggests the cause for an abnormal result in a trial.	Evaluating
6/10 link	453	3	Selects labels for the axes of a graph of results.	Processing, modelling and analysing

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	452	3	Explains the impact of an investigation on a real-world application.	Use and influence of science
10	450	3	Identifies a metal that is not an element.	Chemical sciences
6/10 link	447	3	Identifies the labels for a pie graph using information from a text.	Processing, modelling and analysing
6	447	3	Uses diagrams to show the arrangement of magnets.	Physical sciences
6	445	3	Identifies whether a prediction is supported by the results of an experiment.	Processing, modelling and analysing
6/10 link	445	3	Predicts an outcome by extrapolating data from a graph.	Processing, modelling and analysing
10	443	3	Identifies that a lamp will act as a light source for photosynthesis in an investigation.	Chemical sciences
10	442	3	Understands that similar materials can have different properties.	Evaluating
10	442	3	Explains an advantage of a parasite not killing its host.	Biological sciences
6	441	3	Identifies the independent variable in an experiment.	Planning and conducting
10	440	3	Matches the physiological response of heat to how the body functions.	Biological sciences
10	439	3	Identifies a scientific question that can be answered in an investigation using 2 different pendulums.	Questioning and predicting
6	439	3	Selects the most suitable measuring device for an investigation.	Planning and conducting
6/10 link	437	3	Identifies 2 environmental impacts of plastic bag use.	Use and influence of science
6/10 link	437	3	Explains a limitation of a suggested method of monitoring an investigation or proposes an alternative.	Planning and conducting
6/10 link	436	3	Correctly labels a graph of results.	Processing, modelling and analysing
6	432	3	Explains why washing-up gloves are made of rubber.	Chemical sciences
6	432	3	Predicts the impact of a population change in a food web.	Biological sciences
10	430	3	Identifies parts of an atom.	Chemical sciences
6/10 link	430	3	Identifies the advantages of fruit consumption by orangutangs for durian trees.	Biological sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6	430	3	Uses graphical information to predict an outcome.	Processing, modelling and analysing
10	430	3	Describes how a single adaptation helped a marsupial lion to survive.	Biological sciences
10	430	3	Calculates the energy efficiency of a model rover in an investigation.	Processing, modelling and analysing
10	430	3	Identifies a reason for multiple trials in an investigation.	Evaluating
10	427	3	Defines kinetic energy.	Physical sciences
6	427	3	Explains the purpose of a controlled variable.	Planning and conducting
10	424	3	Uses information from a diagram to explain the presence of fossils in a given location.	Processing, modelling and analysing
10	424	3	Classifies the microorganism malaria based on its life cycle.	Biological sciences
10	423	3	Identifies the energy transformation that occurs during a dive.	Physical sciences
6	423	3	Identifies the producers in the food web.	Biological sciences
6	422	3	Identifies a way to improve the quality of results.	Evaluating
6/10 link	422	3	Identifies the aim of an investigation by looking at the outcomes.	Questioning and predicting
6	419	3	Draws a reasoned conclusion supported by evidence.	Evaluating
6/10 link	419	3	Recognises that a prediction was not supported by the results of an investigation.	Evaluating
6/10 link	418	3	Evaluates conclusions from an investigation to identify an incorrect conclusion.	Evaluating
10	417	3	Identifies the position of a minimum on a line graph.	Processing, modelling and analysing
6	416	3	Identifies friction as force involved in movement.	Physical sciences
6/10 link	416	3	Recognises the independent variable in an investigation.	Planning and conducting
6/10 link	415	3	Explains the environmental benefits of using plant-based plastic bags.	Use and influence of science
6	415	3	Identifies how scientific knowledge can be used to make community decisions.	Use and influence of science
6/10 link	414	3	Applies experimental data to a real-life situation.	Use and influence of science

