# National Assessment Program

# ICT Literacy 2022

Technical Report

AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

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# Table of Contents

## List of Tables



## List of Figures

# Chapter 1: Introduction

The National Assessment Program (NAP) began as an initiative of ministers of education in Australia to monitor outcomes of schooling specified in the 1999 Adelaide Declaration on National Goals for Schooling in the 21st Century (Adelaide Declaration). In 2008, the Adelaide Declaration was superseded by the Melbourne Declaration, which in turn was superseded by the Alice Springs (Mparntwe) Education Declaration in 2019.

The NAP was established to measure student achievement and to report this against key performance measures in relation to the national goals. It was 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.

For the National Assessment Program ICT Literacy (NAP–ICT Literacy), the first collection of data from students was in 2005. Subsequent cycles of assessment have been conducted in 2008, 2011, 2014, 2017 and 2022. The 5-year gap between 2017 and 2022 was a result of disruptions caused by the COVID-19 pandemic.

This report describes the various technical, operational and administrative procedures of the NAP–ICT Literacy 2022 assessment. It should be read in conjunction with the NAP–ICT Literacy 2022 Public Report, which presents a summary of the cognitive and contextual analysis of the data collected in the 2022 cycle.

## NAP–ICT Literacy 2022 assessment instrument

The assessment instrument used in NAP–ICT Literacy 2022 was based on the design principles established for NAP–ICT Literacy 2005, which continued through the assessment cycles in 2008, 2011, 2014 and 2017. As in previous cycles, the assessment was computer-based and included a broad range of task formats including multiple-choice, short text response, and simulated and authentic software applications.

The assessment instrument consisted of 8 discrete test modules. Each student was assigned 4 of these modules. A time limit of 20 minutes per module was enforced by the testing software. Each module followed a linear narrative sequence designed to reflect students' typical, real-world use of ICT. The modules included a range of school-based and out-of-school-based themes. All the modules included large tasks to be completed using purpose-built software applications.

The assessment was created to be congruent with the previous 5 assessment cycles (2005, 2008, 2011, 2014 and 2017) to enable the 2022 results to be reported against the existing NAP–ICT Literacy scale. Three modules were trend modules that were used in at least one of the previous assessment cycles. Five modules were newly developed for use in the 2022 assessment.

The newly developed modules covered skills such as:

- collaboration and teamwork
- algorithm creation and data analysis
- project management and user interface design
- analysis and application of simulation software
- online information management and communication.

The full set of assessable content was distributed across a number of test forms using a rotated module design. Every student was assigned one test form containing a total of 4 modules, appropriate to their year level.

## NAP–ICT Literacy student survey

The student survey collected information about students' behaviours and attitudes regarding the use of ICT, both in school and outside of school. In 2022, the survey canvassed students on the following topics:

- students' experience using ICT
- different types of ICT used, and where these are used
- perceptions of importance and self-efficacy of using ICT
- frequency of using ICT for study, entertainment, communication and technological applications both at school and outside of school
- what ICT applications are used for school-related purposes
- how ICT is used in the classroom environment
- types of activities related to ICT and the Digital Technologies (DT) curriculum undertaken at school
- what ICT-related issues are being taught to students
- the extent to which instruction is given for ICT-related coding and problem-solving activities
- exposure to learning about appropriate social behaviours using ICT and how to appropriately use online sources for schoolwork
- student use of ICT for remote or home learning.

The student survey was completed by all Year 6 and Year 10 students immediately following the assessment. Unlike the assessment, the student survey was not timed, with most students completing it in about 15 minutes.

## Delivering the assessments

All participating schools undertook the NAP–ICT Literacy 2022 assessment via an online delivery system. Students completed their assessment using desktop, laptop or tablet devices that were provided by the school or, in some cases, by the students themselves[1] .

In preparation for the assessment, schools carried out an online technical readiness test (TRT) on a sample of assessment-designated devices to check 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 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.

## Student background data

Data regarding individual student background characteristics were collected and matched to students' cognitive and survey responses for analysis and reporting purposes. Where data were held centrally, it was supplied to the Australian Council for Educational Research (ACER) by the relevant educational authority. Where central data collection was not possible, this information was supplied directly by the schools themselves.

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

## Sample

The NAP–ICT Literacy 2022 assessment was based on a nationally representative sample of 636 schools with 9,981 participating students, of which 5,412 were from Year 6 and 4,569 were from Year 10. The student data represent 84% of the sampled Year 6 students and 73% of the sampled Year 10 students. Sampling followed a 2-stage cluster sampling process to ensure that each eligible student had an equal chance of being selected in the sample. In the first stage of sampling, schools were selected from a list of all schools in each jurisdiction with a probability proportional to the number of students in the relevant year level enrolled at that school. In the second stage, 20 students were selected at random from a school-provided list of all eligible students from each target year level.

## Reporting the NAP–ICT Literacy 2022 results

The Rasch model was used to establish the empirical components of the NAP–ICT Literacy reporting scale. The scale was first developed in 2005 using data collected during the inaugural NAP–ICT Literacy assessment. In 2005, the Year 6 cohort was defined as having a mean scale score of 400 and a standard deviation of 100 scale score units. The Year 10 mean and standard deviation in 2005 were determined by the performance of Year 10 relative to the Year 6 parameters.

The 2022 NAP–ICT Literacy assessment includes a proportion of questions that were used in 2017 and previous cycles. Using common item-equating procedures (for items from the trend modules) enabled the recoding of the results for NAP–ICT Literacy 2022 on the scale that had been established in 2005. Consequently, the results from NAP–ICT Literacy 2022 are directly comparable with those from all 5 previous cycles of NAP–ICT Literacy (2017, 2014, 2011, 2008 and 2005).

It was also possible to describe students' ICT literacy in terms of proficiency levels. Six proficiency levels were defined in NAP–ICT Literacy 2005, based on the content of the tasks corresponding to the difficulty range in each level. They were established at equally spaced intervals across the NAP–ICT Literacy scale and characterised typical student performance at each level. The newly developed assessment modules for NAP–ICT Literacy 2022 provided additional examples of ICT literacy achievement, which were added to the progress map but did not require significant changes to the already established scale descriptions.

In addition to deriving the scale and the associated described levels of proficiency, proficient standards were established in 2005 for both Year 6 and Year 10. The proficient standards represent points on the achievement scale that represent a challenging but reasonable expectation for typical students in that year level to have reached. The proficient standard for Year 6 was defined as the boundary between levels 2 and 3 and the proficient standard for Year 10 was defined as the boundary between levels 3 and 4. In 2022, 55% of Year 6 students reached or exceeded the Year 6 proficient standard, whereas 46% of Year 10 students were at or above the proficient standard for this year level. Further information about students' ICT literacy achievement in 2022, including comparisons with previous years, can be found in the NAP–ICT Literacy 2022 Public Report.

## Structure of the technical report

This report describes the technical aspects of the NAP–ICT Literacy 2022 sample assessment and summarises the main activities involved in the data collection, the assessment instruments and the analysis and reporting of the data.

Chapter 2 summarises the development of the assessment framework and describes the process of item development and construction of the instruments. It also provides an overview of the assessment delivery system and test interface.

Chapter 3 reviews the sample design and describes the sampling process. It also describes the weighting procedures that were implemented to derive population estimates and the calculation of response rates.

Chapter 4 describes the data collection, processing and management procedures used. This includes the steps taken to ensure strict data security protocol was followed, as well as the various methods of data capture that were employed before, during and after the administration of the assessment. The procedures employed in the transfer, tracking, verification, cleaning and transformation of the data are also outlined.

Chapter 5 describes the scaling model and procedures, item calibration, the creation of plausible values and the standardisation of student scores. It discusses the procedures used for vertical (Year 6 to Year 10) and horizontal (2022 to 2017, 2014, 2011, 2008 and 2005) equating and the procedures for estimating equating errors.

Chapter 6 outlines the NAP–ICT Literacy proficiency levels and proficient standards.

Chapter 7 outlines the reporting of student results, including the procedures used to estimate sampling and measurement variance, and the multivariate analyses conducted with data from NAP–ICT Literacy 2022.

# Chapter 2: Assessment framework, instrument design and the assessment delivery system

The NAP–ICT Literacy Assessment Domain, developed prior to the first assessment cycle in 2005, was used without modification to guide the instrument development for the 2 subsequent cycles in 2008 and 2011. As part of the preparation for the assessment in 2014, the assessment domain was revised with reference to the Australian Curriculum: ICT Capability (ACARA 2012) and was released as the NAP–ICT Literacy Assessment Framework (ACARA 2014). As part of NAP–ICT Literacy 2017, the assessment framework was revised to clarify the connections between NAP–ICT Literacy and the Australian Curriculum: ICT Capability and the Australian Curriculum: Digital Technologies. The NAP–ICT Literacy Assessment Framework was released in 2017.

In 2018, ACARA hosted a forum where members of state and territory school sectors came together to consider the scope of the NAP–ICT Literacy 2022 assessment and possible future directions (ACARA 2020a). In 2019, ACARA established a working group comprising ICT and Digital Technologies education experts from all Australian states and territories, with the primary focus of reviewing feedback and recommendations from the 2018 forum, formulating the revised assessment framework, and reviewing the development of the NAP–ICT Literacy 2022 test and survey instruments.

## Summary of the assessment framework

From 2005–2017, the definition of ICT literacy, developed by the Council of Australian Governments (COAG) Education Council for use in the National Assessment Program, was:

> The ability of individuals to use ICT appropriately to access, manage and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society.
>
> ACARA 2017, p 2

The revised definition of ICT literacy for the 2022 cycle is:

> The ability to use ICT appropriately and safely to access, manage and evaluate information; develop new understandings; apply computational, design and systems thinking to create solutions; communicate and collaborate with others; and engage productively with emerging and future technologies.
>
> ACARA 2020, p 13

The structure for the revised NAP–ICT Literacy construct draws on the structure adopted by the International Computer and Information Literacy Study (ICILS), a cross-national study of computer and information literacy and computational thinking. The revised framework consists of 4 strands (overarching conceptual categories) each comprising 2–3 aspects (specific content categories within a strand). This structure is a shift from the previous structure which was organised around 3 strands and 6 processes.

The 4 strands and their associated aspects are detailed below:

- **Strand 1: Understanding ICT and digital systems**

  Aspect 1.1: Managing information and operating ICT
  Aspect 1.2: Understanding digital systems

- **Strand 2: Investigating and planning solutions with ICT**

  Aspect 2.1: Accessing and evaluating information
  Aspect 2.2: Collecting and representing data
  Aspect 2.3: Formulating problems and planning solutions

- **Strand 3: Implementing and evaluating digital solutions**

  Aspect 3.1: Communicating with digital information products
  Aspect 3.2: Developing algorithms, programs and interfaces

- **Strand 4: Applying safe and ethical protocols and practices when using ICT**

  Aspect 4.1: Safe and responsible information consumption with ICT
  Aspect 4.2: Responsible digital solutions and information production with ICT

The new structure expands the range of content included in the NAP–ICT Literacy construct and accommodates the creation of digital solutions through the application of the core concepts of the AC: Digital Technologies.

## The NAP–ICT Literacy Assessment Framework and the Australian Curriculum

The NAP–ICT Literacy Assessment Framework includes a detailed description of how the NAP–ICT Literacy assessment content can be mapped to content described in the Australian Curriculum: ICT Capability and the Australian Curriculum: Digital Technologies. Table 2.1 shows a summary of the outcomes of this detailed mapping.

Table 2.1: Mapping the NAP–ICT Literacy processes against the Australian Curriculum

| NAP–ICT Literacy Assessment Framework (2020) strands and aspects | Australian Curriculum: ICT Capability elements | Australian Curriculum: Digital Technologies process summaries |
|---|---|---|
| **Understanding ICT and digital systems** | | |
| Aspect 1.1: Managing information and operating ICT | Managing and operating ICT | Digital systems |
| Aspect 1.2: Understanding digital systems | Managing and operating ICT | Digital systems |
| **Investigating and planning solutions with ICT** | | |
| Aspect 2.1: Accessing and evaluating information | Investigating with ICT | Data and information |
| Aspect 2.2: Collecting and representing data | Investigating with ICT | Data and information |
| Aspect 2.3: Formulating problems and planning solutions | Investigating with ICT<br>Communicating with ICT | Computational thinking and algorithms |
| **Implementing and evaluating digital solutions** | | |
| Aspect 3.1: Communicating with digital information products | Communicating with ICT | Creating digital solutions |
| Aspect 3.2: Developing algorithms, programs and interfaces | Creating with ICT<br>Applying social and ethical protocols and practices when using ICT | Computational thinking and algorithms<br>Creating digital solutions |

| NAP–ICT Literacy Assessment Framework (2020) strands and aspects | Australian Curriculum: ICT Capability elements | Australian Curriculum: Digital Technologies process summaries |
|---|---|---|
| **Applying safe and ethical protocols and practices when using ICT** | | |
| Aspect 4.1: Safe and responsible information consumption with ICT | Applying social and ethical protocols and practices when using ICT | Data and information<br>Digital systems |
| Aspect 4.2: Responsible digital solution and information production with ICT | Applying social and ethical protocols and practices when using ICT | Data and information<br>Digital systems |

## Field trial

An initial NAP–ICT Literacy field trial was conducted in June 2021 with 847 students from 29 schools taking part. Participating schools were located in New South Wales, Queensland and Victoria. Seven Victorian schools were unable to participate due to ongoing COVID-19 restrictions.

A second field trial was necessary to collect data on a module that required significant contextual edits after a widely reported incident made the content unusable. This second field trial took place in June 2022 and involved 861 students from 43 schools in New South Wales, South Australia, Victoria and Western Australia. As per NAP sample protocol, both field trials included schools from only the larger jurisdictions to avoid burdening the comparatively oversampled schools from the smaller jurisdictions.

The major purpose of the field trials was to test the assessment instruments and associated operational procedures. As a result of the findings, decisions were made as to which modules, and which tasks within modules, would be used in the Main Study assessment instrument. The coverage and content of the assessment instrument is described in the following section.

## Assessment instrument

Three trend modules – Technology on the go (Year 6, from NAP–ICT Literacy 2014 and 2017), Acceptable use agreement (Year 10, from NAP–ICT Literacy 2017) and School website (Year 6 and Year 10, from NAP–ICT Literacy 2017) – were included in the 2022 Main Study instrument. The use of trend modules enables direct comparisons between the performance of students in 2022 with those of previous cycles of NAP–ICT Literacy. The modules were selected after confirming that the contexts and contents of their component items had maintained relevance over time. The comparability of the student data collected for those modules in 2022 with that collected in previous cycles was confirmed in the Field Trial phase. Further detail about the contents of each of these 3 trend modules is given below.

- **Technology on the go (Year 6 only):** Students took a borrowed tablet on a 2-week school trip to Central Australia. The students were asked to set up the tablet to access the internet, install a number of applications, configure one of the applications to collect weather data and use software to create visualisations of the data.
- **Acceptable use agreement (Year 10 only):** Students were asked to use internet search engines and resources to find information about acceptable-use agreements for schools. Students then reflected on some of the requirements of an agreement, such as the permission required for the distribution of images on social media, and created a digital poster to promote positive ICT use.
- **School website (Year 6 and Year 10):** Students were required to analyse website analytics reports to identify problems with a school webpage and make suggestions to improve the website's navigation structure. Students then had to construct a webpage to promote a sports event, including creating a web form for event registration.

In addition to enabling comparisons between cycles, it was also important to ensure that the NAP–ICT Literacy assessment instrument referenced more recent developments in the types of software students use. For this reason, 2 new ICT modules were developed: Fundraiser and Park design.

- **Fundraiser (Year 6 and Year 10):** Students were required to create a 4-slide presentation recommending a sponsored walkathon as a fundraising activity, covering the survey results, benefits and organising tips. Students engaged with various aspects of online information management, including survey administration, evaluating content and sources, and effective communication. They assessed the pros and cons of sharing methods, examined the reliability of search results and interpreted survey outcomes.
- **Park design (Year 6 and Year 10):** Students were asked to design a park for a competition, adhering to a $4,000 budget and incorporating group ideas while following council guidelines. They formed teams within a collaboration app, addressed user editing concerns and added members. Students engaged in team communication, welcomed new members, and shared resources such as webpages and documents to effectively edit documents based on team input.

Digital Technologies items were developed to keep NAP–ICT Literacy up to date with technological advancements and broaden the scope of ICT literacy to cover more contexts and processes. Three new modules were developed: Robodog, Interactive story and Water quality.

- **Robodog (Year 6 only):** Students used simulation software to test and analyse robotic toy components, focusing on sensor functionality, design features and control mechanisms. They developed web forms to gather user feedback and explored various input field types, ultimately employing a digital remote controller for practical application.
- **Interactive story (Year 6 and Year 10):** Students developed an interactive story, employing project management tools like Gantt charts and task assignments. They optimised data sorting tools and focused on user interface design elements for improved usability, created choice-based stories with decision trees and devised algorithms for dynamic scene changes.
- **Water quality (Year 10 only):** Students were required to develop an algorithm that could be used for assessing water quality data. They analysed flow charts, configured databases and processed data. They identified disadvantages of offline data analysis, and issues with data collection and storage, and determined optimal sorting methods. Students created Structured Query Language (SQL) queries, selected suitable charts, inferred missing values, and devised formulas and algorithms to classify and calculate data based on numerical ranges.

## Survey instrument

The student survey is an integral part of the NAP–ICT Literacy assessment program and provides a valuable contextual aspect to the investigation of ICT literacy outcomes for students. It enables the collection and measurement of student behaviours around, and attitudes towards, the use of ICT and allows us to identify the context in which ICT education occurs.

A student survey has been incorporated into the NAP–ICT Literacy assessment in all previous cycles. In 2005 and 2008, the survey material included student demographic information and questions about student ICT use. Since 2011, all student demographic information has been collected from the records held by the schools themselves or their central education authorities. Consequently, there was an opportunity to increase the amount of survey content addressing attitudinal and behavioural aspects. This included:

- students’ experience using ICT
- different types of ICT used, and where these are used
- perceptions of importance and self-efficacy of using ICT
- frequency of using ICT for study, entertainment, communication and technological applications both at school and outside of school
- what ICT applications are used for school-related purposes
- how ICT is used in the classroom environment

- types of ICT activities undertaken at school
- what ICT-related issues are being taught to students
- extent to which instruction is given for ICT-related coding and problem-solving activities.

In 2022, several additions and one significant change in terminology were made to the survey content. These included:

- changing the terminology of “digital devices” to “ICT devices”, reflecting the evolution of types of ICT commonly used across time
- adding new content about undertaking activities related to DT in schooling
- adding new content on exposure to learning about appropriate social behaviours using ICT and how to appropriately use online sources for schoolwork
- adding new content to reflect software that is more widely used since the previous cycle
- adding new content on student use of ICT for remote or home learning.

The student survey was completed by all Year 6 and Year 10 students immediately following the assessment. Unlike the assessment, the student survey was not timed, with most students completing it in about 15 minutes.

A copy of the student survey can be found in Appendix A: Student survey.

## Assessment delivery system

All participating schools undertook the NAP–ICT Literacy 2022 assessment via an online assessment delivery system. Students used desktop, laptop or tablet devices that were provided by the school (or in some cases, by the students themselves), and were connected to the internet via either a wired or wireless connection.

After logging in with assigned student-specific credentials, students were led through a short tutorial to familiarise them with the test interface and the types of tasks they would be presented with. Students were then presented with their assigned test modules, with the assessment delivery system capturing student responses to all allocated tasks and survey questions.

Given the advances in technology and interface design principles over the course of the last few years, it was necessary to refine, update and improve the on-screen environment for NAP–ICT Literacy from its inaugural administration in 2005. The interface experienced by the student was consistent throughout the first 3 cycles of NAP–ICT Literacy. Both aesthetic and functional improvements to the interface were first made in 2014, and then again for the 2022 cycle, in order to reflect modern software interface design. However, certain core elements of the interface were kept constant over the cycles so that the overall user test experience was maintained and comparison of student achievement across cycles could be made.

The following elements were common to all 3 versions of the test interface over the course of the NAP–ICT Literacy program:

- the interface had a surrounding border of test-taking information and navigation facilities
- there was a central information section that contained either software applications or stimulus materials for students to read
- a lower section of the interface contained instructional text and a response area for multiple-choice and short answer response items.

As in previous cycles, the assessment items were presented to students in a linear sequence and students were not permitted to return to previously completed items (which could potentially inform later items).

Figure 2.1 shows a side-by-side comparison of the test interfaces used from 2005–2011 and from 2014–2017. Figure 2.2 shows the test interface for the 2022 cycle.

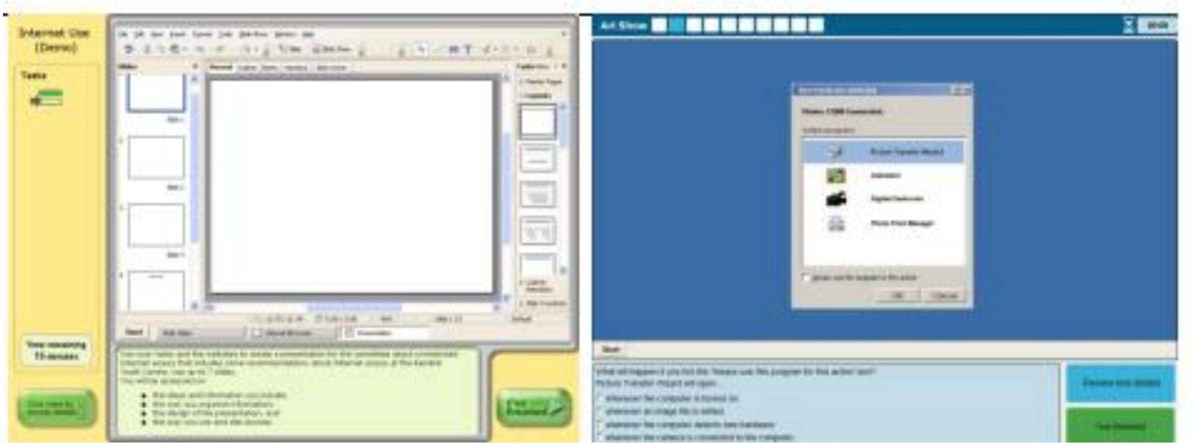

Figure 2.1: NAP–ICT Literacy test interfaces (2005–2011 and 2014–2017)

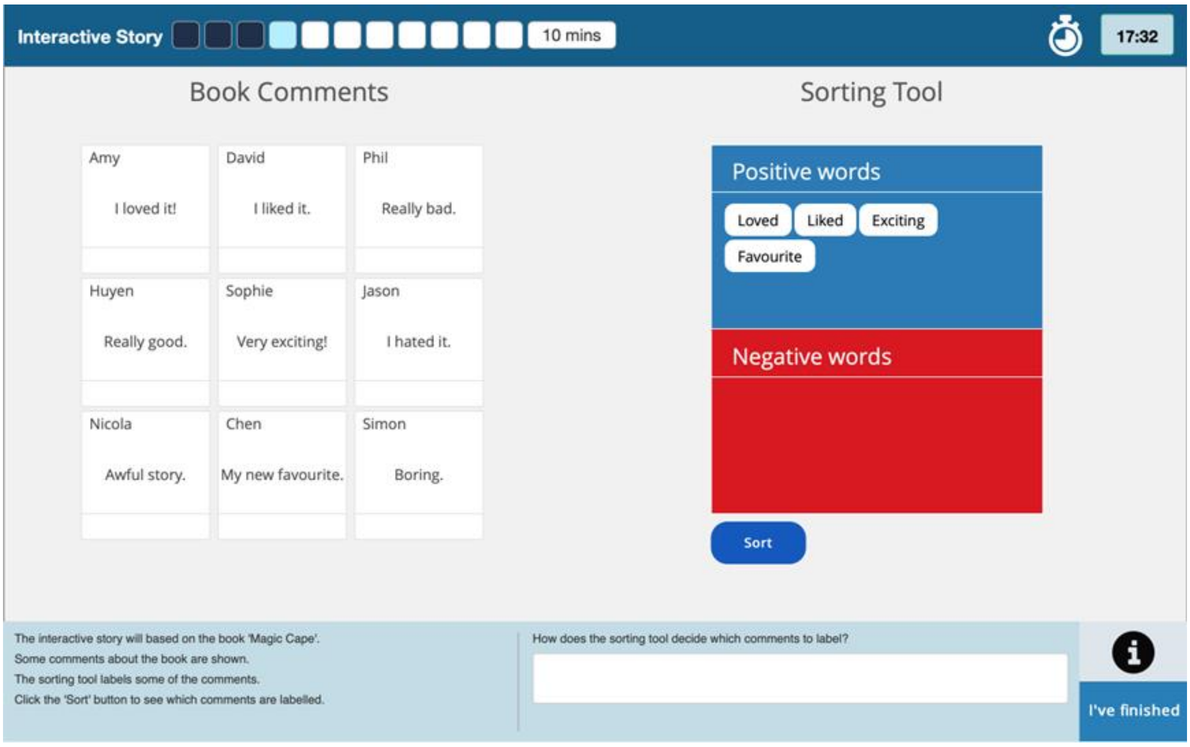


Figure 2.2: NAP–ICT Literacy test interface (2022)

The assessment delivery system managed the test module allocation and timing sequences, while test administrators were responsible for leading students through the tutorial, invigilating the session and assisting with technical and procedural matters, as needed. Test administrators were also able to manage student progression through the allocated module sequence by providing students with the progression passwords needed at each section, including for the provision of rest breaks between modules.

# Chapter 3: Sampling and weighting

This chapter describes the NAP–ICT Literacy 2022 Main Study sample design, the achieved sample and the procedures used to calculate the sampling weights. The sampling and weighting methods were used to ensure that the data provided accurate and efficient estimates of the achievement outcomes for the Australian Year 6 and Year 10 student populations.

Information on the Field Trial sampling can be found in Chapter 2.

## Sampling

The target populations for the study were Year 6 and Year 10 students enrolled in educational institutions across Australia.

A 2-stage stratified cluster sample design was used in NAP–ICT Literacy 2022, similar to that used in other Australian national sample assessments and in international assessments such as the Trends in International Mathematics and Science Study (TIMSS). The first stage consisted of separate, independent samples of schools from each state and sector combination. Schools were stratified according to school type, NAPLAN performance quintiles, the Socio-Economic Index of Education and Occupation (SEIFA IEO)[2], geographic location and enrolment size at the target year level.

### The sampling frame

Schools were selected from ACARA's Australian Schools List, a comprehensive list of all schools and campuses in Australia, comprising schools from all Australian states and territories.

### School exclusions

Schools excluded from the target population included:

- non-mainstream schools (such as correctional schools and schools with a non-English curriculum)
- schools listed on the frame as having fewer than 5 students in the target year level
- very remote schools (except in the Northern Territory)
- schools participating in the TIMSS Field Trial.

These students account for 3.6% of the Year 6 student population and 5.5% of the Year 10 student population.

The decision to include very remote schools in the Northern Territory sample for 2022 was made because very remote schools comprised 25% of the Year 6 population and 19% of the Year 10 population in the Northern Territory, while this population was less than 1% of the total student population of Australia.

### The designed sample

Sample sizes for both Year 6 and Year 10 were chosen to provide accurate estimates of achievement outcomes for all states and territories. The expected 95% confidence intervals were estimated in advance to be within approximately ±0.15 to ±0.2 of the population standard deviation for estimated means of the larger states.

This level of precision was considered an appropriate balance between the analytical demands of the study, the burden on individual schools and the overall costs of the study. An effective sample size of

[2] This is a measure of the socioeconomic status based on the socioeconomic conditions, such as education and employment, of the geographic location of the school.

around 100–150 students[3] is required to meet confidence intervals of this magnitude in the larger states. Smaller sample sizes were deemed as sufficient for the smaller states and territories because of their relatively small student populations. Table 3.1 shows the target populations and designed samples for each state and territory.

Table 3.1: Year 6 and Year 10 target population and design samples by state and territory

| | Year 6 | | | Year 10 | | |
|---|---|---|---|---|---|---|
| State | Enrolment | Schools in population | Schools in sample | Enrolment | Schools in population | Schools in sample |
| NSW | 97,688 | 2,107 | 50 | 90,728 | 804 | 50 |
| VIC | 77,280 | 1,689 | 50 | 71,648 | 559 | 50 |
| QLD | 68,107 | 1,171 | 50 | 61,814 | 475 | 50 |
| SA | 21,159 | 547 | 45 | 20,397 | 207 | 50 |
| WA | 33,690 | 748 | 45 | 30,384 | 256 | 50 |
| TAS | 6,594 | 197 | 40 | 6,366 | 85 | 35 |
| NT | 2,478 | 70 | 20 | 2,138 | 22 | 15 |
| ACT | 5,932 | 97 | 20 | 5,489 | 41 | 20 |
| **Australia** | **312,928** | **6,626** | **320** | **288,964** | **2,449** | **320** |

### First sampling stage

The sample design developed for the project was a stratified cluster sample. Prior to sampling, schools were explicitly stratified by state and sector. That is, separate samples were drawn for each sector within states and territories. Schools within each stratum were ordered by school type, NAPLAN performance quintiles, SEIFA, geographic location, and size (defined by target year level enrolment). With systematic selection of the schools, these variables became implicit stratifiers.

The selection of schools was conducted using a systematic probability-proportional-to-size (PPS) method. For large schools, the measure of size (MOS) was equal to the enrolment at the target year level. To minimise variation in weights, the MOS for very small schools (between 5 and 9 students) was set to 10, and the MOS for small schools (between 10 and 19 students) was set to 20.

After sorting the sampling frame according to the stratification variables listed above, the standard process for the selection of schools with PPS was as follows:

1. The MOS was accumulated from school to school and the running total was listed next to each school. The total cumulative MOS was a measure of the size of the population of sampling elements. Dividing this figure by the number of schools to be sampled provided the sampling interval.

2. The first school was sampled by choosing a random number between one and the sampling interval. The school whose cumulative MOS contained the random number was the first sampled school. By adding the sampling interval to the random number, a second school was identified. This process of consistently adding the sampling interval to the previous selection number resulted in a PPS sample of the required size.

To minimise the burden on schools, a modified approach was adopted for the Year 6 study to statistically control for overlap with the Programme for International Student Assessment (PISA) Main Study. The adopted approach combined the probability of selection for NAP–ICT Literacy 2022

[3] The effective sample size is the sample size of a simple random sample that would produce the same precision as that achieved under a complex sample design.

and the probability of selection for the PISA Main Study to generate a conditional measure of size (CMOS). The school sample was then selected using the cumulative CMOS variable in place of the cumulative MOS variable.

An analysis of small schools (schools with fewer enrolments than the assumed cluster sample size of 20 students) was undertaken prior to sampling. On the basis of this analysis, the school sample size in some strata was increased in order to ensure that the number of students sampled was close to expectations. As a result, after the small school analysis, the actual numbers of schools sampled for Year 6 and Year 10 were 331 and 321, respectively. Both were slightly larger than the designed sample. The actual sample drawn is referred to as the “implemented sample”.

As each school was selected, the next school in the sampling frame was designated as a replacement school to be included in cases where the sampled school did not participate. The adjacent school immediately before the sampled school was designated as the second replacement. It was used if neither the sampled nor the first replacement school participated. In some cases (such as secondary schools in the Northern Territory), there were not enough schools available for replacement samples to be drawn. Due to the stratified sampling frame, the 2 replacement schools were similar (with respect to geographic location, socio-economic status, NAPLAN performance and size) to the originally sampled school for which they were assigned as a replacement.

After the school sample had been drawn, a number of sampled schools were identified as meeting the criteria for exclusion. When this occurred, the sampled school and its replacements were removed from the sample and removed from the calculation of response rates. One school was removed from the Year 6 sample and 4 schools were removed from the Year 10 sample. These exclusions are included in the exclusion rates reported earlier.

### Second sampling stage

The second stage of sampling consisted of the random selection of 20 students within sampled schools.

### 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 had a moderate to severe permanent physical disability such that they could not be expected to perform in the assessment situation.
- Severe intellectual disability: the student had a mental or emotional disability and cognitive delay such that they could not be expected to perform in the assessment situation.
- Very limited assessment language proficiency: the student was 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.

Table 3.2 and Table 3.3 detail the numbers and percentages of students excluded from the NAP–ICT Literacy 2022 assessment, according to the reason given for their exclusion. The number of student-level exclusions was 149 at Year 6 and 258 at Year 10. This gives weighted exclusion rates of 2.2% of the sampled Year 6 students and 4.0% of sampled Year 10 students.

Table 3.2: Year 6 breakdown of student exclusions according to reason by state and territory

| State | Severe functional disability | Severe intellectual disability | Very limited English language proficiency | Total | Proportion of sampled students in Year 6 |
|---|---|---|---|---|---|
| NSW | 4 | 8 | 2 | 14 | 1.3 |
| VIC | 6 | 6 | 6 | 18 | 2.0 |
| QLD | 8 | 11 | 6 | 25 | 2.3 |
| SA | 7 | 12 | 3 | 22 | 2.4 |
| WA | 4 | 2 | 5 | 11 | 1.2 |
| TAS | 5 | 18 | 3 | 26 | 3.2 |
| NT | 3 | 8 | 9 | 20 | 4.0 |
| ACT | 6 | 6 | 1 | 13 | 3.8 |
| **Australia** | **43** | **71** | **35** | **149** | **2.2** |

Table 3.3: Year 10 breakdown of student exclusions according to reason by state and territory

| State | Severe functional disability | Severe intellectual disability | Very limited English language proficiency | Total | Proportion of sampled students in Year 10 |
|---|---|---|---|---|---|
| NSW | 11 | 23 | 3 | 37 | 3.9 |
| VIC | 11 | 13 | 2 | 26 | 2.8 |
| QLD | 9 | 11 | 10 | 30 | 3.0 |
| SA | 17 | 36 | 11 | 64 | 6.7 |
| WA | 7 | 14 | 4 | 25 | 2.5 |
| TAS | 10 | 23 | 1 | 34 | 5.7 |
| NT | 3 | 10 | 6 | 19 | 5.3 |
| ACT | 13 | 6 | 4 | 23 | 5.6 |
| **Australia** | **81** | **136** | **41** | **258** | **4.0** |

## Weighting

While the multi-stage stratified cluster design provides a very economical and effective data collection process in a school environment, oversampling of sub-populations and non-response cause differential probabilities of selection for the ultimate sampling elements, the students. Consequently, one student in the assessment does not necessarily represent the same number of students in the population as another, as would be the case with a simple random sampling approach. To account for differential probabilities of selection due to the design and to ensure unbiased population estimates, a sampling weight was computed for each participating student. It was an essential characteristic of the sample design to allow the provision of proper sampling weights, since these were necessary for the computation of accurate population estimates.

The overall sampling weight is the product of weights calculated at the 2 stages of sampling:

1. the selection of the school at the first stage
2. the selection of students within the sampled schools at the second stage.

### First-stage weight

The first-stage weight is the inverse of the probability of selection of the school, adjusted to account for school non-response within each explicit stratum.

The probability of selection of the school is equal to its measure of size (MOS) divided by the sampling interval (SINT) or one, whichever is lower. A school with a MOS greater than the SINT has a certain probability of selection and therefore has a probability of one.

The sampling interval is calculated at the time of sampling, and for each explicit stratum it is equal to the cumulative MOS of all schools in the stratum, divided by the number of schools to be sampled from that stratum.

The factor of the first-stage weight, or the school base weight ($BW_{sc}$), was the inverse of this probability:

$$BW_{sc} = \frac{SINT}{MOS}$$

Following data collection, counts of the following categories of schools were made for each explicit stratum:

- the number of schools that participated ($n_p^{sc}$)
- the number of schools that were sampled but should have been excluded ($n_x^{sc}$)
- the number of non-responding schools ($n_n^{sc}$).

Note that $n_p^{sc} + n_x^{sc} + n_n^{sc}$ equals the total number of sampled schools from the stratum.

Examples of the second category ($n_x^{sc}$) were:

- a sampled school that no longer exists
- a school that, following sampling, was discovered to fit one of the criteria for school-level exclusion (e.g. very remote, very small), but which had not been removed from the frame prior to sampling.

In the case of a non-responding schools ($n_n^{sc}$), neither the originally sampled school nor its replacements participated. Schools with a student response rate of less than 25% were also considered to be non-responding schools.