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6	411	3	Recalls that a liquid will change into a solid when it cools.	Chemical sciences
6/10 link	410	3	Identifies an independent variable in a scientific investigation.	Planning and conducting
6/10 link	408	3	Identifies gravity as the force that causes glaciers to move downhill.	Earth and space sciences
6	408	3	Interprets graphical data to explain changes relating to tide height.	Processing, modelling and analysing
6	407	3	Converts metres to centimetres.	Planning and conducting
10	406	3	Identifies a prediction for a given investigation.	Questioning and predicting
10	406	3	Identifies the equipment that will give the most accurate measurement in a given investigation.	Planning and conducting
6	405	3	Identifies that objects that form shadows are opaque.	Physical sciences
6	404	3	Identifies whether a prediction is supported by results.	Evaluating
10	404	3	Calculates the missing average in a data table.	Processing, modelling and analysing
10	403	3	Calculates the missing value in a table.	Processing, modelling and analysing
6	403	3	Selects a point on a graph.	Processing, modelling and analysing
10	402	3	Classifies the variables in an investigation.	Planning and conducting
6	400	3	Identifies the benefits of camouflage for an animal.	Biological sciences
10	398	3	Classifies variables in an investigation.	Planning and conducting
6	396	3	Identifies a reliable source of information for growing native yams.	Processing, modelling and analysing
6	394	3	Explains an appropriate risk management for a particular animal bite or sting.	Planning and conducting
10	394	3	Analyses information from a complex graph.	Processing, modelling and analysing
6	390	2	Selects the most suitable measuring device for an investigation.	Planning and conducting
6	389	2	Explains why stars are only seen at night.	Earth and space sciences
6/10 link	388	2	Classifies environmental features as living or non-living.	Biological sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6	385	2	Interprets a hazard map to determine the safest place to build.	Use and influence of science
6	384	2	Identifies the feature of an organism most likely to show a specific adaption.	Biological sciences
10	383	2	Explains the direction of blood circulation in the heart.	Biological sciences
6/10 link	378	2	Identifies the scientific question being investigated from an experimental design.	Questioning and predicting
6	375	2	Predicts shadow formation using information from a diagram.	Physical sciences
6	375	2	Understands that similar materials can have different properties.	Evaluating
6/10 link	375	2	Draws a conclusion from a table of results from an investigation.	Processing, modelling and analysing
6	374	2	Predicts the variable that is most likely to affect the properties of a mixture.	Questioning and predicting
6/10 link	372	2	Extracts information from a life cycle diagram.	Biological sciences
6/10 link	372	2	Identifies the dependent variable that can be most accurately measured in an investigation.	Planning and conducting
6	370	2	Interprets a graph to determine the trend.	Evaluating
6	368	2	Identifies whether an experimental design is a fair test.	Planning and conducting
6	366	2	Labels a graph using information from a data table.	Processing, modelling and analysing
10	366	2	Transfers knowledge of energy transformations to a new situation with similar energy changes.	Nature and development of science
10	364	2	Selects the most accurate piece of equipment to measure volume.	Planning and conducting
10	364	2	Identifies the formula for carbon dioxide.	Chemical sciences
10	364	2	Classifies reasons for the use of a technological innovation as scientific, economic or social.	Use and influence of science
6/10 link	363	2	Identifies advantages and disadvantages for advances in technology in research.	Use and influence of science
6/10 link	361	2	Identifies the point on a perch most susceptible to force.	Physical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	361	2	Identifies a solution to an environmental problem based on scientific observations.	Use and influence of science
6	359	2	Predicts the change of state when temperature is decreased.	Chemical sciences
6/10 link	357	2	Evaluates the inferences made from observations to draw a conclusion.	Evaluating
6/10 link	355	2	Explains how adaptations in orangutangs allow them to live in forests.	Biological sciences
10	354	2	Compares the relative sizes of the Sun, Earth and Earth's Moon.	Earth and space sciences
6	353	2	Identifies an object that is transparent.	Physical sciences
6/10 link	352	2	Identifies appropriate order of testing in an investigation.	Planning and conducting
6	350	2	Classifies environmental features as living or non-living.	Biological sciences
6	348	2	Orders the steps in the life cycle of a bee.	Biological sciences
10	345	2	Identifies a specific section of a distance-time graph.	Processing, modelling and analysing
6	344	2	Determines the evidence to support a conclusion.	Evaluating
6	344	2	Identifies a testable question for a given investigation.	Questioning and predicting
6	344	2	Uses diagrams to show the arrangement of magnets.	Physical sciences
6/10 link	342	2	Completes a calculation to determine energy wastage.	Processing, modelling and analysing
6	341	2	Identifies a prediction about a scientific investigation.	Questioning and predicting
6	341	2	Identifies that decreasing temperatures will change a liquid to a solid faster.	Chemical sciences
6/10 link	340	2	Explains why a method for collecting data is not accurate.	Evaluating
6/10 link	338	2	Identifies the relationship between 2 variables in an investigation.	Processing, modelling and analysing
6	337	2	Matches potential risks of an investigation to ways the risks can be reduced.	Planning and conducting
6	336	2	Determines the position of the Sun to form a shadow.	Physical sciences
6/10 link	336	2	Orders objects using data given in a graph.	Processing, modelling and analysing

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6/10 link	334	2	Extracts data from tabulated results that support a conclusion.	Evaluating
10	334	2	Classifies the advantages and disadvantages of maglev trains.	Use and influence of science
10	328	2	Analyses how stone tools result from contributions from disciplines of science.	Use and influence of science
6	326	2	Uses a diagram to describe damage caused by a storm.	Use and influence of science
6	324	2	Identifies an accurate way to measure time.	Planning and conducting
6	321	2	Draws a conclusion based on information in a text and tabled data.	Processing, modelling and analysing
6	318	2	Classifies predators and prey in a food web.	Biological sciences
6	317	2	Selects variables to keep the same for a given investigation.	Planning and conducting
6	316	2	Classifies objects as solids, liquids or gases.	Chemical sciences
6	315	2	Uses information from a table to identify animals that have a constant body temperature.	Processing, modelling and analysing
10	315	2	Identifies the energy transformations that occurs in solar panels.	Physical sciences
6	314	2	Identifies vibration as the source of sound.	Physical sciences
10	310	2	Identifies a prediction for a given investigation.	Questioning and predicting
6	304	2	Compares the properties of a solid and a liquid.	Chemical sciences
6	304	2	Describes how buildings form shadows.	Physical sciences
10	300	2	Analyses data to order objects from fastest swinging pendulum to slowest.	Processing, modelling and analysing
6	295	2	Identifies a reversible change.	Chemical sciences
10	295	2	Describes the function of the lungs.	Biological sciences
6	292	2	Identifies solid, liquid and gaseous states within a picture of a geological event.	Chemical sciences
6	286	1	Describes the trend in tabulated data.	Processing, modelling and analysing
6	286	1	Interprets graphical data to identify water level.	Processing, modelling and analysing

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
10	286	1	Uses diagrams to describe lunar and solar eclipses.	Earth and space sciences
6	284	1	Identifies correct observations from a diagram.	Processing, modelling and analysing
6/10 link	284	1	Measures the volume in a measuring cylinder.	Planning and conducting
6	279	1	Compares the properties of a solid and a liquid.	Chemical sciences
6/10 link	274	1	Describes advantages and disadvantages of burning rubbish.	Use and influence of science
6/10 link	271	1	Explains why the Sun is essential for human survival.	Earth and space sciences
6/10 link	266	1	Describes the role of fertilisers for a plant.	Biological sciences
6/10 link	264	1	Provides a reason for wearing safety goggles during an investigation.	Planning and conducting
10	257	1	Interprets data from a table to draw a conclusion.	Processing, modelling and analysing
10	256	1	Identifies that a dog has a similar heart to humans.	Biological sciences
6	252	1	Describes the change of state when liquids are cooled.	Chemical sciences
6/10 link	246	1	Extracts information from a table.	Processing, modelling and analysing
10	245	1	Identifies that the immune system provides the first response to an infectious disease.	Biological sciences
6	244	1	Identifies an issue that can be informed by scientific study.	Use and influence of science
6	241	1	Identifies the movement of heat through different objects.	Physical sciences
6	226	1	Selects appropriate equipment for an investigation.	Planning and conducting
6	222	1	Defines an irreversible reaction.	Chemical sciences
6/10 link	221	1	Recognises that Mars takes longer to orbit the Sun than Earth.	Earth and space sciences
6	220	1	Classifies objects as solids or liquids.	Chemical sciences
6	216	1	Identifies 2 common devices that use electricity.	Physical sciences
6	205	1	Identifies when a mixture is boiling.	Chemical sciences
6	205	1	Describes the change of state when liquids are cooled.	Chemical sciences