Within each explicit stratum, an adjustment was made to account for school non-response. This non-

response adjustment (ASC) for a stratum was equal to:

$$ASC_{strt} = \frac{\left(n_p^{sc} + n_n^{sc}\right)}{n_p^{sc}}$$

The first stage weight, or the final school weight, was the product of the base weight of the school and the school non-response adjustment:

$$FW_{sc} = BW_{sc} \times ASC_{strt}$$

### Second-stage weight

Following data collection, counts of the following categories of students were made for each sampled school:

- the number of students at the relevant year level ($n_{tot}^{st}$)
- the number of students who participated ($n_p^{st}$)
- the number of sampled students who were exclusions ($n_x^{st}$)
- the number of non-responding sampled students ($n_n^{st}$).

Note that $n_{samp}^{st} = n_p^{st} + n_x^{st} + n_n^{st}$ equals the total number of sampled students from the sampled school.

The first factor in the second-stage weight was the inverse of the probability of selection of the student from the sampled school.

$$BW_{st} = \frac{n_{tot}^{st}}{n_{samp}^{st}}$$

The student-level non-response adjustment was calculated for each school as:

$$AST_{sc} = \frac{\left(n_p^{st} + n_n^{st}\right)}{n_p^{st}}$$

The final student weight was:

$$FW_{st} = BW_{st} \times AST_{sc}$$

### Overall sampling weight

The overall sampling weight (FWTOT) was simply the product of the weights calculated at each of the 2 sampling stages:

$$FWTOT = FW_{sc} \times FW_{st}$$

After computation of the overall sampling weights, the weights were checked for outliers that would have a large effect on the computation of the standard errors. A weight was regarded as an outlier if the value were more than 4 times the median weight within an explicit stratum. Weights exceeding this threshold were trimmed to 4 times the median weight. The final, trimmed weight was:

$$WT2022 = FWTOT_{trimmed}$$

## Response rates

Separate response rates were computed:

1. with replacement schools included as participants[4]
2. with replacement schools regarded as non-respondents.

[4] A school is considered to be participating if it has a student response rate of at least 50%. Schools with less than 50% response rate and students within schools with less than 50% response rate are given a weight of zero for response rate calculations.

In addition, each of these rates was computed using unweighted and weighted counts. Regardless of the method used, school and student response rates were computed, and the overall response rate was the product of these 2 response rates. The differences in computing the 4 response rates are described below. These methods are consistent with the methodology used in TIMSS (Olson, Martin and Mullis 2013).

### Unweighted response rates including replacement schools

The unweighted school response rate, where replacement schools were counted as participating schools, was computed as follows:

$$RR_1^{sc} = \frac{n_s^{sc} + n_{r1}^{sc} + n_{r2}^{sc}}{n_s^{sc} + n_{r1}^{sc} + n_{r2}^{sc} + n_{nr}^{sc}}$$

where $n_s^{sc}$ is the number of responding schools from the original sample, $n_{r1}^{sc} + n_{r2}^{sc}$ is the total number of responding replacement schools and $n_{nr}^{sc}$ is the number of non-responding schools that could not be replaced.

The student response rate was computed over all responding schools. Of these schools, the number of responding students was divided by the total number of eligible, sampled students:

$$RR_1^{st} = \frac{n_s^{st} + n_{r1}^{st} + n_{r2}^{st}}{n_s^{st} + n_{r1}^{st} + n_{r2}^{st} + n_{nr}^{st}}$$

where $n_s^{st}$ is the total number of responding students in sampled schools, $n_{r1}^{st} + n_{r2}^{st}$ is the total number of responding students in replacement schools and $n_{nr}^{st}$ is the total number of eligible, non-responding, sampled students in all participating schools.

The overall response rate is the product of the school and the student response rates.

$$RR_1 = RR_1^{sc} \times RR_1^{st}$$

### Unweighted response rates excluding replacement schools

The difference of the second method from the first is that the replacement schools were counted as non-responding schools.

$$RR_2^{sc} = \frac{n_s^{sc}}{n_s^{sc} + n_{r1}^{sc} + n_{r2}^{sc} + n_{nr}^{sc}}$$

This difference had an indirect effect on the student response rate because fewer schools were included as responding schools, and student response rates were only computed for the responding schools.

$$RR_2^{st} = \frac{n_s^{st}}{n_s^{st} + n_{r1}^{st} + n_{r2}^{st} + n_{nr}^{st}}$$

The overall response rate was again the product of the 2 response rates.

$$RR_2 = RR_2^{sc} \times RR_2^{st}$$

### Weighted response rates including replacement schools

For the weighted response rates, sums of weights were used instead of counts of schools and students. School and student base weights (BW) are the weight values before correcting for non-participation, so they generate estimates of the population being represented by the responding schools and students. The full weights (FW) at the school and student levels are the base weights corrected for non-participation.

School response rates are computed as follows:

$$RR_3^{sc} = \frac{\sum_i^{s+r1+r2}\left(BW_i \times \sum_j^{r_i}(FW_{ij})\right)}{\sum_i^{s+r1+r2}\left(FW_i \times \sum_j^{r_i}(FW_{ij})\right)}$$

where $i$ indicates a school, $s$ + $r$1 + $r$2 all responding schools, $j$ a student and $ri$ the responding students in school *i*. First, the sum of the student final weights $FW_{ij}$ for the responding students from each school was computed. Second, this sum was multiplied by the school's base weight (numerator) or the school's final weight (denominator). Third, these products were summed over the responding schools (including replacement schools). Finally, the ratio of these values was the response rate.

As in the previous methods, the numerator of the school response rate is the denominator of the student response rate:

$$RR_3^{st} = \frac{\sum_i^{s+r1+r2}\left(BW_i \times \sum_j^{r_i}(BW_{ij})\right)}{\sum_i^{s+r1+r2}\left(BW_i \times \sum_j^{r_i}(FW_{ij})\right)}$$

The overall response rate is the product of the school and student response rates:

$$RR_3 = RR_3^{sc} \times RR_3^{st}$$

### Weighted response rates excluding replacement schools

Practically, replacement schools were excluded by setting their school base weight to zero for computation of the school response rates and applying the same computation as above. More formally, the parts of the response rates are computed as follows:

$$RR_4^{sc} = \frac{\sum_i^{s}\left(BW_i \times \sum_j^{r_i}(FW_{ij})\right)}{\sum_i^{s+r1+r2}\left(FW_i \times \sum_j^{r_i}(FW_{ij})\right)}$$

$$RR_4^{st} = \frac{\sum_i^{s+r1+r2}\left(BW_i \times \sum_j^{r_i}(BW_{ij})\right)}{\sum_i^{s+r1+r2}\left(BW_i \times \sum_j^{r_i}(FW_{ij})\right)}$$

$$RR_4 = RR_4^{sc} \times RR_4^{st}$$

### Reported response rates

In terms of the coverage of the sampled population, weighted response rates are a more accurate indicator of the representativeness of the sample. For the 2022 cycle, the weighted national school response rate in Year 6 was 89% when including replacement schools and 86% when excluding replacement schools. In Year 10, the respective percentages were 78% and 72%.

Overall unweighted response rates for Year 6 were 86% when including replacement schools and 83% when excluding replacement schools. Overall unweighted response rates for Year 10 were 74% when including replacement schools and 71% when excluding replacement schools.

Table 3.4: Overall school and student response rates in Year 6

| | Unweighted, including replacement schools | | | Unweighted, excluding replacement schools | | | Weighted, including replacement schools | | | Weighted, excluding replacement schools | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Overall | School | Student | Overall | School | Student | Overall | School | Student | Overall | School | Student |
| NSW | 0.90 | 1.00 | 0.90 | 0.86 | 0.96 | 0.90 | 0.90 | 1.00 | 0.90 | 0.87 | 0.97 | 0.90 |
| VIC | 0.90 | 1.00 | 0.90 | 0.88 | 0.98 | 0.90 | 0.90 | 1.00 | 0.90 | 0.88 | 0.98 | 0.90 |
| QLD | 0.89 | 1.00 | 0.89 | 0.89 | 1.00 | 0.89 | 0.88 | 1.00 | 0.88 | 0.88 | 1.00 | 0.88 |
| SA | 0.86 | 0.98 | 0.88 | 0.82 | 0.93 | 0.88 | 0.86 | 0.98 | 0.88 | 0.83 | 0.95 | 0.88 |
| WA | 0.88 | 1.00 | 0.88 | 0.80 | 0.92 | 0.88 | 0.87 | 1.00 | 0.87 | 0.78 | 0.89 | 0.87 |
| TAS | 0.84 | 0.98 | 0.86 | 0.82 | 0.95 | 0.86 | 0.84 | 0.98 | 0.86 | 0.82 | 0.94 | 0.86 |
| NT | 0.70 | 0.87 | 0.80 | 0.70 | 0.87 | 0.80 | 0.68 | 0.86 | 0.79 | 0.68 | 0.86 | 0.79 |
| ACT | 0.87 | 1.00 | 0.87 | 0.87 | 1.00 | 0.87 | 0.88 | 1.00 | 0.88 | 0.88 | 1.00 | 0.88 |
| **Australia** | **0.86** | **0.98** | **0.88** | **0.84** | **0.95** | **0.88** | **0.89** | **1.00** | **0.89** | **0.86** | **0.97** | **0.89** |

Table 3.5: Overall school and student response rates in Year 10

| | Unweighted, including replacement schools | | | Unweighted, excluding replacement schools | | | Weighted, including replacement schools | | | Weighted, excluding replacement schools | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Overall | School | Student | Overall | School | Student | Overall | School | Student | Overall | School | Student |
| NSW | 0.78 | 0.96 | 0.81 | 0.63 | 0.78 | 0.81 | 0.80 | 0.98 | 0.81 | 0.63 | 0.78 | 0.81 |
| VIC | 0.74 | 0.92 | 0.80 | 0.72 | 0.90 | 0.80 | 0.76 | 0.94 | 0.81 | 0.75 | 0.93 | 0.81 |
| QLD | 0.75 | 0.96 | 0.79 | 0.72 | 0.92 | 0.79 | 0.77 | 0.98 | 0.78 | 0.73 | 0.94 | 0.78 |
| SA | 0.73 | 0.90 | 0.81 | 0.70 | 0.86 | 0.81 | 0.82 | 1.00 | 0.82 | 0.73 | 0.89 | 0.82 |
| WA | 0.81 | 1.00 | 0.81 | 0.79 | 0.98 | 0.81 | 0.81 | 1.00 | 0.81 | 0.79 | 0.97 | 0.81 |
| TAS | 0.66 | 0.88 | 0.76 | 0.66 | 0.88 | 0.76 | 0.76 | 1.00 | 0.76 | 0.76 | 1.00 | 0.76 |
| NT | 0.57 | 0.73 | 0.77 | 0.57 | 0.73 | 0.77 | 0.66 | 0.86 | 0.77 | 0.66 | 0.86 | 0.77 |
| ACT | 0.76 | 0.95 | 0.80 | 0.76 | 0.95 | 0.80 | 0.81 | 1.00 | 0.81 | 0.81 | 1.00 | 0.81 |
| **Australia** | **0.74** | **0.93** | **0.80** | **0.71** | **0.88** | **0.80** | **0.78** | **0.97** | **0.80** | **0.72** | **0.89** | **0.80** |

# Chapter 4: Data collection, management and processing

The collection and processing of cognitive, contextual and administrative data for NAP–ICT Literacy is supported by a framework of high-quality and well-organised data management procedures. These procedures have been developed and refined by The Australian Council for Educational Research (ACER) over the course of many NAP sample cycles to ensure the integrity and quality of the data, while also minimising the administrative burden on participating schools.

This chapter outlines the data management procedures implemented for NAP–ICT Literacy 2022. This includes the various methods of data collection that were employed before, during and after the administration of the assessment, as well as the procedures applied in the transfer, tracking, verification and transformation of the data collected.

## Data management plan

In line with best practice project management methodology, ACER creates a detailed data management plan for the collection, transfer, processing and storage of data for NAP sample projects. For the NAP–ICTL 2022 cycle, established NAP sample data management plans and associated processes formed the basis for the plan, which was updated over the course of the project to accurately describe the most current data management practices.

## Data security

ACER is extremely aware of the importance schools, educational authorities and wider society rightly place on the security of personal data. In the context of collecting, transferring and storing school- and student-level data, it is important to ensure that all systems, staff and processes are handling those information assets securely for the life of the project. Given that many of the NAP–ICT Literacy information assets contain a level of Personally Identifiable Data of Australian school children, all assets were marked as protected in accordance with both ACER's Data Classification Policy and its Cryptographic Policy.

ACER therefore implemented an Information Security Management System that is compliant with:

- ISO 27001:2013 Information technology – Security techniques – Information security management systems – Requirements
- ISO 27002:2015 Information technology – Security techniques – Code of practice for information security controls.

ACER's Information Security Management System also complies with:

- The Australian Government Information Security Manual (ISM) produced by the Australian Signals Directorate
- The Australian Government Protective Security Policy Framework.

ACER ensured that all the processes, systems and solutions used to support and implement the NAP–ICT Literacy 2022 study complied with our Information Security Management System. This assures that ACER systems, staff and processes are securely handling information assets.

## Data identification

To track and monitor data throughout the life of the NAP–ICT Literacy project, a system of identification (ID) codes was implemented. At the school level, a unique ID was created for each school at the time of sampling. This school ID was 7 digits in length and comprised a concatenation of codes relating to year level, state, sector, substitution status as well as a unique sequential number. The specific codes used for each variable are outlined in Figure 4.1.

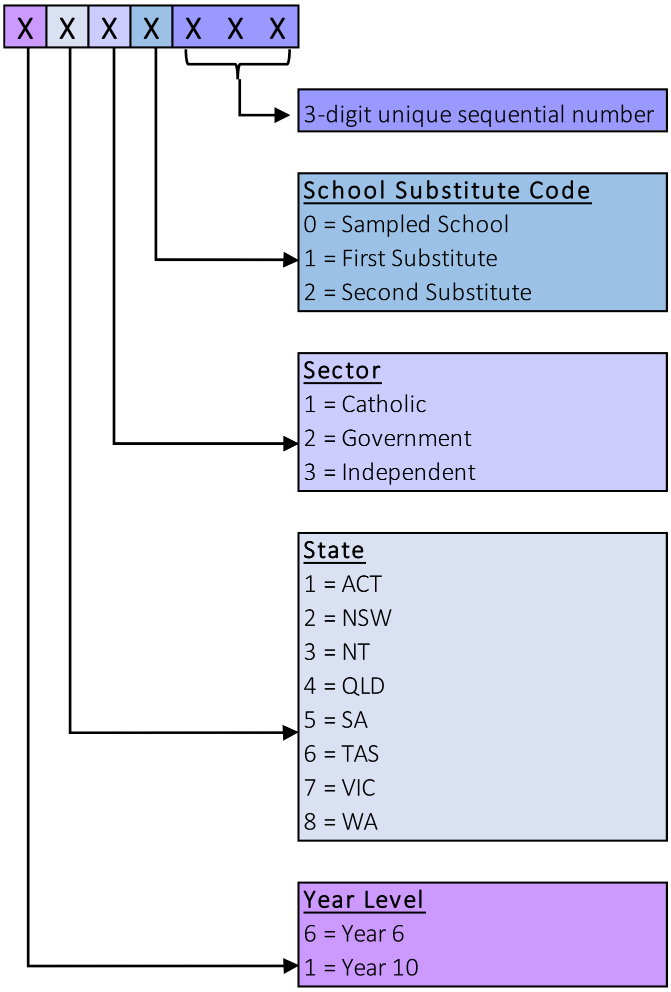


Figure 4.1: Breakdown of codes used in unique school ID

At a student level, an ID was created that comprised the 7-digit school ID followed by a 2-digit student number (01–20) that was unique to each sampled student within the school. This student ID was included in the student cognitive, contextual and student background data files so that data could be accurately matched and tracked throughout the data capture, cleaning and analysis stages. Five spare IDs were created for each school and were distributed if additional test login credentials were required. The spare ID comprised the 7-digit school ID followed by a 2-digit student number (21–25).

## Data collection from schools and jurisdictions

The administration of the NAP–ICT Literacy 2022 assessment required several stages of contact with the sampled schools to request or provide information. The contribution of both educational authorities and school staff to the data collection process is an essential part of the field administration.

To ensure the participation of sampled schools, education authority liaison officers were appointed for each jurisdiction. The liaison officers were expected to facilitate communication between ACER and the selected schools from their respective jurisdictions. The liaison officers helped to achieve a high participation rate for the assessment, which in turn helped to ensure unbiased, valid and reliable data.

Key personnel at each of the schools were nominated by the principal so that administrative and technical information could be collected in a timely manner. The roles of these nominated school personnel are outlined below:

- **The School Contact (SC):** The SC was the main point of contact for ACER at the school and was responsible for coordinating and overseeing the assessment. SCs provided ACER with information about the school's preferred assessment dates, student cohort lists and, if this could not be provided by the jurisdiction, student background data (SBD) for the selected students.
- **The School Technical Support Officer (STSO):** The STSO was responsible for ensuring that the school's computer system was test-ready by the scheduled assessment date. Primarily, the role involved conducting a series of technical checks on a sample of computers that were to be used for the assessment and helping to troubleshoot any issues ahead of assessment day.
- **The Test Administrator (TA):** The TA was responsible for administering the assessment to the sampled students, according to the standardised administration procedures provided in the TA Handbook. The SC at the school would often also perform the duties of TA, though they could alternatively choose to nominate another staff member for this role.

An overview of the school liaison and data collection processes is provided in Table 4.1.

Table 4.1: School liaison and data collection processes

| Stage | Jurisdictional activity | ACER project team activity | School activity |
|---|---|---|---|
| 1 | Educational authorities inform sampled schools of their selection in the assessment. If the jurisdiction confirms that a sampled school is unable to participate, the relevant replacement school is contacted. | ACER contacts principals of sampled schools to request the nomination of a school contact person and school technical support officer. | Principals of contacted schools supply requested contact information via secure online form. |
| 2 | | ACER contacts nominated School Contacts and requests preferred assessment dates and student lists for target year level (either Year 6 or Year 10 cohort). | School Contacts submit preferred assessment dates and student list via school administration website. |
| 3 | | ACER contacts nominated School Technical Support Officers and provides technical check instructions. ACER provides technical support and troubleshooting advice to STSOs via the Helpdesk. | School Technical Support Officers undertake technical checks to ensure the school's computer resources are test-ready. |
| 4 | | ACER notifies School Contacts of finalised assessment date and selected students via the school administration website. | School Contacts make relevant school-level test day arrangements (including room bookings and informing sampled students of their selection). |
| 5 | Educational authorities provide SBD for students in schools for which this information is held centrally. | Where SBD cannot be provided by the jurisdiction, ACER requests this information from School Contacts for all sampled students. | School Contacts provide SBD for all sampled students via the school administration website. |
| 6 | | ACER provides detailed test administration manual and test login credentials to all nominated Test Administrators. ACER continues to provide support to schools via the Helpdesk. | Test Administrators familiarise themselves with the processes and procedures outlined in the test administration manual and consult with ACER Helpdesk staff to confirm understanding of protocol and circumvent any perceived issues prior to the scheduled assessment date. |

### The NAP–ICT Literacy online school administration website

All information provided by SCs to ACER was submitted via a secure website. The benefits of the NAP–ICT Literacy school administration website were twofold: it eased the administrative burden on the selected schools, as well as providing a convenient, intuitive and secure repository for all school data relating to the study.

Schools were able to download all relevant administrative materials from this site, as well as use it to provide information to ACER regarding SC details, assessment date preferences and student-related information as required. To access the website, SCs needed to create a secure password and activate their school-specific account. Figure 4.2 shows a screenshot from the homepage of the website.

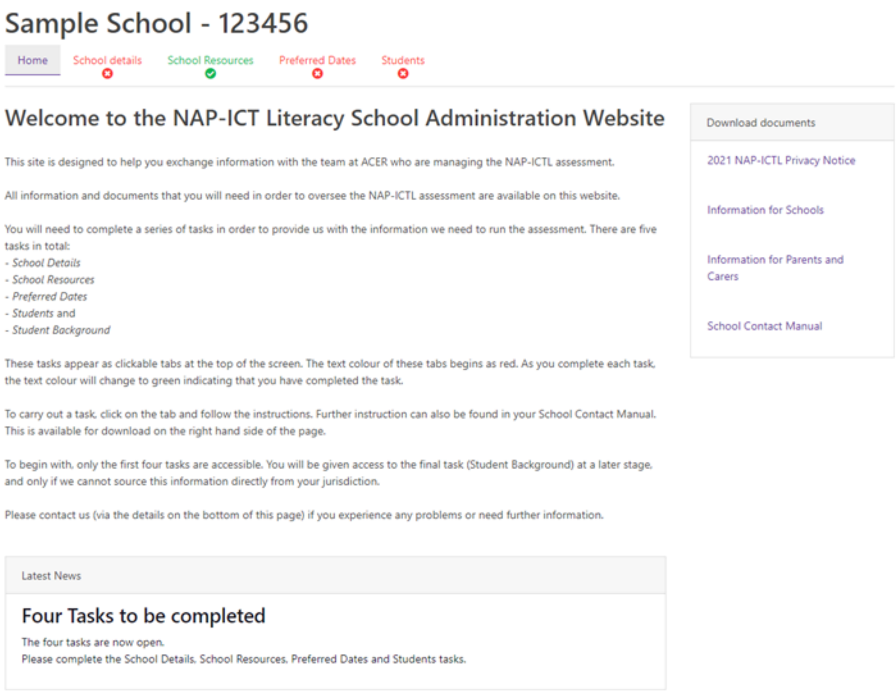


Figure 4.2: NAP–ICT Literacy 2022 school administration website

### The STSO technical checks

To ensure the smooth running of the assessment, it was necessary for STSOs to perform a series of technical checks on the devices that were selected for use. The technical readiness test (TRT) consisted of an online device check that checked the compatibility of the schools' devices with the NAP–ICT Literacy test delivery program, and a feedback questionnaire to report the results. The device check instructions and steps are provided in Appendix B: Technical Readiness Test (TRT) instructions.

After the TRT was performed, the ACER project team would liaise with the STSOs who had reported issues. Technical issues were resolved through a process of troubleshooting with the ACER project team. This sometimes involved referring the matter to the test delivery system engineers or, in the case of access/security protocols, to the relevant central education authority of the applicable school.

### Helpdesk provision and online support

An 1800 helpdesk support number and a dedicated email address were made available to schools for the entire Main Study administration phase (July – December 2022). Using these means, the ACER project team supported schools through all administrative, technical and operational tasks related to the administration of the NAP–ICT Literacy assessment. Project staff were also on hand to provide any urgent assistance required during, or immediately preceding, the assessment session itself.

The helpdesk hours of operation during the assessment window were 8am–6pm AEST so that school hours across Australia's various time zones could be accommodated.

### Collection of student background information

As per NAP protocol, student background data were collected for all participating students and matched to students' cognitive assessment and survey responses for analysis and reporting purposes.

The structure of these student background variables follows NAP protocols as set out in the *Data Standards Manual* (ACARA 2022). The data were matched to students' test and survey results for analysis and reporting purposes. The information collected included:

- sex
- date of birth
- Indigenous status
- parents' school education
- parents' non-school education
- parents' occupation group
- students' and parents' home language.

Schools are required to collect this information from the time of student enrolment. For NAP–ICT Literacy 2022, student background data were collected in one of 2 ways: from the education authorities in each jurisdiction or from the schools themselves. Where possible, education authorities from each jurisdiction supplied these data directly to ACER so that schools were not unnecessarily burdened with this administrative task. Provision of student background data from education authorities occurred in 16 out of 24 of the jurisdictions across the country. The source of student background data for each of the jurisdictions is outlined in Table 4.2.

Table 4.2: Student background data provision

| State/Territory | Sector | Source |
|---|---|---|
| ACT | Government | ACT DET |
| | Catholic | ACT DET |
| | Independent | ACT DET |
| NSW | Government | NSW DET |
| | Catholic | School |
| | Independent | School |
| NT | Government | NT DET |
| | Catholic | School |
| | Independent | School |
| Qld | Government | QLD DETE |
| | Catholic | School |
| | Independent | School |
| SA | Government | SA DECD |

| State/Territory | Sector | Source |
|---|---|---|
| | Catholic | SA CEO |
| | Independent | School |
| Tas | Government | Tas DoE |
| | Catholic | Tas CEO |
| | Independent | School |
| Vic | Government | VIC DET |
| | Catholic | VIC DET |
| | Independent | VIC DET |
| WA | Government | WA DET |
| | Catholic | WA DET |
| | Independent | WA DET |

Where data collection from educational authorities was not possible, ACER collected this information from the schools themselves. To do this, the ACER project team created a template into which schools could enter the coded background details for each sampled student. This template was then uploaded by each school onto the secure NAP–ICT Literacy school administration website. The code list for the student background data collected is presented in Table 4.3.

Table 4.3: Variable definitions for Student Background Data

| Category | Description | Codes |
|---|---|---|
| Gender | Gender of student | F = female<br>M = male<br>O = other |
| Date of birth | Date of birth of student | Free response DD-MMM-YYYY |
| Indigenous status | A student is considered to be Indigenous if they identify as being of Aboriginal and/or Torres Strait Islander origin. | 1 = Aboriginal but not Torres Strait Islander origin<br>2 = Torres Strait Islander but not Aboriginal origin<br>3 = Both Aboriginal and Torres Strait Islander origin<br>4 = Neither Aboriginal nor Torres Strait Islander origin<br>9 = Not stated/unknown. |
| Parent school education | The highest year of primary or secondary education a parent/guardian has completed. | 1 = Year 9 or below<br>2 = Year 10<br>3 = Year 11<br>4 = Year 12<br>0 = Not stated/unknown/Does not have Parent 2. |
| Parent non-school education | The highest qualification attained by a parent/guardian in any area of study other than school education. | 5 = Certificate I to IV (including Trade Certificate)<br>6 = Advanced Diploma/Diploma<br>7 = Bachelor's degree or above<br>8 = No non-school qualification<br>0 = Not stated/unknown/Does not have Parent 2. |

| Category | Description | Codes |
|---|---|---|
| Parent occupation group | The occupation group that includes the main work undertaken by the parent/guardian. | 1 = Senior management professionals<br>2 = Other management associate professionals<br>3 = Tradespeople skilled office, sales and service<br>4 = Unskilled workers hospitality<br>8 = Not in paid work in last 12 months<br>9 = Not stated/unknown/Does not have Parent 2. |
| Student/Parent home language | The main language spoken in the home by the respondent. | 1201 = English<br>Codes for all other languages as per the Australian Standard Classification of Languages (ASCI) Coding Index 2nd Edition |

The ability of the ACER project team to collect student background data to the level required for data analysis purposes depends on how complete the records are kept at participating schools and central authorities. Where data variables were labelled as unknown or left blank by the school or jurisdiction, and the absence of data was confirmed upon follow up from the project team, these values were coded as missing. The percentage of missing values for the derived background data variables, along with the percentages for all valid codes, are presented in the NAP–ICT Literacy 2022 Public Report.

## Assessment administration

The NAP–ICT Literacy 2022 assessment was conducted across Australia at the beginning of Term 4. Schools were permitted to schedule the assessment on a day that suited them within the official assessment period. The scheduled assessment window for each state and territory is outlined below:

| | |
|---|---|
| **Vic and Qld**: | Monday 10 October – Friday 4 November 2022 |
| **ACT, NSW, NT and WA**: | Monday 17 October – Friday 11 November 2022 |
| **SA and Tas**: | Wednesday 19 October – Friday 11 November 2022 |

To maximise data collection, the assessment window was extended to Friday 18 November 2022 for all states and territories.

The NAP–ICT Literacy assessment consisted of an introductory tutorial (10 minutes), 4 assessment modules (20 minutes each) and a student survey (15 minutes). All components were to be administered on the same day, with a short break between the modules. While the actual assessment time was 80 minutes, schools were asked to allow approximately 2 hours for the entire assessment process to cater for breaks between modules. Students were also able to break for either recess or lunch depending on the start time of the test.

The test administration times were designed to minimise the disruption of teaching and classroom patterns. Table 4.4 shows the suggested timing of the assessment session.

Table 4.4: The suggested timing of the assessment session

| Activity | Time required |
|---|---|
| Introductory tutorial | 10 minutes |
| Module 1 | 20 minutes |
| Break | 5 minutes |
| Module 2 | 20 minutes |
| Break | 5 minutes |
| Module 3 | 20 minutes |
| Break | 5 minutes |
| Module 4 | 20 minutes |
| Break | 5 minutes |
| Student survey | 15 minutes |

### Impact of the COVID-19 pandemic on data collection

Previous cycles of NAP–ICT Literacy employed external test administrators (TAs) to administer the test in all standard delivery schools. Due to ongoing COVID-19 restrictions, and to limit the exposure of students (and TAs) to external persons, the decision was made to have the 2022 Main Study administered by a member of staff at the school. This brought NAP–ICT Literacy into line with the other NAP sample assessments, which are administered by the school.

### Flexible administration

Flexible administration was a practice initiated in NAP–ICT Literacy 2011 for a small number of very remote schools. It was initiated to better target the instrument and to provide an opportunity to maximise participation rates in those schools. The provisions included modifications to the assessment and to the method of administration.

For NAP–ICT Literacy 2022, flexible administration was undertaken in 9 schools in very remote locations. For these schools, the number of modules to be completed by each student was reduced from 4 to 2 and the time allocation for each module was doubled to allow students additional time to complete the tasks.

Test administrators in flexible administration schools were permitted to read all instructions and test questions to students, which was similar to the provision in all schools for test administrators to read instructions and questions to students requiring support.

### Data capture

In 2022, all participating schools were able to undertake the assessment via the online delivery method and using school- or student-supplied devices. There were no instances of schools having to use the “backup” delivery methods used previously, such as the USB delivery or mini-server solutions. As all the student survey and achievement data were collected electronically, scanning and manual data entry of student responses were not required.

### Follow-up test sessions

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

### Quality monitor visits

In line with quality assurance processes, ACER sent 18 trained quality monitors to 5% of participating schools nationally. The responsibility of the quality monitor was to ensure the uniformity and consistency of test administration procedures implemented across all participating schools. This was done by observing the test administrator before and during the administration of the assessment. The quality monitor then reported back to ACER via the online submission of a detailed, structured report. The quality monitor report template is provided in Appendix C: Quality Monitor report template.

## Scoring student responses

Students completed tasks on computers using software that included a combination of simulated and live applications. Student responses were either scored automatically by the testing system or scored during the later marking operation by a team of trained markers using a detailed scoring guide. The different types of tasks and items, together with their associated scoring procedures, are summarised below.

### Software simulation items – single step

Single-step software simulation items are those in which a single action by a student is sufficient to trigger a response in the system. These are used to assess the execution of single-step commands such as copy, paste and click on a link. These items were automatically scored using simple scoring – 0 (incorrect attempt made), 1 (correct attempt made) or 9 (no attempt made). After attempting an item, students were given an option to "Try Again" on the same item. Only the final attempt (the first, or second if the student chose to try again) was recorded by the system. This was explained to students during a tutorial before the assessment. Students had the opportunity to practise both completing items at the first attempt and exercising the "Try Again" option during the tutorial.

### Software simulation items – multiple step

Multiple-step software simulation items are those in which students need to execute a number of steps in sequence with multiple available paths. Examples of such items include:

- configuring software settings by navigating through a set of menus in a simulated piece of software
- dragging and snapping together code blocks to create an algorithm, which the students would then execute using the "Run" button.

In these workspaces, students also had the option to select an "undo" icon to revert to the original workspace. Unlike the single-step simulation items, students needed to indicate "I've Finished" before the system would recognise the response. This was to allow students to navigate and explore the software to complete their response.

These tasks either used simple scoring, as with single step items, or used partial credit scoring, scoring 0 (incorrect attempt made), 1 (partially correct attempt made), 2 (fully correct attempt made) or 9 (no attempt made).

For example, partial credit may have been awarded to students who navigated to the correct interface, but then incorrectly applied the specified setting, or who developed an algorithm that only partially completed the desired task. As with single step items, once students had selected "I've Finished", they were given the option to "Try Again". There was no limit for these items on how often a student could elect to try again.

### Multiple-choice items

For the purposes of test item analysis, in multiple-choice items the selection made by a student was recorded by the test administration system and later coded as 0 (incorrect), 1 (correct) or 9 (no attempt made).

### Constructed response items

Some items required students to respond using one or 2 sentences. These responses were captured by the test delivery system and later delivered to markers using a purpose-built online scoring system. Some of these items had scoring guides that allowed for dichotomous scoring (correct/incorrect), whereas others had scoring guides with partial credit scoring in which different categories of student responses could be scored according to the degree of knowledge, skill or understanding they demonstrated.

### Tasks completed using live applications

Students completed tasks on computers using live software applications. The information products that resulted from these tasks were stored automatically by the administration system and delivered to markers using the online scoring system. Typically, these information products (such as a map, an edited website or a presentation) were assessed using a set of criteria. These criteria broadly reflected either elements of the information literacy demonstrated by students (such as selection of relevant information or tailoring information to suit the audience) or the use of the software features by students to enhance the communicative effect of the product (such as use of colours, transitions or text formatting). The criteria had between 2 and 4 score categories (including zero) that reflected different levels of sophistication with reference to the ICT literacy framework and the elements of the task.

### Centre-based marking operation

For the items and tasks that could not be autoscored by the assessment delivery system, responses were marked by a team of trained markers in a centre-based marking operation. The Main Study marking operation was conducted in the ACER Sydney Marking Centre between Thursday 10 November and Thursday 24 November 2022. Marking was conducted online using the RM Assessment Master platform.

ACER employed a total of 20 markers, including 4 group leaders, to mark the 36 items needing to be human scored. These individuals were chosen from ACER's pool of highly experienced markers, many of whom had marked multiple previous cycles of the NAP–ICT Literacy Field Trial and Main Study.

As per previous NAP sample marking operations, ACER utilised an ongoing training model (train-mark, train-mark) over the entire duration of the operation. This means that training in each item is conducted directly before marking of that particular item begins, so that the rubric and construct are fresh in the minds of the markers as they begin to mark an item.

As per the previous Field Trial marking operation, ACER again employed a “train the trainer” marking approach. ACER test developers performed the role of Professional Leaders. Four Group Leaders (GLs) were selected from ACER’s pool of highly experienced leaders to be trained in each of the items by the Professional Leaders in the 2 days preceding the first day of marking. Once marking began, the 4 GLs then conducted the training for each of the items assigned to their group. The Professional Leaders were on hand if any points of clarification needed to be sought.

### Quality assurance during the marking process

Part of the role of the 4 experienced GLs was to backread (spot check) a random sample of approximately 10% of all responses scored by markers. A high degree of accuracy was noted, with higher than 95% agreement between marker and GL scores, when spot checking results were compared.

Control scripts for each item were pre-selected by the Professional Leaders and added into the system for the markers to score as part of their allocated packet of responses. In total, 348 control scripts were scored by the 20 markers across the 36 items that were marked. Minimal control script flags were raised by the system, which again denotes a high level of marker accuracy.

## Data cleaning and verification

Data cleaning and verification relate to processes of ensuring the integrity of the data collected. For NAP–ICT Literacy, a series of data cleaning steps was undertaken on all data collected from jurisdictions, schools and students. With respect to student background data, the following steps were performed:

- Student names (for the purposes of school reporting) were corrected where there was obvious first name/surname reversal, or where foreign characters (e.g. ?, !, %) were included. Some instances of correction had to be confirmed with the school directly.
- Missing gender of the student was attributed where it could be inferred from the school type (e.g. where single-sex). Some instances of correction had to be confirmed with the school directly.
- All dates of birth were converted to the standard dd/mm/yyyy format, and any auto-formatting executed by the spreadsheet template that rendered dates of birth illegible was reversed and corrected.
- Any free text or abbreviated text was coded as per the variable coding schema presented in Table 4.3.
- Any out of range, implausible or missing values were double-checked with the school or jurisdiction that provided the data. Where possible, the correct values were inputted. Where no further information was provided or available, the data were recoded to missing.

Student background variables were also derived for the purposes of reporting achievement outcomes. Table 4.5 shows the derived variables and the transformation rules used to recode them.