Year level	Scale score	Proficiency level	Task descriptor	Sub-strand
6	199	1	Identifies labels required for a column graph.	Processing, modelling and analysing
6	190	1	Identifies risk management strategies when carrying out field experiments.	Planning and conducting
6/10 link	108	1	Analyses a graph to identify the renewable energy source that generates the most electricity.	Processing, modelling and analysing
6	-17	1	Identifies that decreasing temperatures will change a liquid to a solid.	Chemical sciences

Appendix B: Sample characteristics by state and territory

Table A2: Age – percentages of students by year level, nationally and by state and territory

	Mode	10	11	12	13	14	15	16	17	Missing
Year 6										
NSW	11	1	55	44	0					
VIC	12		47	51	1					1
QLD	11	0	73	25	1					2
SA	11	0	62	38	0					0
WA	11	0	81	18						0
TAS	12	0	30	69	0					0
NT	11	0	71	28						1
ACT	11	1	54	44		0				1
Aust.	11	0	60	39	0	0				1
Year 10										
NSW	15					0	60	39	1	
VIC	16					0	46	52	1	1
QLD	15					1	73	26	0	
SA	15					1	57	41		1
WA	15					0	77	23		
TAS	16						32	65	1	1
NT	15					1	75	23		
ACT	15						55	45		
Aust.	15					0	60	39	0	0

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Table A3: Gender – percentages of students by year level, nationally and by state and territory

	Gender	Aust.	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Year 6	Male	51	52	48	51	52	52	47	49	51
	Female	49	48	52	49	48	48	53	51	49
	Other	0	0	0	0	0	0	0	0	0
Year 10	Male	50	48	53	51	47	48	41	47	57
	Female	50	52	47	49	53	52	58	53	43
	Other	0	0	0	0	0	0	1	0	0

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Table A4: Parental occupation – percentages of students by year level, nationally and by state and territory

	Parental occupation	Aust.	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Year 6	Senior managers and professionals	33	33	31	33	34	33	30	30	40
	Other managers and associate professionals	23	25	24	19	26	22	23	21	24
	Tradespeople & skilled office, sales and service staff	22	25	22	21	19	18	22	22	14
	Machine operators, labourers, hospitality, and related staff	11	11	13	9	10	13	15	15	3
	Not in paid work in last 12 months	7	5	9	8	3	6	6	12	5
	Missing data	5	1	1	11	8	8	3	1	14
Year 10	Senior managers and professionals	36	36	33	37	40	34	42	44	58
	Other managers and associate professionals	22	22	24	21	13	20	24	21	20
	Tradespeople & skilled office, sales and service staff	21	22	21	22	20	16	21	30	13
	Machine operators, labourers, hospitality, and related staff	11	12	13	7	13	15	6	5	7
	Not in paid work in last 12 months	5	5	8	3	6	5	2	0	0
	Missing data	5	2	2	11	8	10	5	1	2

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Table A5: Parental education – percentages of students by year level, nationally and by state and territory

	Parental education	Aust.	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Year 6	Bachelor degree or above	47	46	53	44	39	45	37	40	65
	Advanced diploma/diploma	14	14	14	14	14	14	12	13	8
	Certificate I to IV (inc trade cert)	24	25	19	29	22	24	35	31	14
	Year 12 or equivalent	7	7	7	6	16	6	5	4	5
	Year 11 or equivalent	1	1	2	1	3	3	3	2	1
	Year 10 or equivalent	2	2	3	2	2	3	6	4	2
	Year 9 or equivalent or below	2	2	3	1	1	1	0	5	1
	Missing data	2	2	1	2	4	4	2	1	5
Year 10	Bachelor degree or above	46	48	47	44	34	46	46	62	74
	Advanced diploma/diploma	14	14	16	16	7	13	10	14	10
	Certificate I to IV (inc trade cert)	23	25	21	27	17	19	35	19	10
	Year 12 or equivalent	7	5	8	5	26	8	3	3	5
	Year 11 or equivalent	2	1	2	2	1	2	2	0	0
	Year 10 or equivalent	2	2	1	2	2	4	0	1	0
	Year 9 or equivalent or below	2	2	2	1	1	1	0	0	0
	Missing data	4	2	4	3	12	7	4	0	2

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Table A6: Indigenous status – percentages of students by year level, nationally and by state and territory

	Indigenous status	Aust.	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Year 6	Non-Indigenous students	92	92	92	92	92	91	86	70	96
	Indigenous students	5	6	2	5	4	7	10	30	2
	Missing data	3	2	5	2	4	2	4	0	2
Year 10	Non-Indigenous students	93	90	96	93	97	96	93	84	99
	Indigenous students	5	9	1	5	2	3	4	16	1
	Missing data	1	1	3	2	1	1	3	0	0

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Table A7: Language spoken at home – percentages of students by year level, nationally and by state and territory

	Language spoken at home	Aust.	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Year 6	English only	70	71	65	79	78	56	91	65	69
	Language other than English	27	29	34	21	22	27	7	33	30
	Missing data	2	0	1	0	0	17	3	1	0
Year 10	English only	73	64	73	87	70	68	91	67	66
	Language other than English	26	35	27	13	29	25	7	33	34
	Missing data	1	0	0	0	1	7	2	0	0

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Table A8: Geographic location – percentages of students by year level, nationally and by state and territory

	Geographic location	Aust.	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Year 6	Major cities	72	75	76	66	74	76	0	0	100
	Regional	27	25	24	34	21	19	98	68	0
	Remote	1	0	0	0	5	4	2	32	0
Year 10	Major cities	72	77	77	58	88	75	0	0	98
	Regional	27	23	23	38	12	25	100	55	2
	Remote	1	0	0	3	0	0	0	45	0

Results are rounded to the nearest whole number so some totals may appear inconsistent.