Table 4.5: Transformation rules to derive student background variables for reporting

| Variable | Label | Transformation rule |
| --- | --- | --- |
| School location | ASGSRemote | The geographical classification of the school location according to the ABS remoteness classification (1 = major cities, 2 = inner regional, 3 = outer regional, 4 = remote, 5 = very remote). |
| Gender | GENDER | Classified by response; missing data treated as missing unless the student was present at a single-sex school. |
| Age | AGE | Derived from the difference between the date of assessment and the date of birth, transformed to whole years. |
| Indigenous status | INDIG | Coded as Indigenous (1) if response was “yes” to Aboriginal OR Torres Strait Islander OR Both. Coded as non-Indigenous (0) otherwise. |
| Language spoken at home | LBOTE | Each of the 3 Language spoken at home questions (student, Parent 1 or Parent 2) were recoded to “LBOTE” (1) or “Not LBOTE” (0) according to ASCL codes. The reporting variable (LBOTE) was coded as “LBOTE” (1) if response was “LBOTE” for any student, Parent 1 or Parent 2. If all 3 responses were “not LBOTE” then the LBOTE variable was designated as “not |

| Variable | Label | Transformation rule |
|---|---|---|
| | | LBOTE" (0). If any of the data were missing, then the data from the other questions were used. If all of the data were missing, then LBOTE was coded as missing. |
| Parental education | PARED | Parental education equalled the highest education level (of either parent). Where one parent had missing data, the highest education level of the other parent was used. Only if parental education data for both parents were missing would parental education be coded as "missing" (0). |
| Parental occupation | POCC | Parental occupation equalled the highest occupation group (of either parent). Where one parent had missing data or was classified as "not in paid work", the occupation group of the other parent was used. Where one parent had missing data and the other was classified as "not in paid work", parental occupation equalled "not in paid work". Only if parental occupation data for both parents were missing would parental occupation be coded as "missing" (9). |

With respect to the student cognitive and survey data, the following preliminary data cleaning steps were performed:

- Instances of invalid IDs were investigated and, after liaison with the test administration team, corrected where possible or else removed from the dataset.
- Instances of spare IDs were matched with valid Student IDs and recoded accordingly. This often necessitated confirmation and cross-checking with the attendance roll data and notes from the test administration team.
- Patterns of missing values were explored and, where appropriate, recoded to "9" for embedded missing, "r" for not reached (cognitive data only) or "n" for not administered.

Further information regarding the scaling procedures implemented for the cognitive achievement data and student survey data can be found in Chapter 6 of this report.

### Student eligibility for respondent flag

Psychometric analysis of student cognitive and contextual data requires a minimum threshold of valid responses to be met. To include a student record in the database for scaling, each student must meet a combination of 3 criteria (as shown in Table 4.6) including:

- valid attempts of at least 3 ICT or DT cognitive items, or at least one valid attempt in the student survey
- an appropriate attendance status
- not being listed as exempt.

Students who did not meet the minimum valid attempt criterion were flagged as "Ineligible" and subsequently "non-respondent".

Students who met the minimum valid attempt criterion were flagged as "Eligible" for consideration to be identified as "Respondent". They were marked as "Respondent" only when their attendance status was "Participated", "Other" or "Not in attendance file" and their exemption status was "Not stated". The remaining "Eligible" students were flagged as "Non-respondent".

Students flagged as "Respondent" were kept for the purposes of scaling and analysis only if the school response rate met the minimum requirement as outlined in Chapter 3.

Table 4.6: Rules of flagging students as respondents

<table>
<tr><th rowspan="2">Eligibility</th><th rowspan="2">Student attendance</th><th colspan="4">Student exemption</th></tr>
<tr><th>Not stated</th><th>1</th><th>2</th><th>3</th></tr>
<tr><td rowspan="7">Ineligible</td><td>Participated</td><td colspan="4" rowspan="7">Non-respondent</td></tr>
<tr><td>Absent</td></tr>
<tr><td>Exempt</td></tr>
<tr><td>Left school</td></tr>
<tr><td>Parent refusal</td></tr>
<tr><td>Other</td></tr>
<tr><td>Not in attendance data file</td></tr>
<tr><td rowspan="7">Eligible</td><td>Participated</td><td>Respondent</td><td colspan="3" rowspan="7">Non-respondent</td></tr>
<tr><td>Absent</td><td rowspan="4">Non-respondent</td></tr>
<tr><td>Exempt</td></tr>
<tr><td>Left school</td></tr>
<tr><td>Parent refusal</td></tr>
<tr><td>Other</td><td rowspan="2">Respondent</td></tr>
<tr><td>Not in attendance data file</td></tr>
</table>

*Students identified to be eligible when:*
*a) at least 3 or more valid responses* in either ICT or DT cognitive items, or b) at least 1 valid response* in StQ*
*Exemption code 1 = severe functional disability*
*Exemption code 2 = severe intellectual disability*
*Exemption code 3 = very limited English language proficiency*
** Valid responses exclude missing, not reached and not applicable*

## Data processing for school reporting

Once all student responses were marked, the following data processing steps were implemented to produce the school summary reports that were distributed to the participating schools:

- collation of all marked student data and creation of a single data file for each year level
- removal of introductory practice items for each student and separation of student survey data (which was not included in the analysis for school summary reports)
- checking of the student response data file against the codebook to ensure no major data anomalies
- computation of item per cent correct (unweighted) and excluding not reached responses
- for partial credit items, computation of item per cent correct for each item in standard NAP sample format (e.g. 75,23 where 0,1,2 item becomes 75 [facility of 1 and 2], 23 [facility of 2 only])
- formatting of data file to required specifications for export into school-specific MS Excel reports.

### Providing the school summary reports to schools

After all test data were collected, cleaned, marked and analysed, ACER provided access to an interactive, Excel report for all participating schools via the NAP–ICTL school administration website.

For the first 3 cycles of this assessment (2005–2011), these reports were in a static, electronic PDF format. They included:

- descriptions of each item in the test
- details of which students were administered each item
- the level of credit students received for each item they were administered
- summary information of the percentage of students (sampled students for the Field Trial and weighted percentages for the Main Study) receiving different levels of credit for each item.

For NAP–ICT Literacy 2014 and 2017, ACER developed interactive online versions of the reports. They were created and disseminated within the ACER Online Assessment and Reporting System (OARS). These interactive reports were based on the same data used in previous cycles, but it also allowed users to filter and sort data to view information grouped by categories of interest (such as by student gender or item format).

For the NAP–ICT Literacy 2022 cycle, ACER developed interactive Microsoft Excel reports, which were generated through the R open-source software program. These reports included the same data as previous cycles, however focused further on readability and allowed schools to undertake detailed interrogation of the data using existing Excel features many would be familiar with.

For 2022, the school summary reports were also hosted on the school administration website, allowing schools to access the reports on the same website used for other NAP–ICT Literacy administrative tasks and using existing login credentials.

Schools were advised to read their report in conjunction with the NAP–ICT Literacy School Report Instructions provided in Appendix D. These instructions provided a description of each of the fields shown in the report and outlined how to interpret the data provided. An example of a school summary report is shown in Appendix E.

# Chapter 5: Scaling procedures

Both cognitive and survey items were scaled using item response theory (IRT) scaling methodology. The cognitive items were used to derive a one-dimensional NAP–ICT Literacy achievement scale, while a number of scales were constructed based on different sets of survey items.

## The scaling model

Test items were scaled with the one-parameter model (Rasch, 1960). In the case of dichotomous items, the model predicts the probability of selecting a correct response (value of one) instead of an incorrect response (value of zero) and is modelled as:

$$P_i(\theta_n) = \frac{\exp(\theta_n - \delta_i)}{1 + \exp(\theta_n - \delta_i)}$$

where $P_i(\theta_n)$ is the probability of person *n* scoring 1 on item *i*, $\theta_n$ is the estimated ability of person *n* and $\delta_i$ is the estimated location of item *i* on this dimension. For each item, item responses are modelled as a function of the latent trait $\theta_n$.

For items with more than 2 (*k*) categories (as for example with Likert-type items) the more general Rasch partial credit model (Masters and Wright 1997) was applied, which takes the form of:

$$P_{x_i}(\theta_n) = \frac{\exp \sum_{k=0}^{x} (\theta_n - \delta_i + \tau_{ik})}{\sum_{h=0}^{m_i} \exp \sum_{k=0}^{h} (\theta_n - \delta_i + \tau_{ik})} \qquad x_i = 0, 1, \mathrm{K}, m_i$$

where $P_{xi}(\theta_n)$ denotes the probability of person *n* scoring *x* on item *i*, $\theta_n$ denotes the person's ability, the item parameter $\delta_i$ gives the location of the item on the latent continuum and $\tau_{ij}$ denotes an additional step parameter for each step *k* between adjacent categories.

The analysis of item characteristics and the estimation of model parameters were carried out with the ACER ConQuest software package (Version 5.29 software: see Adams, Wu, Cloney, Berezner and Wilson 2020).

### Scaling cognitive items

This section outlines the procedures for analysing and scaling the cognitive test items measuring ICT literacy. The procedures are somewhat different from scaling the student survey items, which will be discussed in the following section.

The model fit of cognitive test items was assessed using a range of item statistics. The weighted mean-square statistic (infit), which is a residual-based fit statistic, was used as a global indicator of item fit. Infit statistics were reviewed both for item and step parameters. In addition to this, item characteristic curves (ICCs) were also used to review item fit. ICCs provide a graphical representation of item fit across the range of student abilities for each item (including dichotomous and partial credit items). The functioning of the partial credit score guides was further analysed by reviewing the proportion of responses in each response category and the correct ordering of mean abilities of students across response categories. Of the 132 items in the test, 2 were removed at Year 10 only (NI17M3Q07, NI20M5Q04). Consequently, these items were not used to estimate student performance.

Final decisions on retaining test items were based on a range of different criteria. Generally, items were flagged for review if first item calibrations showed a considerably higher infit statistic (e.g. infit > 1.2) as well as low item–rest correlation (0.2 or lower). The ACER project team considered both item-fit criteria as well as the content of the item prior to a decision about removing or retaining flagged items for scaling.

### Differential item functioning

The quality of the items was also explored by assessing differential item functioning (DIF) by gender. DIF occurs when groups of students with the same ability have different probabilities of responding correctly to an item. For example, if boys have a higher probability of success than girls with the same ability on an item, the item shows DIF in favour of boys. This constitutes a violation of the model, which assumes that the probability is only a function of ability and not of any other variable. Substantial item DIF with respect to gender may result in bias of performance estimates across gender groups.

An example item that advantages boys is presented in Figure 5.1. he graph shows that at any ability (the horizontal axis), the probability of responding correctly is somewhat higher for boys (blue line) than for girls (green line). The DIF was in general consistent over the range of student ability for the item. Between 2017 and 2022, the range of change in gender DIF is -0.14 and 0.25. No item had significant change (e.g. < -0.5 or > 0.5) in gender DIF between the 2 cycles and therefore no item deletion occurred due to significant gender DIF.

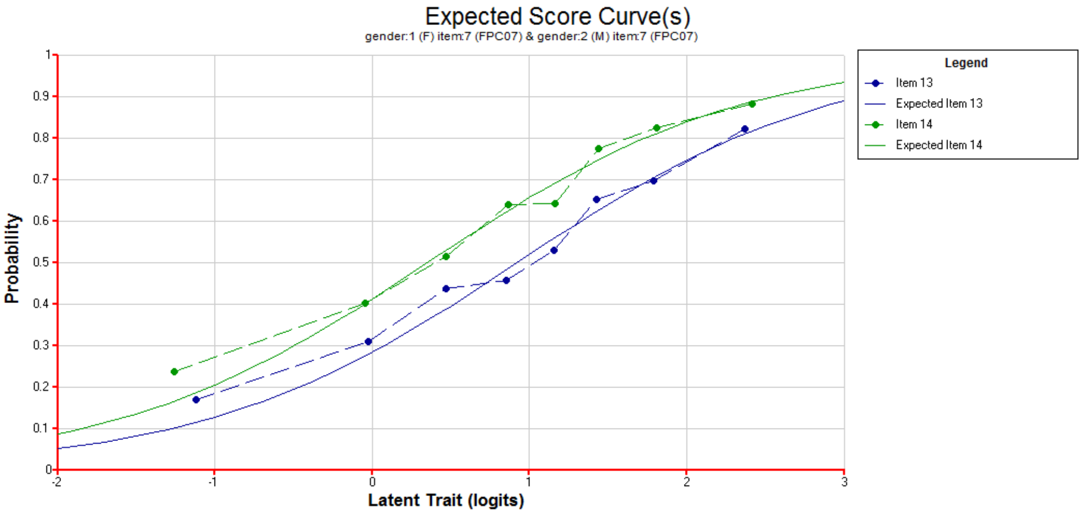


Figure 5.1: Example of item that advantages boys in Year 10

Another form of DIF used to evaluate the items was DIF related to the year level of students. Items with substantial year-level DIF were not used as link items between the Year 6 and the Year 10 assessments. Of the 76 common items between Year 6 and Year 10, 59 were used as link items and 17 were treated as different items for the 2 year levels with year-level-specific item parameters.

### Item calibration

Missing student responses, likely caused by issues with test length ("Not reached" items)[5], were omitted from the calibration of item parameters but were treated as incorrect for the scaling of student responses. All other missing responses were included as incorrect responses for the calibration of items (except for the ones that were not administered).

[5] "Not reached" items were defined as all consecutive missing values at the end of the test except the first missing value of the missing series, which was coded as "embedded missing", like other items that were presented to the student but not receive a response.

Item parameters were calibrated using all sampled student data, except for (the few) students from very remote schools where we had used flexible delivery and specific administration modes for the assessment. The student weights were rescaled to ensure that each state or territory was equally represented in the sample. In the first stage of the scaling procedures, the items were calibrated separately for Year 6 and Year 10. There were 132 items were included in total, of which 32 were Year 6 only items and 24 were Year 10 only items. The other 76 items were used for both year levels. Of the 76 common items, 59 were used as vertical link items and 17 were regarded as different items in the 2 year levels.

The difficulties of these 59 link items are plotted in Figure 5.2, with Year 6 estimates on the horizontal axis and Year 10 estimates on the vertical axis. For each set of 59 items, their respective difficulties were centred to having a mean of zero for this graph. The black broken lines represent the boundaries of the confidence intervals around differences from zero (the identity line indicating that there are no differences in item difficulty). The green broken line is the identity line. The pink broken line is the best fit line of the scatter plot. The difference between the 2 relative difficulties was less than half a logit for each of the 59 vertical link items.

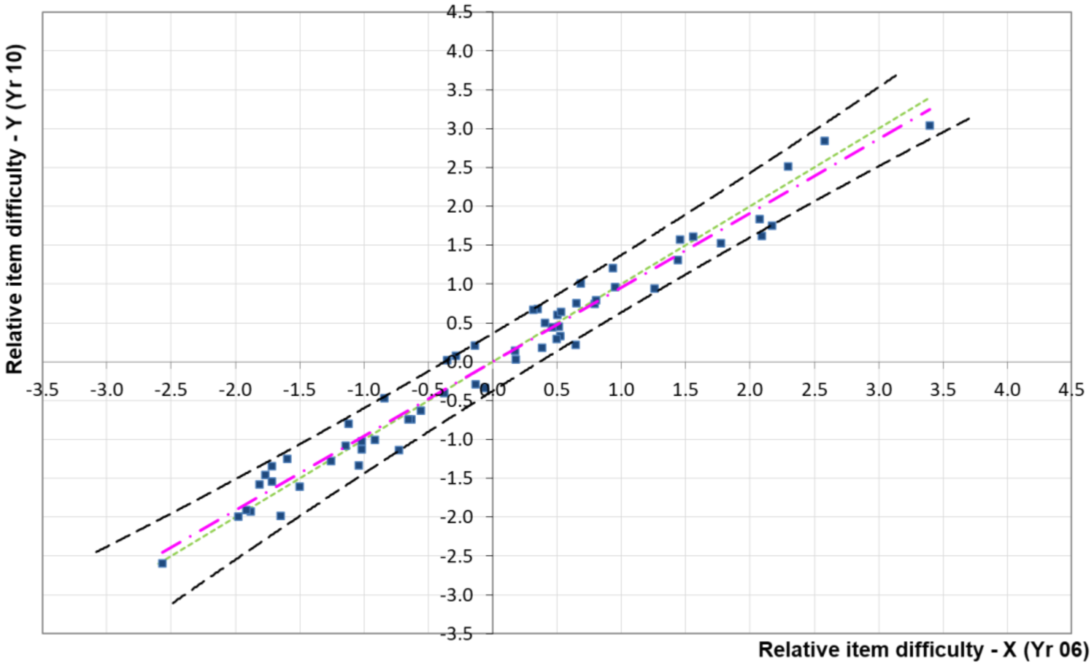


Figure 5.2: Scatter plot of relative item difficulties for Year 6 and Year 10

Figure 5.3 presents item maps for the 2 year levels. The crosses represent students, the numbers represent items. In the case of a partial credit item, the threshold is included. The vertical line represents the measured ICT literacy scale with high-performing students and difficult items at the top, and low-performing students and easy items at the bottom. The 2 scales are not directly comparable because they have been calibrated separately, but they have been lined up approximately for this report. The response probability in this figure is 0.5, which means that students with an ability equal to the difficulty (or threshold) of an item have a 50% chance of responding correctly to that item. The figure shows that the test was well targeted at each year level.


Figure 5.3: Item maps for Year 6 and Year 10

In the second stage scaling procedures, Year 6 data was scaled first. Then Year 10 data was scaled, anchoring the estimates of the 59 vertical link items to the Year 6 item parameter estimates in order to place both year levels on the same scale.

The overall reliability of the test, as obtained from the scaling model, was 0.93 for Year 6 and 0.95 for Year 10 (ACER ConQuest EAP/PV reliability estimate). Appendix F: Item difficulties shows the item difficulties on the NAP–ICT Literacy scale with a response probability of 0.62[6] in logits on the reporting scale. It also shows the respective percentages of correct responses for each year sample (giving equal weight to each jurisdiction). The weighted fit statistics are included in the last column. In addition, column 3 indicates if an item was used as a horizontal link (trend) item.

## Test form effects

Two Digital Technology (DT) modules were embedded in the first half of test forms 1 to 4 and the flexible delivery test forms, and in the second half of test forms 5 to 8. There were no DT modules in test forms 9 to 12. It was observed that the DT module positions within test forms had an influence on the estimated achievement distributions.

The effect was modelled at the module position level in test forms separately for each year level. When estimating the item parameters, module position effects were used as the regressors in the measurement model to prevent confounding item difficulties and module position effects. The students who responded to the flexible delivery test form were excluded from the calibration model. This calibration model (giving equal weight to each jurisdiction) was used to estimate the item parameters for ICT Literacy. Then a set of module position effects was obtained by scaling the entire data set in full weight with the item parameters anchored. The same module

[6] This means that a student with a scale score equal to the item difficulty parameters has 62% probability of giving a correct response to the test question.

position variable was recoded to dummy direct regressors for conditioning. The DT module position effects were adjusted by subtracting the estimated effects from the achievement of students based on the module position of each test form assigned to them accordingly. There was no adjustment for students who responded to test forms 9 to 12 and the flexible delivery booklets. Table 5.1 presents the estimated DT module position effects by year level.