Appendix C: Reporting of results

The students assessed in NAP–Science Literacy 2023 were selected using a 2-stage cluster sampling procedure. In the first stage, schools were sampled from a sampling frame with a probability proportional to their size as measured by student enrolments in the relevant year level. In the second stage, 20 students at each year level were randomly sampled within schools (see NAP–Science Literacy 2023 Technical Report, Chapter 3 on sampling and weighting).

Applying cluster sampling techniques is an efficient and economical way of selecting students in educational research. However, as these samples were not obtained through (one-stage) simple random sampling, standard formulae to obtain sampling errors of population estimates are not appropriate. In addition, NAP–Science Literacy estimates were obtained using plausible value methodology (see NAP–Science Literacy 2023 Technical Report, Chapter 6 on scaling procedures), which allows for estimating and combining the measurement error of achievement scores with their sampling error.

Reporting of results by subgroups of interest becomes more limited as group sizes decrease due to the increase in error that accompanies this. For this cycle of NAP–Science Literacy, the gender category “other” is not reported because there are fewer than 30 students or fewer than 5 schools with valid data.

This appendix describes the method applied for estimating sampling as well as measurement error. In addition, it contains a description of the types of statistical analyses and significance tests that were carried out for reporting of results in this report.

Computation of sampling and measurement variance

Unbiased standard errors from studies should include both sampling variance and measurement variance. One way of estimating sampling variance on population estimates from cluster samples is by using the application of replication techniques (Wolter 1985). The sampling variances of population means, differences, percentages and correlation coefficients in NAP–Science Literacy studies were estimated using the jackknife repeated replication technique (JRR). The other component of the standard error of achievement test scores, the measurement variance, can be derived from the variance among the 5 plausible values for NAP–Science Literacy. In addition, for comparing achievement test scores with those from previous cycles (2006, 2009, 2012, 2015 and 2018), an equating error was added as a third component of the standard error.

Replicate weights

When applying the JRR method for stratified samples, primary sampling units (PSUs) – in this case schools – are paired into pseudo-strata, also called sampling zones. The assignment of schools to these sampling zones needs to be consistent with the sampling frame from which they were sampled (to obtain pairs of schools that were adjacent in the sampling frame), and zones are always constructed within explicit strata of the sampling frame. This procedure ensures that schools within each zone are as similar to each other as possible.[12] For NAP–Science Literacy 2023, there were 191 sampling zones in Year 6 and 114 in Year 10.

Within each sampling zone, a jackknife indicator variable was created by randomly assigning a value of 2 for one school and assigning a value of zero to the other one. To create replicate weights for each of these sampling zones, the jackknife indicator variable was multiplied by the original sampling weights of students within the corresponding zone so that one of the paired schools had a contribution of zero and the other school a double contribution, whereas schools from all other sampling zones remained unmodified.

[12] In the case of an odd number of schools within an explicit stratum on the sampling frame, the remaining school is randomly divided into 2 halves and each half assigned to the 2 other schools in the final sampling zone to form *pseudo-schools*.

At each year level, 193 replicate weights were computed. The last 2 replicates in Year 6 and the last 79 replicates in Year 10 were equal to the final sampling weight. This was done to have a consistent number of replicate weight variables in the final database.

Standard errors

To compute the sampling variance for a statistic t, t is estimated once for the original sample S and then for each of the jackknife replicates J_h. The JRR variance is computed using the formula:

$$Var_{jrr}(t) = \sum_{h=1}^{H} \left[t(J_h) - t(S) \right]^2$$

where H is the number of replicate weights, t(S) the statistic t estimated for the population using the final sampling weights, and $t(J_h)$ the same statistic estimated using the weights for the h^{th} jackknife replicate. For all statistics that are based on variables other than student test scores (plausible values) the standard error of t is equal to:

$$\sigma(t) = \sqrt{Var_{jrr}(t)}$$

The computation of JRR variance can be obtained for any statistic. However, many standard statistical software packages like SPSS® do not generally include any procedures for replication techniques. Therefore, specialist software, the SPSS® Replicates add-in, was used to run tailored SPSS® macros to estimate JRR variance for means and percentages.[13]

Population statistics for NAP–Science Literacy scores were always estimated using all 5 plausible values with standard errors reflecting both sampling and measurement error. If t is any computed statistic and t_i is the statistic of interest computed on one plausible value, then:

$$t = \frac{1}{M} \sum_{i=1}^{M} t_i$$

with M being the number of plausible values.

The sampling variance U is calculated as the average of the sampling variance over all plausible values (U_i):

$$U = \frac{1}{M} \sum_{i=1}^{M} U_i$$

Using 5 plausible values for data analysis allows the estimation of the error associated with the measurement of NAP–Science Literacy due to the lack of precision of the test instrument. The measurement variance or imputation variance B_M was computed as:

$$B_m = \frac{1}{M-1} \sum_{i=1}^{M} \left(t_i - t \right)^2$$

13 Conceptual background and application of macros with examples are described in the PISA Data Analysis Manual SPSS®, Second Edition (OECD, 2009b).

To obtain the final standard error of NAP–Science Literacy statistics, the sampling variance and measurement variance were combined as:

$$SE = \sqrt{U + \left(1 + \frac{1}{M}\right) B_m}$$

with U being the sampling variance.

The 95% confidence interval, as used in this report, was computed as 1.96 times the standard error. The actual 95% confidence interval of a statistic is between the value of the statistic minus 1.96 times the standard error and the value of the statistic plus 1.96 times the standard error.

Reporting of mean differences

Chapter 4 of this report includes comparisons of achievement test results across states and territories; that is, means of scales and percentages are compared in graphs and tables. Each population estimate is accompanied by its 95% confidence interval. In addition, tests of significance for the difference between estimates are provided, to flag results that are significant at the 5% level ($p < 0.05$), which indicates a 95% probability that these differences are not a result of sampling and measurement error.

The following types of significance tests for achievement mean differences in population estimates were reported:

- between states and territories
- between student subgroups such as male and female students
- between this assessment cycle and previous ones in 2018, 2015, 2012, 2009 and 2006 for Year 6, and between this assessment cycle and previous one in 2018 for Year 10.

Mean differences between states and territories and year levels

Pairwise comparison charts allow the comparison of population estimates between one state or territory and another or between Year 6 and Year 10. Differences in means were considered significant when the test statistic t was outside the critical values ±1.96 ($\alpha = 0.05$). The t value is calculated by dividing the difference in means by its standard error, which is given by the formula:

$$SE_{dif\_ij} = \sqrt{SE_i^2 + SE_j^2}$$

where SE_{dif_ij} is the standard error of the difference and SE_i and SE_j are the standard errors of the 2 means i and j. This computation of the standard error was only applied for comparisons between 2 samples that had been drawn independently from each other (for example, jurisdictions or year levels).

In this report, differences were also estimated between percentages attaining the proficient standards in states and territories. The method for estimating the standard error of the difference between percentages is identical to the procedure described for mean differences.

Mean differences between dependent subgroups

The formula for calculating the standard error described in the previous section is not appropriate for subgroups from the same sample (see OECD 2009 for more detailed information). Here, the covariance between the 2 standard errors for subgroup estimates needs to be considered and JRR should be used to estimate correct sampling errors of mean differences. Standard errors of differences between statistics for subgroups from the same sample (for example, groups classified according to student background characteristics) were derived using the SPSS® Replicates add-in. Differences between subgroups were considered significant when the test statistic t was outside the critical values ±1.96 (α = 0.05). The value t was calculated by dividing the mean difference by its standard error.

Mean differences between assessment cycles (2006, 2009, 2012, 2015, 2018 and 2023)

Chapter 4 also includes comparisons of achievement results across assessment cycles. The process of equating tests across different achievement cycles introduces a new form of error when comparing population estimates over time: the equating or linking error. When computing the standard error, equating error as well as sampling and measurement error were taken into account. The computation of equating errors is described in Chapter 6 of the Technical Report.

The value of the equating error between 2023 and the previous assessment in 2018 is 6.03 score points on the NAP–Science Literacy scale for both year levels. When testing the difference of a statistic between these 2 assessment cycles, the standard error of the difference was computed as follows:

$$E(t_{23} - t_{18}) = \sqrt{SE_{23}^2 + SE_{18}^2 + EqErr_{23\_18}^2}$$

where t can be any statistic in units on the NAP–Science Literacy scale (mean, percentile, gender difference, but not percentages), SE_{23}^2 is the respective standard error of this statistic in 2023, SE_{18}^2 the corresponding standard error in 2018 and $\mathrm{EqErr}_{23\_18}^2$ the equating error for comparing 2023 with 2018 results.

When comparing population estimates between 2023 and the assessment in 2015, 2 equating errors (between 2023 and 2018 and between 2018 and 2015) had to be taken into account. This was achieved by applying the following formula for the calculation of the standard error for differences between statistics from 2023 and 2015:

$$SE(\mu_{23} - \mu_{15}) = \sqrt{SE_{23}^2 + SE_{15}^2 + EqErr_{23\_15}^2}$$

where $\mathrm{EqErr}_{23\_15}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 2023 and 2018 (6.03 score points) as well as between 2018 and 2015 (4.39 score points). This combined equating error was equal to 7.46 score points and was calculated as:

$$EqErr_{23\_15} = \sqrt{EqErr_{23_{18}}^2 + EqErr_{18_{15}}^2}$$

Similarly, for comparisons between 2023 and the NAP–Science Literacy assessment in 2006, the equating errors between each adjacent pair of assessments had to be considered and standard errors for differences were computed as:

$$SE(\mu_{23} - \mu_{06}) = \sqrt{SE_{23}^2 + SE_{06}^2 + EqErr_{23\_06}^2}$$

$\mathrm{EqErr}^2_{23\_06}$ reflects the uncertainty associated with the equating between the assessment cycles of 2023 and 2018 (6.03 score points) and between 2018 and 2006 (8.28 score points). The combined equating error was equal to 10.24 score points, and was calculated as:

$$EqErr_{23\_06} = \sqrt{EqErr^2_{23_{18}} + EqErr^2_{18_{06}}}$$

To report the significance of differences between percentages at or above proficient standards, the corresponding equating error had to be estimated using a different approach. To obtain an estimate, the following replication method was applied to estimate the equating error for percentages at the proficient standards.