Table 5.1: Digital Technology module position effects by year level

| DT module position effects | Year 6 | Year 10 |
|---|---|---|
| Test forms 1 to 4 | -0.184 | -0.167 |
| Test forms 5 to 8 | -0.046 | -0.050 |

## Horizontal equating

Test forms at both year levels consisted of newly developed modules and trend modules. The trend modules were developed for and used in previous cycles. As they had been kept confidential, they could be used as horizontal link items to equate the results of the 2022 assessment with the established NAP–ICT Literacy scale. To ensure that the link items had the same measurement properties across cycles, the relative difficulties in 2022 and 2017 were compared. Out of 47 common items, 10 showed large DIF. Thirty-seven items were retained and used for equating between the 2022 and 2017 cycles. For both assessments, this set of selected link items showed similar average discrimination (item–rest correlation was 0.42 in 2017 and 0.45 in 2022) and the average DIF with respect to gender in both cycles was close to zero (0.01 logits in 2017 and 0.03 logits in 2022).

Figure 5.4 shows a scatter plot of item difficulties for the 37 horizontal link items in 2017 and 2022. The average difficulty of each set of link items was set to zero and each dot represents one link item. The expected location under the assumption of complete measurement equivalence across both assessments is the identity line ($y = x$). The thick broken lines represent the 95% confidence interval around the expected values. Items outside of these lines had statistically significant deviations from the identity line. The original standard errors provided by ACER ConQuest were adjusted by multiplying them by the square root of 7, the approximate design effect in 2022. This correction was made because data were collected from a cluster sample design, whereas the scaling software assumes simple random sampling of data (see also Chapter 3 for more information on sampling). Historical items were not used as link items if the difference between relative item difficulties was significant and more than 0.5 logits. Using this criterion, 8 items were excluded from equating.

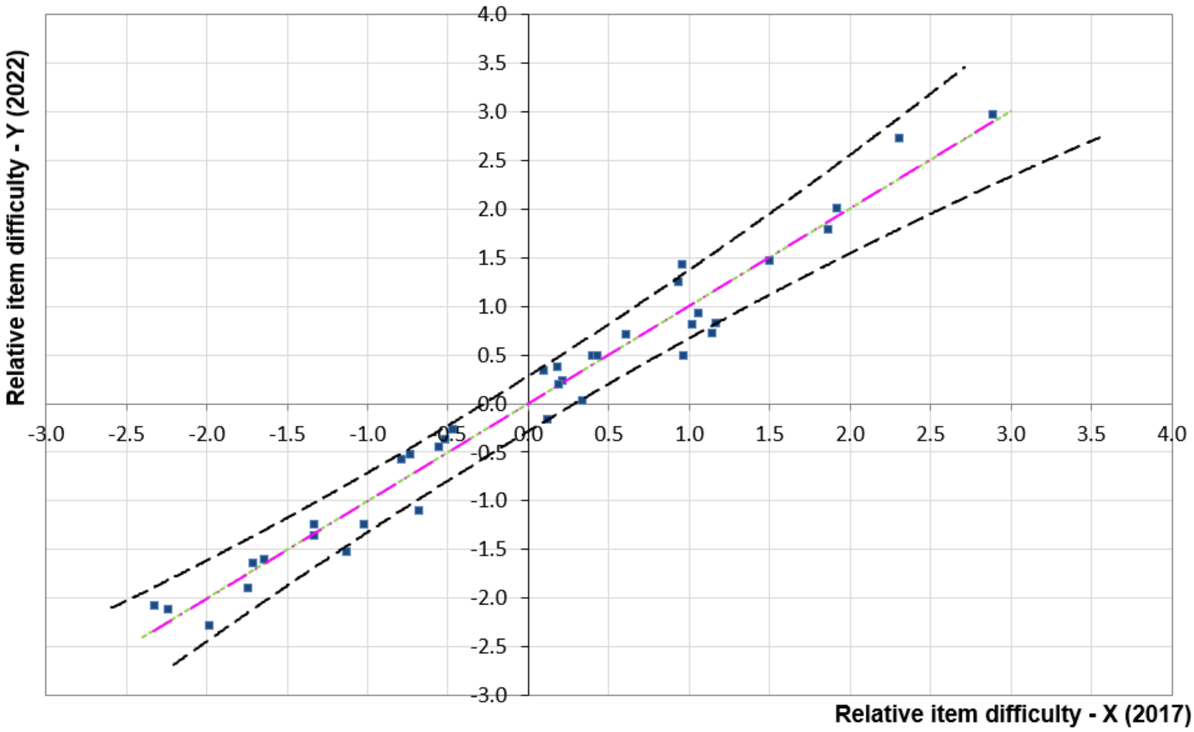


Figure 5.4: Relative item difficulties in logits of horizontal link items between 2017 and 2022

Item–rest correlation is an index of item discrimination, which is computed as the correlation between the scored item and the raw score of all other items in a booklet. It indicates how well an item discriminates between high- and low-performing students. The 2017 and 2022 values of these discrimination indices are plotted in Figure 5.5.

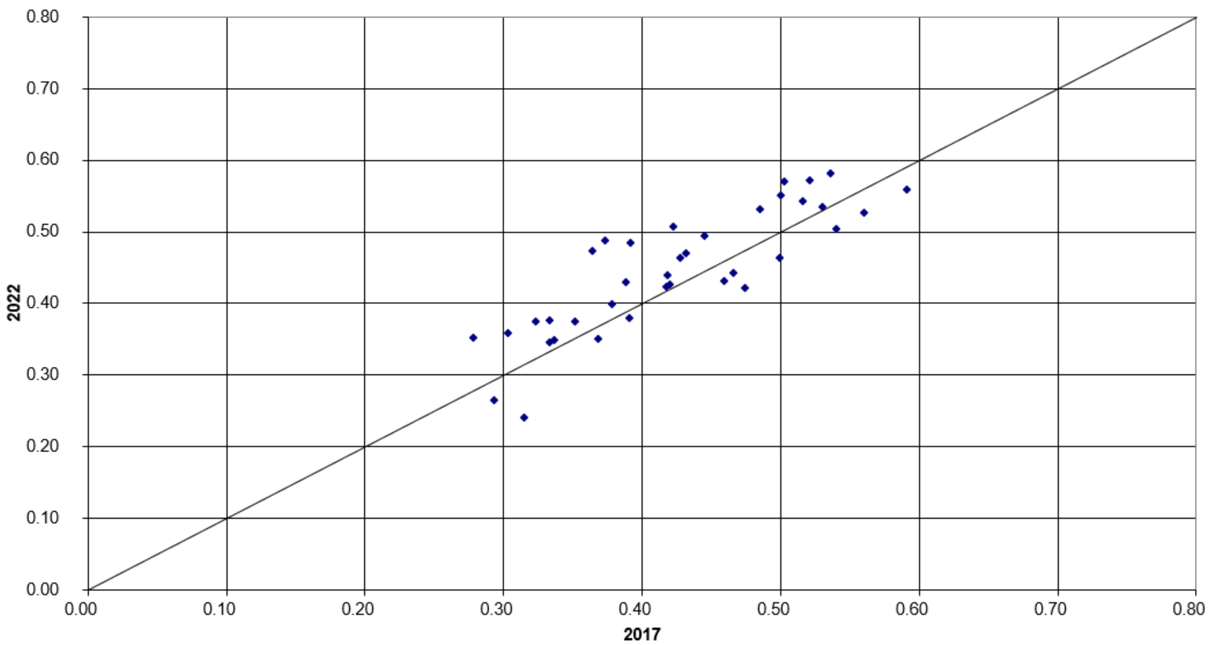


Figure 5.5: Discrimination of link items in 2017 and 2022

After the selection of link items, common item equating was used to shift the 2022 scale onto the historical scale. The value of the shift is the difference in average difficulty of the link items between 2017 and 2022 (0.007). After applying this shift, the same transformation was applied as in 2017. Original scale scores (logits) were converted as:

$$\theta_n^* = \{(\theta_n + 0.007 - 0.167 - 0.039 + 0.210 - 0.032 - \bar{\theta}_{05})/\sigma_{05}\} \times 100 + 400$$

where $\theta_n^*$ is the transformed knowledge estimate for student *n*, $\theta_n$ is the original knowledge estimate for student *n* in logits, each numeric term is the equating shift between each 2 of the previous cycles, $\overline{\theta}_{05}$ is the mean ability in logits of the Year 6 students in 2005 (–0.34197) and $\sigma_{05}$ is the standard deviation in logits of the Year 6 students in 2005 (1.04072).

### Uncertainty in the link

The shift that equates the 2022 data with the 2017 data depends upon the change in difficulty of each of the individual link items. As a consequence, the sample of link items that have been chosen will influence the estimated shift. This means that the resulting shift could be slightly different if an alternative set of link items had been selected. As a result, there is an uncertainty associated with the equating that is due to the choice of link items, similar to the uncertainty associated with the sampling of schools and students.

The uncertainty that results from the selection of a subset of link items is referred to as a linking or equating error. This error should be taken into account when making comparisons between the results from different data collections across time. Just as with the error that is introduced through the process of sampling students, the exact magnitude of this equating error cannot be determined. We can, however, estimate the likely range of magnitudes for this error and take this error into account when interpreting results. As with sampling errors, the likely range of magnitude for the combined errors is represented as a standard error of each reported statistic.

The following approach has been used to estimate the equating error. Suppose we have a total of *L* score points in the link items in *K* modules. Use *i* to index items in a unit and *j* to index units so that $\hat{\delta}_{ij}^{y}$ is the estimated difficulty of item *i* in unit *j* for year *y*, and let:

$$C_{ij} = \hat{\delta}_{ij}^{2017} - \hat{\delta}_{ij}^{2014}$$

The size (number of score points) of unit *j* is $m_j$ so that:

$$\sum_{j=1}^{K} m_j = L \qquad \text{and} \qquad \overline{m} = \frac{1}{K}\sum_{j=1}^{K} m_j$$

Further, let:

$$c_{\bullet j} = \frac{1}{m_j}\sum_{i=1}^{m_j} c_{ij} \qquad \text{and} \qquad \overline{c} = \frac{1}{N}\sum_{j=1}^{K}\sum_{i=1}^{m_j} c_{ij}$$

Then the link error, taking into account the clustering, is as follows:

$$LinkError_{2017,2014} = \sqrt{\frac{\sum_{j=1}^{K} m_j^2 (c_{\bullet j} - \overline{c})^2}{K\left(K-1\right)\overline{m}^2}} = \frac{\sum_{j=1}^{K} m_j^2 (c_{\bullet j} - \overline{c})^2}{L^2}\frac{K}{K-1}$$

The link error between 2017 and 2022 is 4.87 scale score points. The equating error between 2022 and 2014 is the sum of the 2 equating errors between adjacent cycles.

$$error_{2022-2014} = \sqrt{5.52^2 + 4.87^2} = 7.36$$

The equating error between 2022 and 2011 is the sum of the 3 equating errors between the 3 cycles.

$$error_{2022-2011} = \sqrt{4.010^2 + 5.52^2 + 4.87^2} = 8.38$$

$$error_{2022-2008} = \sqrt{5.712^2 + 4.010^2 + 5.52^2 + 4.87^2} = 10.14$$

$$error_{2022-2005} = \sqrt{4.300^2 + 5.712^2 + 4.010^2 + 5.52^2 + 4.87^2} = 11.02$$

## Plausible values

Plausible values methodology was used to generate estimates of students' ICT literacy. Using item parameters anchored at their estimated values from the calibration process, plausible values were randomly drawn from the marginal posterior of the latent distribution (Mislevy 1991; Mislevy and Sheehan 1987; von Davier, Gonzalez and Mislevy 2009). During this process, "not reached" items were marked as incorrect responses, in the same way as embedded missing responses were scored in the item calibration. Estimations are based on the conditional item response model and the population model, which includes the regression on background and survey variables used for conditioning (Adams and Wu 2002). The ACER ConQuest Version 5.28 software was used for drawing plausible values.

Some variables were used as direct regressors in the conditioning model for drawing plausible values. The variables included school mean performance adjusted for the student's own performance[7] and dummy variables for the school-level variables of state/territory, sector, geographic location of the school, SEIFA levels and the student-level variables of gender, Indigenous status and language background other than English. Principle component analysis (PCA) was used to extract component scores from all other student-background variables and responses to questions in the student survey. The principle components were estimated separately for each year level. Subsequently, the components that explained 99% of the variance in the original variables were included as regressors in the final conditioning model for each state or territory. Details of the coding of variables included directly in the conditioning model or included in the PCA are listed in Appendix G: Variables for conditioning.

## Scaling survey items

Before estimating student scores on the survey scales, exploratory and confirmatory factor analyses were conducted with survey data.

Exploratory factor analyses were carried out on newly developed or heavily modified questions (questions 11 and 15) to provide evidence of the factor structure (suggesting a 2-factor solution to question 15 and a one-factor solution to question 11 that fit the conceptual model). Confirmatory factor analyses were carried out for all scales. For example, there are 6 items designed to measure perceptions of the importance of ICT use (question 5) and 11 items reflecting confidence (self-efficacy) in using ICT (question 10). The analyses confirmed the expected one-dimensional factor structure of each of these item sets.

Table 5.2 describes the main characteristics of the survey scales, including the scale reliabilities (Cronbach's alpha) and their respective correlation with ICT literacy scores.

Student and item parameters were estimated using the ACER ConQuest Version 5 software. Items were scaled using the Rasch partial credit model (Masters and Wright 1997). Item parameters and student scores were jointly estimated, giving equal weight to jurisdictional samples. Weighted likelihood estimation was used to obtain the individual student scores (Warm 1989). The scales were converted to a metric with a mean score of 50 and a standard deviation of 10 for the Year 6 sample.

[7] So-called *weighted likelihood estimates* (WLEs) were used as ability estimates in this case (Warm 1989).

Table 5.2: Description of survey scales

| Name | Index name | Question number | Number of items | Cronbach's alpha | | Correlation with achievement | |
|---|---|---|---|---|---|---|---|
| | | | | Year 6 | Year 10 | Year 6 | Year 10 |
| Students' perceptions of the importance of ICT use | IMPICT | Q5a-c, e-g | 6 | 0.77 | 0.86 | 0 | 0.20 |
| Students' frequency of using study utilities on ICT devices – at school | UTILSCH | Q6a1 to j1 | 10 | 0.78 | 0.80 | -0.09 | -0.04 |
| Students' frequency of using study utilities on ICT devices – outside school | UTILOUT | Q6a2 to j2 | 10 | 0.84 | 0.84 | 0 | 0.05 |
| Students' frequency of using ICT devices for entertainment purposes – at school | ENTSCH | Q7a1 to f1 | 6 | 0.73 | 0.73 | -0.21 | -0.08 |
| Students' frequency of using ICT devices for entertainment purposes – outside school | ENTOUT | Q7a2 to f2 | 6 | 0.68 | 0.63 | 0 | 0.08 |
| Students' frequency of using ICT devices for communication activities – at school | COMSCH | Q8a1 to f1 | 5 | 0.68 | 0.69 | -0.19 | -0.12 |
| Students' frequency of using ICT devices for communication activities – outside school | COMOUT | Q8a2 to f2 | 5 | 0.72 | 0.59 | 0 | -0.04 |
| Students' frequency of completing technological tasks using ICT devices – at school | TECSCH | Q9a1 to g1 | 7 | 0.79 | 0.88 | -0.18 | -0.19 |
| Students' frequency of completing technological tasks using ICT devices – outside school | TECOUT | Q9a2 to g2 | 7 | 0.81 | 0.88 | 0 | -0.15 |
| Students' ICT self-efficacy | EFFICACY | Q10a-l | 11 | 0.87 | 0.86 | 0.24 | 0.35 |
| Students' ICT learning at school | ICTLEARN | Q11a-s | 19 | 0.89 | 0.91 | 0 | 0.14 |
| Use of standard tools for school-related purposes | OFFICE | Q13a-c, f, g | 5 | 0.77 | 0.80 | 0.23 | 0.31 |
| Use of specialist ICT tools for school-related purposes | MEDTEC | Q13d-e, h-k, n-p, r-t | 12 | 0.94 | 0.96 | 0 | -0.22 |
| Use of ICT devices in general classroom activities | GENERAL | Q14a-d, f-h, k-l, p | 10 | 0.92 | 0.93 | 0.14 | 0.2 |
| Use of ICT devices in specialised classroom activities | SPECIAL | Q14e, i-j, m-o | 6 | 0.90 | 0.91 | 0 | -0.16 |
| Students' computational thinking–related learning at school | COMPTK | Q15a-b, d, j-l | 6 | 0.87 | 0.88 | 0.1 | 0.14 |

# Chapter 6: Proficiency levels and the proficient standards

In addition to analysing and reporting ICT literacy using the NAP–ICT Literacy scale, 2 other summary measures of student achievement were used. One of these measures referenced a set of 6 proficiency levels that were ranges on the scale accompanied by descriptions of the ICT capabilities associated with each level. The percentage of students performing at each proficiency level provided a measure of student achievement. Furthermore, the proficient standards represent points on the NAP–ICT Literacy scale indicating a "challenging but reasonable" proficiency level that Year 6 and Year 10 students would be expected to have reached by the end of each year level. The percentage of students who had attained (i.e. reached or exceeded) the proficient standard presented an additional measure of student performance. The proportion of students achieving at or above the proficient standard is also the national Key Performance Measure for ICT literacy specified in the Measurement Framework for Schooling in Australia 2020 (ACARA 2020b). This chapter describes the development of these 2 measures.

## Proficiency levels

One of the key objectives of NAP–ICT Literacy is to monitor trends in ICT literacy performance over time. The NAP–ICT Literacy scale forms the basis for the empirical comparison of student performance. In addition to the metric established for the scale, a set of 6 proficiency levels with substantive descriptions was established in 2005. Descriptions were updated in 2022 to cover the new aspects of the ICT Literacy definition. These described levels are syntheses of the item contents within each level.