For the cut-point that defines the corresponding proficient standard at each year level (393 for Year 6 and 497 for Year 10), a number of n replicate cut-points were generated by adding a random error component with a mean of 0 and a standard deviation equal to the estimated equating error of 6.03 score points for comparisons between 2023 and 2018, 7.46 score points for comparisons between 2023 and 2015, 8.99 score points for comparisons between 2023 and 2012, 9.56 score points for comparisons between 2023 and 2009, and 10.24 score points for comparisons between 2023 and 2006. Percentages of students at or above each replicate cut-point (ρ_n) were computed and the equating error was estimated as:

$$\mathrm{EquErr}(\rho) = \sqrt{\frac{\Sigma(\rho_n - \rho_o)^2}{n}}$$

where ρ_o is the percentage of students at or above the (reported) proficient standard. The standard errors of the differences in percentages at or above proficient standards between 2023 and 2018 were calculated as:

$$SE(\rho_{23} - \rho_{18}) = \sqrt{SE(\rho_{23})^2 + SE(\rho_{18})^2 + EqErr(\rho_{23\_18})^2}$$

where ρ_{23} is the percentages at or above the proficient standard in 2023 and ρ_{18} in 2018, $\mathrm{SE}(\rho_{23})$ and $\mathrm{SE}(\rho_{18})$ their respective standard errors, and $\mathrm{EqErr}(\rho_{23\_18})$ the equating error for comparisons. For estimating the standard error of the corresponding differences in percentages at or above proficient standards between 2023 and 2015, the following formula was used:

$$SE(\rho_{23} - \rho_{15}) = \sqrt{SE(\rho_{23})^2 + SE(\rho_{15})^2 + EqErr(\rho_{23\_15})^2}$$

Likewise, for estimating the standard error of the corresponding differences in percentages at or above proficient standards between 2023 and 2009 and between 2023 and 2006, the following formulas were used:

$$SE(\rho_{23} - \rho_{09}) = \sqrt{SE(\rho_{23})^2 + SE(\rho_{09})^2 + EqErr(\rho_{23\_09})^2}$$

$$SE(\rho_{23} - \rho_{06}) = \sqrt{SE(\rho_{23})^2 + SE(\rho_{06})^2 + EqErr\left(\rho_{23\_06}\right)^2}$$

For NAP–Science Literacy 2023, 5,000 replicate cut-points were created. Equating errors on percentages were estimated for each sample or subsample of interest. Table A 9 and Table A 10 show the values of these equating errors of Year 6 and Year 10 respectively.

Table A 9: Year 6 equating errors for comparisons between percentages

Group	2023/2018	2023/2015	2023/2012	2023/2009	2023/2006
Aust	2.28	2.83	3.42	3.64	3.90
NSW	2.14	2.67	3.24	3.45	3.71
VIC	2.56	3.13	3.75	3.97	4.24
QLD	2.22	2.78	3.39	3.61	3.88
SA	2.43	3.02	3.62	3.84	4.11
WA	2.17	2.69	3.25	3.45	3.70
TAS	2.04	2.58	3.17	3.38	3.65
NT	2.31	2.84	3.40	3.61	3.86
ACT	2.41	2.91	3.44	3.63	3.87
Female	2.41	2.99	3.60	3.83	4.10
Male	2.15	2.68	3.24	3.45	3.71
Non-Indigenous students	2.30	2.85	3.45	3.67	3.93
Indigenous students	1.92	2.42	2.94	3.13	3.36
English only	2.25	2.81	3.41	3.63	3.89
Language other than English	2.40	2.93	3.50	3.71	3.96
Major cities	2.24	2.78	3.36	3.57	3.83
Regional	2.39	2.98	3.60	3.83	4.10
Remote	2.02	2.49	2.97	3.15	3.35
Senior managers and professionals	1.91	2.37	2.86	3.05	3.27
Other managers and associate professionals	2.29	2.87	3.48	3.71	3.98
Tradespeople & skilled office, sales and service staff	2.54	3.16	3.83	4.08	4.37
Machine operators, labourers, hospitality, and related staff	2.82	3.45	4.12	4.36	4.65
Not in paid work in last 12	2.31	2.82	3.36	3.55	3.79
Bachelor degree or above	2.09	2.98	3.61	3.85	4.13
Advanced diploma/diploma	2.38	3.20	3.88	4.14	4.44
Certificate I to IV (inc trade	2.56	3.07	3.69	3.92	4.18
Year 12 or equivalent	2.45	2.11	2.52	2.67	2.85
Year 11 or equivalent	1.73	2.67	3.13	3.30	3.51
Year 10 or equivalent	2.23	2.58	3.07	3.25	3.47
Year 9 or equivalent or below	2.15	3.52	4.19	4.42	4.70

Table A 10: Year 10 equating errors for comparisons between percentages

Group	2023/2018
Aust	2.15
NSW	2.20
VIC	2.17
QLD	2.16
SA	1.82
WA	2.23
TAS	1.85
NT	3.62
ACT	1.83
Female	2.19
Male	2.10
Non-Indigenous students	2.19
Indigenous students	1.40
English only	2.15
Language other than English	2.15
Major cities	2.12
Regional	2.14
Remote	4.73
Senior managers and professionals	2.08
Other managers and associate professionals	2.27
Tradespeople & skilled office, sales and service staff	2.26
Machine operators, labourers, hospitality, and related staff	2.03
Not in paid work in last 12 months	2.58
Bachelor degree or above	2.05
Advanced diploma/diploma	2.20
Certificate I to IV (inc trade cert)	2.49
Year 12 or equivalent	2.02
Year 11 or equivalent	2.14
Year 10 or equivalent	2.10
Year 9 or equivalent or below	1.13

Appendix D: Student questionnaire

All questions were presented to both Year 6 and Year 10 unless otherwise stated.

Question 1: Year 6 version

1. How much do you agree with the statements below?

Select one choice in each row.

	Strongly agree	Agree	Disagree	Strongly Disagree
I would like to learn more science at school.				
I think it would be interesting to be a scientist.				
I enjoy doing science.				
I enjoy learning new things in science.				
I learn science topics quickly.				
I can understand new ideas about science easily.				
Science is part of my everyday life.				
Science is important for lots of jobs.				
Science is important because it changes how we live.				
Scientific information helps people make good decisions.				

Question 1: Year 10 version

	Strongly agree	Agree	Disagree	Strongly Disagree
I want to study one or more science subjects in Years 11 and 12.				
I am considering a science-related career.				
I enjoy doing science.				
I enjoy learning new things in science.				
I learn science topics quickly.				
I can understand new ideas about science easily.				
Science is part of my everyday life.				
Science is important for lots of jobs.				
Science is important because it changes how we live.				
Scientific information helps people make good decisions.				