Comparison of student achievement against the proficiency levels provides an empirically and substantively convenient way of describing profiles of student achievement. Students whose results are located within a particular level of proficiency are typically able to demonstrate the understandings and skills associated with that level, and also typically possess the understandings and skills defined as applying to lower proficiency levels.

## Creating the proficiency levels

The proficiency levels were established in 2005 and were based on an approach developed for the OECD's Programme for International Student Assessment (PISA). PISA made use of a method that ensured that the notion of *being at a level* could be interpreted consistently and in line with the fact that the achievement scale is a continuum. It provides a common understanding about what *being at a level* means and that the meaning of *being at a level* is consistent across levels. Similar to the approach taken in the PISA study (OECD 2005 p 255), this method took the following 3 variables into account:

- the expected success of a student at a particular level on a test containing items at that level
- the width of the levels in that scale
- the probability that a student in the middle of a level would correctly answer an item of average difficulty for that level.

To achieve this for NAP–ICT Literacy, the following 2 parameters for defining proficiency levels were adopted:

- setting the response probability for the analysis of data at $p = 0.62$
- setting the width of the proficiency levels at 1.25 logits.

Once these parameters had been established, it was possible to make the following statements about the achievement of students relative to the proficiency levels:

- A student at the lowest possible point of the proficiency level is likely to get approximately 50% correct on a test made up of items spread uniformly across the level, from the easiest to the most difficult.

- A student at the lowest possible point of the proficiency level is likely to get 62% correct on a test made up of items similar to the easiest items in the level.
- A student at the top of the proficiency level is likely to get 82% correct on a test made up of items similar to the easiest items in the level.

The final step was to establish the position of the proficiency levels on the scale. This was done in combination with a standards-setting exercise in which a proficient standard was established for the NAP–ICT Literacy 2005 assessment cycle at each year level. The Year 6 proficient standard was established as the cut-point between levels 2 and 3 on the NAP–ICT Literacy scale, and the Year 10 proficient standard was set as the cut-point between levels 3 and 4.

It should be acknowledged that it would have been possible to choose other solutions with different parameters defining the proficiency levels. The approach used in PISA, and adopted for NAP–ICT Literacy, attempted to balance the notions of mastery and “pass” in a way that is likely to be understood by the community.

## Proficiency level cut-points

Six proficiency levels were established for reporting student performance on the assessment. Table 6.1 identifies these levels by cut-point (in logits and scale score) and shows the percentage of Year 6 and Year 10 students in each level in NAP–ICT Literacy 2022.

## Describing proficiency levels

Information about the items in each level was used to develop summary descriptions of the ICT literacy associated with different levels of proficiency. These summary descriptions encapsulate the ICT literacy of students associated with each level. As a set, the descriptions represent growth in ICT literacy. The levels are not discrete discontinuous steps but are a way of illustrating progress. The texts of the proficiency level descriptions, together with descriptions of examples of achievement at each level, are described in Appendix H: Proficiency level descriptions.

Table 6.1: Proficiency level cut-points and percentage of Year 6 and Year 10 students in each level in 2022

| Proficiency level | Cut-points | | Percentage | | | |
|---|---|---|---|---|---|---|
| | Logits | Scale | Year 6 | | Year 10 | |
| **Level 6** | 3.5 | 769 | | | 0 | (±0.2) |
| **Level 5** | 2.25 | 649 | 0 | (±0.2) | 6 | (±1.1) |
| **Level 4** | 1.00 | 529 | 13 | (±1.6) | 40 | (±2.7) |
| **Level 3** | -0.25 | 409 | 42 | (±1.9) | 37 | (±2.8) |
| **Level 2** | -1.50 | 289 | 32 | (±2.0) | 13 | (±1.9) |
| **Level 1** | | | 13 | (±1.8) | 5 | (±1.1) |

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

## Setting the proficient standards

The process for setting standards in science literacy, information and communications technologies, civics and citizenship, and secondary (15-year-old) reading, mathematics and science was endorsed by the Performance Measurement and Reporting Taskforce (PMRT) of the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) at its meeting on 6 March 2003 and is described in the paper *Setting National Standards* (PMRT 2003).

This process, referred to as the empirical judgmental technique, requires stakeholders to examine the test items and the results from the national assessments and agree on a proficient standard for the 2 year levels.

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 2020b p 6). This is different from the definition of either a benchmark or a national minimum standard, which refer to minimum competence. The proficient standards in NAP–ICT Literacy (one for Year 6 and one for Year 10) were established as a result of consultations with ICT experts and representatives from all states and territories and all school sectors as part of the inaugural assessment in 2005. The standards-setting group included practising teachers with specific ICT expertise, ICT curriculum experts and educational assessment experts. The procedures followed by the group are outlined in the NAP–ICT Literacy Public Report (MCEETYA 2007 pp 46–7).

The proficient standard for Year 6 and the proficient standard for Year 10 were established in 2005 on the NAP–ICT Literacy scale. The proficient standard for Year 6 is 409 scale points, which is the boundary between levels 2 and 3 on the NAP–ICT Literacy scale. The proficient standard for Year 10 is 529 scale points, which is the boundary between levels 3 and 4 on the scale. Year 6 students performing at level 3 and above, and Year 10 students performing at level 4 and above have consequently met or exceeded their relevant proficient standard.

# Chapter 7: Reporting of results

The students assessed in NAP–ICT Literacy 2022 were selected using a 2-stage cluster sampling procedure. At 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 Chapter 3). 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–ICT Literacy estimates were obtained using plausible value methodology (see Chapter 5), 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. For this cycle of NAP–ICT Literacy, gender category “other” is not reported because there are fewer than 30 students or fewer than 5 schools with valid data.

This chapter 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 the NAP–ICT Literacy Public Report 2022.

## 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 utilising the application of replication techniques (Wolter 1985, Gonzalez and Foy 2000). The sampling variances of population means, differences, percentages and correlation coefficients in NAP–ICT 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–ICT Literacy. In addition, for comparing achievement test scores with those from previous cycles (2005, 2008, 2011, 2014 and 2017), 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.[8] For NAP–ICT Literacy 2022, 172 sampling zones were used in Year 6 and 163 in Year 10.

Within each sampling zone, one school was randomly assigned a value of 2, whereas the other one received a value of zero. 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.

At each year level, 172 replicate weights were computed. In Year 10, which had only 163 sampling zones, the last 10 replicate weights were equal to the final sampling weight. This was done in order to have a consistent number of replicate weight variables in the final database.

[8] 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*.

## Standard errors

In order 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.[9]

Population statistics for NAP–ICT 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 for each plausible value $U_i$:

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

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

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

To obtain the final standard error of NAP–ICT 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.

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

The 95% confidence interval, as presented in the NAP–ICT Literacy Public Report 2022, is 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

The NAP–ICT Literacy Public Report 2022 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 are reported:

- between states and territories
- between student subgroups
- between this assessment cycle and previous ones in 2017, 2014, 2011, 2008 and 2005.

### 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 the 2022 public report, differences are 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 sub-groups

The formula for calculating the standard error described in the previous section is not appropriate for sub-groups 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 taken into account 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 ($\alpha = 0.05$). The value $t$ was calculated by dividing the mean difference by its standard error.

### Mean differences between assessment cycles (2005, 2008, 2011, 2014, 2017, 2022)

The NAP–ICT Literacy Public Report 2022 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.

The value of the equating error between 2022 and the previous assessment in 2017 is 4.87 score points on the NAP–ICT 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:

$$E(t_{22} - t_{17}) = \sqrt{SE_{22}^2 + SE_{17}^2 + EqErr_{22\_17}^2}$$

where *t* can be any statistic in units on the NAP–ICT Literacy scale (mean, percentile, gender difference, but *not* percentages), $SE_{22}^2$ is the respective standard error of this statistic in 2022, $SE_{17}^2$ the corresponding standard error in 2017 and $EqErr_{22\_17}^2$ the equating error for comparing 2022 with 2017 results.

When comparing population estimates between 2022 and the fourth assessment in 2014, 2 equating errors (between 2022 and 2017 and between 2017 and 2014) 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 2022 and 2014:

$$SE(\mu_{22} - \mu_{14}) = \sqrt{SE_{22}^2 + SE_{14}^2 + EqErr_{22\_14}^2}$$

where $EqErr_{22\_14}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 2022 and 2017 (4.87 score points) as well as between 2017 and 2014 (5.52 score points). This combined equating error was equal to 7.36 score points and was calculated as:

$$EqErr_{22\_14} \quad = \sqrt{EqErr_{22_{17}}^2 + EqErr_{17_{14}}^2}$$

Similarly, for comparisons between 2022 and the first NAP–ICT Literacy assessment in 2005, the equating errors between each adjacent pair of assessments had to be taken into account and standard errors for differences were computed as:

$$SE(\mu_{22} - \mu_{05}) = \sqrt{SE_{22}^2 + SE_{05}^2 + EqErr_{22\_05}^2}$$

$\mathrm{EqErr}_{22\_05}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 2022 and 2017 (4.87 score points), between 2017 and 2014 (5.52 score points), between 2014 and 2011 (4.01 score points), between 2011 and 2008 (5.71 score points) and between 2008 and 2005 (4.3 score points). The combined equating error was equal to 11.02 score points, and was calculated as:

$$EqErr_{22\_05} = \sqrt{EqErr_{22_{17}}^2 + EqErr_{17_{14}}^2 + EqErr_{14_{11}}^2 + EqErr_{11_{08}}^2 + EqErr_{08_{05}}^2}$$

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 (409 for Year 6 and 529 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 4.87 score points for comparisons between 2022 and 2017, 7.36 score points for comparisons between 2022 and 2014, 8.38 score points for comparisons between 2022 and 2011, 10.14 score points for comparisons between 2022 and 2008, and 11.02 score points for comparisons between 2022 and 2005.

Percentages of students at or above each replicate cut-point ($\rho_n$) were computed and the equating error was estimated as:

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

where $\rho_o$ 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 2022 and 2017 were calculated as:

$$SE(\rho_{22} - \rho_{17}) = \sqrt{SE(\rho_{22})^2 + SE(\rho_{17})^2 + EqErr(\rho_{22\_17})^2}$$

where $\rho_{22}$ is the percentages at or above the proficient standard in 2022 and $\rho_{17}$ in 2017, $SE(\rho_{22})$ and $SE(\rho_{17})$ their respective standard errors, and $EqErr(\rho_{22\_17})$ the equating error for comparisons. For estimating the standard error of the corresponding differences in percentages at or above proficient standards between 2022 and 2014, the following formula was used:

$$SE(\rho_{22} - \rho_{14}) = \sqrt{SE(\rho_{22})^2 + SE(\rho_{14})^2 + EqErr(\rho_{22\_14})^2}$$

Likewise, for estimating the standard error of the corresponding differences in percentages at or above proficient standards between 2022 and 2008 and between 2022 and 2005, the following formulas were used:

$$SE(\rho_{22} - \rho_{08}) = \sqrt{SE(\rho_{22})^2 + SE(\rho_{08})^2 + EqErr(\rho_{22\_08})^2}$$

$$SE(\rho_{22} - \rho_{05}) = \sqrt{SE(\rho_{22})^2 + SE(\rho_{05})^2 + EqErr(\rho_{22\_05})^2}$$

For NAP–ICT Literacy 2022, 5000 replicate cut-points were created. Equating errors on percentages were estimated for each sample or subsample of interest. Table 7.1 and Table 7.2 show the values of these equating errors of Year 6 and Year 10 respectively.

Table 7.1: Year 6 equating errors for comparisons between percentages

| Group | 2022/2017 | 2022/2014 | 2022/2011 | 2022/2008 | 2022/2005 |
|---|---|---|---|---|---|
| Aust | 1.63 | 2.54 | 2.92 | 3.58 | 3.91 |
| NSW | 1.54 | 2.42 | 2.78 | 3.40 | 3.71 |
| VIC | 1.58 | 2.48 | 2.86 | 3.54 | 3.89 |
| QLD | 2.03 | 3.05 | 3.46 | 4.15 | 4.49 |
| SA | 1.61 | 2.52 | 2.89 | 3.55 | 3.87 |
| WA | 1.44 | 2.42 | 2.82 | 3.53 | 3.88 |
| TAS | 1.95 | 2.73 | 3.06 | 3.64 | 3.94 |
| NT | 1.82 | 2.50 | 2.77 | 3.27 | 3.52 |
| ACT | 1.28 | 1.89 | 2.16 | 2.63 | 2.88 |
| Female | 1.65 | 2.65 | 3.06 | 3.76 | 4.10 |
| Male | 1.61 | 2.45 | 2.81 | 3.42 | 3.73 |
| Non-Indigenous | 1.68 | 2.63 | 3.02 | 3.70 | 4.04 |
| Indigenous | 1.06 | 1.47 | 1.65 | 1.96 | 2.12 |
| Not LBOTE | 1.75 | 2.68 | 3.07 | 3.74 | 4.07 |
| LBOTE | 1.24 | 2.12 | 2.48 | 3.10 | 3.41 |
| Metropolitan | 1.65 | 2.56 | 2.94 | 3.58 | 3.90 |
| Provincial | 1.59 | 2.53 | 2.92 | 3.62 | 3.97 |
| Remote | 1.69 | 2.33 | 2.58 | 3.06 | 3.33 |
| Senior Managers and Professionals | 1.59 | 2.39 | 2.72 | 3.28 | 3.57 |
| Other Managers and Associate Professionals | 1.55 | 2.38 | 2.75 | 3.40 | 3.73 |
| Tradespeople & skilled office, sales and service staff | 1.67 | 2.76 | 3.20 | 3.95 | 4.32 |
| Unskilled labourers, office, sales and service staff | 1.84 | 3.09 | 3.59 | 4.43 | 4.84 |
| Not in paid work in last 12 months | 1.87 | 2.59 | 2.90 | 3.47 | 3.77 |
| Year 9 | 3.51 | 5.29 | 5.89 | 6.81 | 7.21 |
| Year 10 | 1.33 | 2.04 | 2.39 | 3.01 | 3.32 |
| Year 11 or equivalent | 2.06 | 2.88 | 3.26 | 3.90 | 4.20 |
| Year 12 or equivalent | 1.88 | 2.85 | 3.23 | 3.90 | 4.25 |
| Certificate I to IV (including trade cert) | 1.83 | 2.85 | 3.29 | 4.03 | 4.39 |
| Advanced Diploma/Diploma | 1.57 | 2.61 | 3.05 | 3.80 | 4.16 |
| Bachelor’s degree or above | 1.44 | 2.25 | 2.59 | 3.16 | 3.46 |

Table 7.2: Year 10 equating errors for comparisons between percentages

| Group | 2022/2017 | 2022/2014 | 2022/2011 | 2022/2008 | 2022/2005 |
|---|---|---|---|---|---|
| Aust | 0.97 | 1.47 | 1.67 | 2.00 | 2.16 |
| NSW | 0.91 | 1.34 | 1.51 | 1.79 | 1.94 |
| VIC | 1.03 | 1.55 | 1.75 | 2.09 | 2.26 |
| QLD | 1.03 | 1.64 | 1.88 | 2.28 | 2.47 |
| SA | 0.87 | 1.21 | 1.36 | 1.63 | 1.76 |
| WA | 1.07 | 1.64 | 1.85 | 2.19 | 2.36 |
| TAS | 1.34 | 1.89 | 2.11 | 2.48 | 2.66 |
| NT | 2.00 | 2.95 | 3.33 | 3.94 | 4.22 |
| ACT | 0.70 | 0.93 | 1.03 | 1.19 | 1.27 |
| Female | 1.02 | 1.59 | 1.79 | 2.14 | 2.30 |
| Male | 0.95 | 1.38 | 1.57 | 1.88 | 2.04 |
| Non-Indigenous | 0.97 | 1.47 | 1.66 | 1.98 | 2.15 |
| Indigenous | 1.54 | 2.31 | 2.59 | 3.05 | 3.29 |
| Not LBOTE | 1.10 | 1.64 | 1.85 | 2.19 | 2.36 |
| LBOTE | 0.66 | 1.04 | 1.20 | 1.46 | 1.60 |
| Metropolitan | 0.71 | 1.11 | 1.28 | 1.56 | 1.70 |
| Provincial | 1.75 | 2.49 | 2.76 | 3.20 | 3.42 |
| Remote | 3.28 | 5.39 | 6.18 | 7.36 | 7.88 |
| Senior Managers and Professionals | 0.50 | 0.81 | 0.94 | 1.15 | 1.27 |
| Other Managers and Associate Professionals | 0.76 | 1.22 | 1.41 | 1.72 | 1.87 |
| Tradespeople & skilled office, sales and service staff | 1.20 | 1.81 | 2.05 | 2.47 | 2.68 |
| Unskilled labourers, office, sales and service staff | 1.95 | 2.71 | 2.96 | 3.36 | 3.56 |
| Not in paid work in last 12 months | 1.30 | 1.95 | 2.22 | 2.71 | 2.95 |
| Year 9 | 3.29 | 4.00 | 4.27 | 4.68 | 4.88 |
| Year 10 | 3.28 | 4.08 | 4.34 | 4.78 | 5.00 |
| Year 11 or equivalent | 1.72 | 2.54 | 2.82 | 3.23 | 3.44 |
| Year 12 or equivalent | 2.26 | 3.22 | 3.54 | 4.03 | 4.25 |
| Certificate I to IV (including trade cert) | 1.26 | 1.95 | 2.23 | 2.70 | 2.94 |
| Advanced Diploma/Diploma | 0.84 | 1.31 | 1.50 | 1.82 | 1.99 |
| Bachelor’s degree or above | 0.56 | 0.86 | 0.98 | 1.20 | 1.31 |

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# Appendices

## Appendix A: Student survey

All questions are for both Year 6 and Year 10 unless otherwise stated.

### INSTRUCTIONS

This questionnaire is about your use of Information and Communication Technology (ICT). In this questionnaire ICT devices are:

- desktop computers
- laptop computers (including notebooks and netbooks)
- tablets
- smartphones (to access the internet or use apps).

Some questions will ask about your use of ICT at school. This is intended only to focus on use while physically present at school, and not for school-related work at home or during periods of remote learning.