2. How much do you agree with the statements below?

Select one choice in each row.

	Strongly agree	Agree	Disagree	Strongly Disagree
Science is about remembering facts.				
Science is about doing experiments.				
Science is finding out about how things work.				
Science is about solving problems.				
Science is about collaborating with others.				
Science is about making enquiries.				

3. **How often do you do these things <u>outside of school</u>?**

Select one choice in each row.

	Frequently (more than 2 times a week)	Often (1 or 2 times a week)	Sometimes (less than once a week)	Never
Watch television or stream content about science-related topics	○	○	○	○
Read physical or digital books, newspapers or articles about science	○	○	○	○
Listen to podcasts, audiobooks or radio on science-related topics	○	○	○	○
Talk about science with my friends	○	○	○	○
Talk about science with my family	○	○	○	○
Post or share content about science-related topics on the internet or social media	○	○	○	○
Contribute to existing discussions about science-related topics on the internet or social media	○	○	○	○
'Like' someone else's content on science-related topics on the internet or social media	○	○	○	○

4. **How often do you do these things <u>at school</u>?**

Select one choice in each row.

	Frequently (more than 2 times a week)	Often (1 or 2 times a week)	Sometimes (less than once a week)	Never
Watch television or stream content about science-related topics	○	○	○	○
Read physical or digital books, newspapers or articles about science	○	○	○	○
Talk about science with my friends	○	○	○	○

5. How much do you agree with the statements below?

Select one choice in each row.

	Strongly agree	Agree	Disagree	Strongly Disagree
Scientific information helps people make informed decisions.	○	○	○	○
Our scientific knowledge is constantly changing.	○	○	○	○
Science can help us understand global issues that impact on people and the environment.	○	○	○	○
I follow the advice of the scientific community when making decisions related to health crises (e.g. during the COVID-19 pandemic).	○	○	○	○
Government decisions should be based on scientific evidence where available.	○	○	○	○
I know where to find scientific information about local and global issues.	○	○	○	○
I know how to decide whether to trust online information about a science topic.	○	○	○	○

6. Which of these science topics have you studied at school?

Select one choice in each row.

	Yes	No
Earth sciences - for example, weather, soil, rocks, using Earth's resources	○	○
Space (astronomy) - for example, galaxies, objects in space including the planets, Sun and Moon	○	○
Forces and motion - for example, how toys and other machines move and work	○	○
Energy, forms and transfer - for example, electricity, heat, light, sound, magnets	○	○
Living things - for example, how animals and plants survive in their environment, food chains and webs, ecosystems	○	○
Multicellular systems - for example, the human body, cells, tissues, organs, body systems	○	○
Diversity and evolution - for example, how living things change over time	○	○
States of matter - for example, changes to materials (solids, liquids and gases), processes of change such as melting, evaporation	○	○
Properties of matter - characteristics of materials such as density, mass, volume, melting point, hardness, elasticity	○	○

Question 6b: Year 6 only

6b. How often do you have science lessons at school?

Note: A science lesson is a lesson with any teacher where you explore how and why things happen. In science lessons, you do experiments, collect information, or talk about scientific ideas.

Select one choice only.

- ○ More than once a week
- ○ Once a week
- ○ Less than once a week, but more than once a month
- ○ Once a month or less
- ○ Never

Question 7: first bullet point only shown to Year 6

7. Do you agree with the statements below?

Select one choice in each row.

	Yes	No
My classroom teacher teaches science to our class.	◯	◯
My teacher invites visitors to school to talk about science topics.	◯	◯
Our class goes on excursions related to the science topics we are learning about.	◯	◯
My teacher can explain scientific concepts clearly.	◯	◯

8. How much do you agree with the statements below?

Science is about ...

Select one choice in each row.

	Strongly agree	Agree	Disagree	Strongly Disagree
making observations about the world.	◯	◯	◯	◯
asking questions about objects and events.	◯	◯	◯	◯
making predictions and testing them.	◯	◯	◯	◯
describing patterns and relationships.	◯	◯	◯	◯
using evidence to develop explanations.	◯	◯	◯	◯
building knowledge by trial and error.	◯	◯	◯	◯

9. How much do you agree with the statements below?

Select one choice in each row.

	Strongly agree	Agree	Disagree	Strongly Disagree
People from many different countries have made important contributions to science.	○	○	○	○
Women and men are both involved in science.	○	○	○	○
People from all cultural backgrounds in Australia are involved in science.	○	○	○	○
People of all ages are involved in science.	○	○	○	○
Women and men are equally skilled in science.	○	○	○	○
Female scientists get as much recognition as male scientists.	○	○	○	○

10. How often do the following activities take place in your science lessons?

Select one choice in each row.

	Never	Sometimes	Mostly	Always
My teacher asks us to brainstorm ideas.	○	○	○	○
My teacher helps me identify patterns between different pieces of information.	○	○	○	○
My teacher encourages me to explain the reasons why I did something.	○	○	○	○
My teacher encourages me to think through all the different options when making decisions.	○	○	○	○
I get to plan and carry out my own investigations.	○	○	○	○
I use a computer or tablet for research into science-related topics.	○	○	○	○
Our class has in-depth discussions about science ideas.	○	○	○	○
We work in groups to carry out investigations.	○	○	○	○

11. How much do you agree with the following statements?

My family encourage me to ...

Select one choice in each row.

	Strongly agree	Agree	Disagree	Strongly Disagree
come up with creative solutions to solving problems.	○	○	○	○
question information I find on the internet or TV.	○	○	○	○
consider situations from different perspectives.	○	○	○	○
consider the source of information.	○	○	○	○
explain my reasons for doing something.	○	○	○	○
look at the different parts of a problem to help me solve it.	○	○	○	○

12. How often do you do the following activities outside of school?

Select one choice in each row.

	Never	Sometimes	Mostly	Always
Do activities which require creative solutions	○	○	○	○
Participate in problem solving activities	○	○	○	○
Come up with my own activities to entertain myself	○	○	○	○
Develop new ways to solve problems	○	○	○	○
Debate topics with my family or friends	○	○	○	○

Question 13: Year 10 only

13. How confident are you in undertaking the following activities?

Select one choice in each row.

	Not at all confident	Not very confident	Somewhat confident	Very confident
Making predictions based on prior evidence	○	○	○	○
Identifying what I don't know about a topic, so I understand what I need to learn	○	○	○	○
Identifying patterns and making connections between different pieces of information	○	○	○	○
Testing different options and monitoring the outcomes	○	○	○	○
Thinking about problems from different perspectives	○	○	○	○
Working on tasks that require creative thinking	○	○	○	○
Questioning the accuracy of the source of information I am receiving	○	○	○	○
Explaining where my ideas came from	○	○	○	○

Appendix E: Average scale scores on questionnaire indices by year level and state and territory

Table A 11: Student perceptions of the nature of science

State/territory	Year 6		Year 10	
NSW	50	(±0.6)	50	(±0.9)
VIC	51	(±0.8)	51	(±0.9)
QLD	49	(±0.6)	-	
SA	50	(±0.8)	-	
WA	50	(±0.3)	50	(±0.9)
TAS	50	(±1.0)	-	
NT	51	(±2.7)	-	
ACT	49	(±1.1)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 12: Student experiences of science-related activities – outside school

State/territory	Year 6		Year 10	
NSW	49	(±0.6)	48	(±1.0)
VIC	50	(±0.9)	48	(±0.9)
QLD	51	(±0.9)	-	
SA	50	(±0.9)	-	
WA	51	(±0.5)	49	(±1.2)
TAS	50	(±0.9)	-	
NT	51	(±2.7)	-	
ACT	49	(±0.6)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 13: Student experiences of science-related activities – at school

State/territory	Year 6		Year 10	
NSW	49	(±0.8)	50	(±1.0)
VIC	50	(±0.8)	51	(±1.0)
QLD	51	(±0.8)	-	
SA	51	(±1.0)	-	
WA	51	(±0.4)	54	(±1.2)
TAS	50	(±0.8)	-	
NT	51	(±2.8)	-	
ACT	50	(±0.8)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 14: Student perceptions of the influence of science

State/territory	Year 6		Year 10	
NSW	50	(±0.9)	49	(±0.9)
VIC	51	(±1.0)	51	(±0.8)
QLD	50	(±0.8)	-	
SA	50	(±1.0)	-	
WA	50	(±0.4)	50	(±1.0)
TAS	49	(±1.2)	-	
NT	50	(±2.7)	-	
ACT	50	(±1.3)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 15: Student reports of science topics studied at school

State/territory	Year 6		Year 10	
NSW	51	(±0.7)	51	(±1.0)
VIC	47	(±1.2)	48	(±1.0)
QLD	52	(±0.7)	-	
SA	51	(±1.0)	-	
WA	51	(±0.3)	50	(±0.9)
TAS	50	(±0.9)	-	
NT	49	(±1.9)	-	
ACT	51	(±1.4)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 16: Student perceptions of the scientific process

State/territory	Year 6		Year 10	
NSW	50	(±0.8)	50	(±1.1)
VIC	51	(±0.9)	51	(±1.0)
QLD	50	(±0.7)	-	
SA	51	(±1.0)	-	
WA	49	(±0.3)	51	(±1.0)
TAS	50	(±1.0)	-	
NT	50	(±2.1)	-	
ACT	49	(±1.6)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 17: Student attitudes to equality in science

State/territory	Year 6		Year 10	
NSW	50	(±0.9)	47	(±0.7)
VIC	50	(±0.9)	49	(±0.9)
QLD	50	(±0.7)	-	
SA	50	(±0.7)	-	
WA	50	(±0.4)	49	(±0.8)
TAS	50	(±0.8)	-	
NT	49	(±2.2)	-	
ACT	49	(±1.5)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 18: Exposure to activities conducive to critical and creative thinking

State/territory	Year 6		Year 10	
NSW	50	(±0.8)	48	(±0.9)
VIC	49	(±1.0)	48	(±1.2)
QLD	51	(±0.8)	-	
SA	50	(±0.9)	-	
WA	50	(±0.5)	48	(±1.7)
TAS	51	(±1.0)	-	
NT	48	(±1.6)	-	
ACT	50	(±1.4)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 19: Family support for critical and creative thinking

State/territory	Year 6		Year 10	
NSW	50	(±0.8)	49	(±0.9)
VIC	51	(±0.9)	49	(±0.7)
QLD	50	(±0.6)	-	
SA	50	(±0.9)	-	
WA	50	(±0.3)	49	(±0.6)
TAS	50	(±0.8)	-	
NT	50	(±2.0)	-	
ACT	50	(±1.6)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 20: Participation in activities outside of school related to critical and creative thinking

State/territory	Year 6		Year 10	
NSW	49	(±0.9)	49	(±1.1)
VIC	50	(±0.9)	49	(±0.7)
QLD	51	(±0.8)	-	
SA	50	(±0.9)	-	
WA	50	(±0.2)	49	(±1.0)
TAS	50	(±1.0)	-	
NT	49	(±1.0)	-	
ACT	51	(±0.9)	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.

Table A 21: Student self-efficacy to apply critical and creative thinking to problem-solving tasks

State/territory	Year 10	
NSW	50	(±1.0)
VIC	50	(±0.7)
QLD	-	
SA	-	
WA	50	(±1.2)
TAS	-	
NT	-	
ACT	-	

Confidence Intervals (1.96 * SE) are reported in brackets.

- = state or territory opted out of sampling sufficient schools for reporting at the jurisdictional level and contributed to national results only.