Q1 **How long have you been using ICT devices?**

| Never or less than one year | At least one year but less than three years | At least three years but less than five years | At least five years but less than seven years | Seven years or more |
|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ |

Q2 **What type of ICT devices do you use in the following places?**
(Select as many responses as are relevant to you for each place.)

| | Computer (desktop or laptop) | Tablet | Smartphone (to access the internet or use apps) | None |
|---|---|---|---|---|
| At school | ☐ | ☐ | ☐ | ☐ |
| Outside of school | ☐ | ☐ | ☐ | ☐ |

Q3 **Do you have your own portable ICT device for use in class?**
(Select one response for each device.)

| | No | Yes, my school provides me with the device | Yes, the school tells me what brand or model of device I may bring | Yes, I can bring any brand or model of device to school |
|---|---|---|---|---|
| Laptop computer | ○ | ○ | ○ | ○ |
| Tablet | ○ | ○ | ○ | ○ |

Q4 **How often do you use each type of ICT device in the following places?**
(Select one response for each place.)

| | At school | Outside of school |
|---|---|---|
| Desktop or laptop computer | [dropdown] | [dropdown] |
| Tablet | [dropdown] | [dropdown] |

Q5 **To what extent do you agree or disagree with each of the following statements?**
(Select one response for each statement.)

| | Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|---|
| I like using ICT devices because they help me improve the quality of my work. | ○ | ○ | ○ | ○ |
| I like using ICT devices because they make work easier. | ○ | ○ | ○ | ○ |
| I enjoy using ICT devices because they help me to work with others. | ○ | ○ | ○ | ○ |
| I like using ICT devices because I prefer to work alone. | ○ | ○ | ○ | ○ |
| I enjoy using ICT devices because they help me communicate with my friends. | ○ | ○ | ○ | ○ |
| I like using ICT devices to find new ways to do things. | ○ | ○ | ○ | ○ |
| It is very important to me to work with an ICT device | ○ | ○ | ○ | ○ |

Q6 **How often do you use an ICT device to do each of the following?**
(Use the drop-down menu to select one option for each of **At school** and **Outside of school**.)

| | At school | Outside of school |
|---|---|---|
| Search the Internet for information for study or school work | | |
| Use word processing software or apps to create documents | | |
| Use spreadsheets to create a graph or perform calculations | | |
| Use mathematics, language or other learning programs on a computer | | |
| Enter data in a spreadsheet | | |
| Create presentations for school projects | | |
| Watch online videos to support your own learning | | |
| Listen to podcasts or audiobooks to support your own learning | | |
| Organise your school work using a learning management or school management system (e.g. a Moodle, Compass, Canvas, Google Classroom, Apple Classroom) | | |
| Record your reflections on learning (e.g. through a blog) | | |

Q7 **How often do you use an ICT device to do each of the following?**
(Use the drop-down menu to select one option for each of **At school** and **Outside of school**.)

| | At school | Outside of school |
|---|---|---|
| Watch videos for entertainment | | |
| Play video games | | |
| Use software to create sounds, music, movies, animations or artwork | | |
| Listen to music for entertainment | | |
| Listen to podcasts, audiobooks or internet radio for entertainment | | |
| Search for online information about things you are interested in | | |

## Q8 Y6 version

Q8 **How often do you use an ICT device to do each of the following?**
(Use the drop-down menu to select one option for each of **At school** and **Outside of school**.)

| | At school | Outside of school |
|---|---|---|
| Use email | | |
| Use chat or messaging apps | | |
| Write or reply to blog or forum posts | | |
| Use voice or video calls to communicate with people online (e.g. Skype, WhatsApp, FaceTime) | | |
| Create and share content with others on social media (e.g. Kidzworld, Popjam, LegoLife or similar) | | |

## Q8 Y10 version

Q8 **How often do you use an ICT device to do each of the following?**
(Use the drop-down menu to select one option for each of **At school** and **Outside of school**.)

| | At school | Outside of school |
|---|---|---|
| Use email | | |
| Use chat or messaging apps | | |
| Write or reply to blog or forum posts | | |
| Use voice or video calls to communicate with people online (e.g. Skype, WhatsApp, FaceTime) | | |
| Create and share content with others on social media (e.g. Instagram, Snapchat, Twitter, Facebook or similar) | | |

Q9 **How often do you use an ICT device to do each of the following?**
(Use the drop-down menu to select one option for each of **At school** and **Outside of school**.)

| | At school | Outside of School |
|---|---|---|
| Create programs with a visual programming tool (e.g. Alice, GameMaker, Kodu, Lego Mindstorms, MIT App Inventor, Scratch) | | |
| Write code, programs or macros (e.g. HTML, Javascript, Swift, Python, Visual Basic, .NET) | | |
| Publish media you have created on a website (e.g. to YouTube, SoundCloud) | | |
| Create or edit a website using a website editor | | |
| Use drawing, painting or graphics programs | | |
| Change application settings to suit your purposes | | |
| Combine music, video or images to create digital content | | |

## Q10 Y6 version

Q10 **How well can you do each of these tasks on an ICT device?**
(Select one response for each task.)

| | I can do this easily by myself | I can do this with a bit of effort | I know what this means but I cannot do it | I don't know what this means |
|---|---|---|---|---|
| Edit digital photographs or other graphic images | | | | |
| Create a database (e.g. using Microsoft Access, FileMaker, SQL) | | | | |
| Enter data in a spreadsheet (e.g. using Microsoft Excel, Google Sheets, Apple Numbers) | | | | |
| Plot a graph using spreadsheet software (e.g. using Microsoft Excel, Google Sheets, Apple Numbers) | | | | |
| Download music from the internet | | | | |
| Create a multimedia presentation (with sound, pictures, video) | | | | |
| Use a website builder to create or edit websites | | | | |
| Post content (e.g. comments, images, videos) on social media (e.g. Kidzworld, Popjam, LegoLife or similar) | | | | |
| Use a collaborative workspace (e.g. Google G Suite, Microsoft Teams or Microsoft Office 365) to work with others on a shared project | | | | |
| Use videoconferencing software (e.g. Zoom, MS teams, Webex) for communication purposes | | | | |
| Using an online learning management system (e.g. Moodle, Google Classroom, ClassDojo) | | | | |

## Q10 Y10 version

Q10 **How well can you do each of these tasks on an ICT device?**
(Select one response for each task.)

| | I can do this easily by myself | I can do this with a bit of effort | I know what this means but I cannot do it | I don't know what this means |
|---|---|---|---|---|
| Edit digital photographs or other graphic images | | | | |
| Create a database (e.g. using Microsoft Access, FileMaker, SQL) | | | | |
| Enter data in a spreadsheet (e.g. using Microsoft Excel, Google Sheets, Apple Numbers) | | | | |
| Plot a graph using spreadsheet software (e.g. using Microsoft Excel, Google Sheets, Apple Numbers) | | | | |
| Download music from the internet | | | | |
| Create a multimedia presentation (with sound, pictures, video) | | | | |
| Use a website builder to create or edit websites | | | | |
| Post content (e.g. comments, images, videos) on social media (e.g. Instagram, Snapchat, Twitter, Facebook or similar) | | | | |
| Use a collaborative workspace (e.g. Google G Suite, Microsoft Teams or Microsoft Office 365) to work with others on a shared project | | | | |
| Use videoconferencing software (e.g. Zoom, MS teams, Webex) for communication purposes | | | | |
| Using an online learning management system (e.g. Moodle, Google Classroom, ClassDojo) | | | | |

Q11 **In your schooling, have you learnt about the following issues?**
(Select one response for each issue.)

| | Yes | No |
|---|---|---|
| The need to provide references to content from webpages that you include in your schoolwork | ○ | ○ |
| The need to know whether you have copyright permission to share music or video | ○ | ○ |
| The problems of using software to illegally copy or download games or videos for free (e.g. copyright, viruses) | ○ | ○ |
| Reading licence or usage agreements before you click on 'I agree' to install new software | ○ | ○ |
| Opening email attachments from safe sources | ○ | ○ |
| Checking where a message is from before clicking on links | ○ | ○ |
| Reporting spam to an authority (such as a teacher or parent) | ○ | ○ |
| How to create secure passwords for internet services (e.g. email) | ○ | ○ |
| Security risks when using the internet (e.g. viruses, malware, phishing) | ○ | ○ |
| How to decide where to look for information about an unfamiliar topic | ○ | ○ |
| How to look for different types of digital information on a topic | ○ | ○ |
| How to judge the relevance of information to include in school work | ○ | ○ |
| How to judge whether information on the internet can be trusted | ○ | ○ |
| Responsible use of social media | ○ | ○ |
| Respectful online relationships | ○ | ○ |
| How to spot cyberbullying | ○ | ○ |
| How to report cyberbullying or image based abuse | ○ | ○ |
| Where you can get reliable information and help about dealing with cyberbullying and/or suspicious online contact | ○ | ○ |
| How to protect your personal safety when communicating with strangers online | ○ | ○ |

Q12 **During the current school year, have you participated in any of the following activities at school?**
(Select one response for each activity.)

| | Yes | No |
|---|---|---|
| Creating programs with a visual coding tool (e.g. Alice, GameMaker, Kodu, Lego Mindstorms, MIT App Inventor, Scratch) | ○ | ○ |
| Creating a digital game | ○ | ○ |
| Working with others to create a digital solution to a problem | ○ | ○ |
| Designing a program to control a robotic device. | ○ | ○ |
| Using a virtual reality (VR) program | ○ | ○ |
| Using an augmented reality (AR) program | ○ | ○ |
| Using tools to organise and make sense of data (e.g. spreadsheets) | ○ | ○ |
| Learning about the components of a digital system | ○ | ○ |
| Examining the way big data can be used to inform decisions | ○ | ○ |

## Q13 Y6 version

Q13 **How often do you use the following tools for school-related purposes?**
(Select one response for each purpose.)

| | Never | Less than once a month | At least once a month but not every week | At least once a week |
|---|---|---|---|---|
| Word processing software (e.g. Microsoft Word, Apple Pages, Google Docs) | | | | |
| Spreadsheet software (e.g. Microsoft Excel, Apple Numbers, Google Sheets) | | | | |
| Presentation software (e.g. Microsoft Powerpoint, Apple Keynote, Google Slides) | | | | |
| Software for capturing and editing media (e.g. Apple iMovie, Audacity) | | | | |
| Graphic design or drawing software (e.g. Microsoft Paint, Adobe Photoshop, Sketch) | | | | |
| Text-based information websites (e.g. Wikipedia) | | | | |
| Video-based information resources (e.g. YouTube, Kahn Academy) | | | | |
| Digital journals (e.g. to reflect on your learning) | | | | |
| Data logging or monitoring tools | | | | |
| Concept mapping software (e.g. Inspiration, Lucidchart) | | | | |
| Simulations and modelling software (e.g. FlexSim, Labster) | | | | |
| Social media (e.g. Kidzworld, Popjam, LegoLife or similar) | | | | |
| Robotic devices (e.g. Bee-Bots, Sphero or similar) | | | | |
| 3D printers | | | | |
| Computer-aided drawing (CAD) software (e.g. TinkerCAD, BlocksCAD, FreeCAD) | | | | |
| Communications software (e.g. Skype) | | | | |
| 3D design software (e.g. SketchUp, Blender, Maya, 3ds Max) | | | | |
| Visual programming tools (e.g. Alice, GameMaker, Kodu, Lego Mindstorms, MIT App Inventor, Scratch) | | | | |
| Software to create, compile and execute text-based programs (e.g. Microsoft Visual Studio, Atom, Sublime Text, Notepad++) | | | | |

## Q13 Y10 version

Q13 **How often do you use the following tools for school-related purposes?**
(Select one response for each purpose.)

| | Never | Less than once a month | At least once a month but not every week | At least once a week |
|---|---|---|---|---|
| Word processing software (e.g. Microsoft Word, Apple Pages, Google Docs) | | | | |
| Spreadsheet software (e.g. Microsoft Excel, Apple Numbers, Google Sheets) | | | | |
| Presentation software (e.g. Microsoft Powerpoint, Apple Keynote, Google Slides) | | | | |
| Software for capturing and editing media (e.g. Apple iMovie, Audacity) | | | | |
| Graphic design or drawing software (e.g. Microsoft Paint, Adobe Photoshop, Sketch) | | | | |
| Text-based information websites (e.g. Wikipedia) | | | | |
| Video-based information resources (e.g. YouTube, Kahn Academy) | | | | |
| Digital journals (e.g. to reflect on your learning) | | | | |
| Data logging or monitoring tools | | | | |

## Q13 Y10 version (continued)

| | | | | |
|---|---|---|---|---|
| Concept mapping software (e.g. Inspiration, Lucidchart) | ○ | ○ | ○ | ○ |
| Simulations and modelling software (e.g. FlexSim, Labster) | ○ | ○ | ○ | ○ |
| Social media (e.g. Instagram, Snapchat, Twitter, Facebook) | ○ | ○ | ○ | ○ |
| Robotic devices (e.g. Bee-Bots, Sphero or similar) | ○ | ○ | ○ | ○ |
| 3D printers | ○ | ○ | ○ | ○ |
| Computer-aided drawing (CAD) software (e.g. TinkerCAD, BlocksCAD, FreeCAD) | ○ | ○ | ○ | ○ |
| Communications software (e.g. Skype) | ○ | ○ | ○ | ○ |
| 3D design software (e.g. SketchUp, Blender, Maya, 3ds Max) | ○ | ○ | ○ | ○ |
| Visual programming tools (e.g. Alice, GameMaker, Kodu, Lego Mindstorms, MIT App Inventor, Scratch) | ○ | ○ | ○ | ○ |
| Software to create, compile and execute text-based programs (e.g. Microsoft Visual Studio, Atom, Sublime Text, Notepad++) | ○ | ○ | ○ | ○ |

Q14 **How often do the following activities take place in your lessons?**
(Select one response for each activity.)

| | Never | Less than once a month | At least once a month but not every week | At least once a week but not every day | At least once a day |
|---|---|---|---|---|---|
| My teacher uses ICT devices to present information to the class. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to present information to the class. | ○ | ○ | ○ | ○ | ○ |
| My teacher uses ICT devices to provide feedback on our work. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to collaborate with each other on projects. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to collaborate with students from other schools on projects. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to complete tests. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to work on short assignments (i.e. within one week). | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to work on extended projects (i.e. projects that last longer than one week). | ○ | ○ | ○ | ○ | ○ |
| We use the Internet to contact students from other schools about projects. | ○ | ○ | ○ | ○ | ○ |
| We use the Internet to contact experts outside the school. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to collect data for a project. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to analyse data. | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to produce or edit audio. | ○ | ○ | ○ | ○ | ○ |
| We create or edit visual products (e.g. animations, videos, 3D drawings). | ○ | ○ | ○ | ○ | ○ |
| We create or program robotic devices (e.g. Bee-Bots, Sphero or similar). | ○ | ○ | ○ | ○ | ○ |
| We use ICT devices to submit assessments and gather feedback from my teacher. | ○ | ○ | ○ | ○ | ○ |

Q15 **In your lessons in the current school year, to what extent have you received instruction on how to do the following tasks?**
(Select one response for each task.)

| | To a large extent | To a moderate extent | To a small extent | Not at all |
|---|---|---|---|---|
| Breaking a complex problem into smaller parts | ○ | ○ | ○ | ○ |
| Planning tasks by setting out the steps needed to complete them | ○ | ○ | ○ | ○ |
| Developing algorithms (e.g. instructions for a program like Scratch) | ○ | ○ | ○ | ○ |
| Using ICT devices to present information to the class | ○ | ○ | ○ | ○ |
| Writing code, programs or macros | ○ | ○ | ○ | ○ |
| Checking code, programs or macros | ○ | ○ | ○ | ○ |
| Developing applications (apps) | ○ | ○ | ○ | ○ |
| Making changes to code to increase efficiency | ○ | ○ | ○ | ○ |
| Debugging code | ○ | ○ | ○ | ○ |
| Creating visual displays of information or processes (such as graphs, flow charts and decision trees) | ○ | ○ | ○ | ○ |
| Displaying data to help understand and solve problems | ○ | ○ | ○ | ○ |
| Making sense of data to help understand and solve problems | ○ | ○ | ○ | ○ |

Between 2020 and 2022, many students in Australia were required to use ICT to participate in remote or home learning (where they undertook their schooling from home) due to the impact of COVID-19.

Q16 **Did you use ICT for remote or home learning between 2020 and 2022?**

| Yes | No |
|---|---|
| ○ | ○ |

Q17 **What ICT device (computer, laptop or tablet) did you mostly use for remote or home learning since 2020?**

| I did not use an ICT device for remote or home learning | An ICT device supplied to me by my school | An ICT device from home which was my own to use | An ICT device from home that was shared with others in my family |
|---|---|---|---|
| ○ | ○ | ○ | ○ |

Q18 **How prepared do you feel to use ICT to participate in remote or home learning if necessary?**

| Not at all prepared | Not very prepared | Quite prepared | Very prepared |
|---|---|---|---|
| ○ | ○ | ○ | ○ |

# Appendix B: Technical Readiness Test (TRT) instructions

NAP NATIONAL ASSESSMENT PROGRAM

| Browser ✔ | JavaScript ✔ | Screen resolution ✔ |
|---|---|---|
| Chrome 113.0 | Enabled | 1920x1200 |

## NAP ICT Literacy 2022 – Device Check

The instructions below outline the steps for conducting the NAP-ICTL Device Check on the devices the students will use for the assessment.
It is **imperative** that this test be performed on devices:

- that will be used on assessment day using **student access privileges**, and;
- during school hours, where possible, to best represent usual bandwidth load.

### Instructions

**At the top of this page are the results of the automatic check of the browser version, JavaScript status and screen resolution of the device. Components that meet the minimum requirements show a tick and are coloured green. If any of the components don't pass the automatic check please refer to the *NAP ICT Literacy Minimum Requirements document* for further information on system requirements. This document was included in the email to School Technical Support Officers.**

Complete steps 1 to 3 and submit your results on as many student devices as possible. After resolving any issues and checking your final device, please complete the IT Feedback Questionnaire. The link to the questionnaire can be found in the same email to School Technical Support Officers that contains the Device Check link.

### Step 1. Speed test

Please run a speed test on this device and indicate the result below. Links to a selection of speed test providers are listed below or you can use any other.

- http://www.speedtest.net/
- https://fast.com/
- https://speedtest.telstra.com/

Speed test result:

- ○ Less than 500kbps
- ○ 500kbps – 1Mbps
- ○ 2Mbps – 3Mbps
- ○ 4Mbps – 5Mbps
- ○ 6Mbps – 9Mbps
- ○ 10Mbps – 30Mbps
- ○ More than 30Mbps
- ○ None of the speed test websites worked for me.

### Step 2. Animation Item

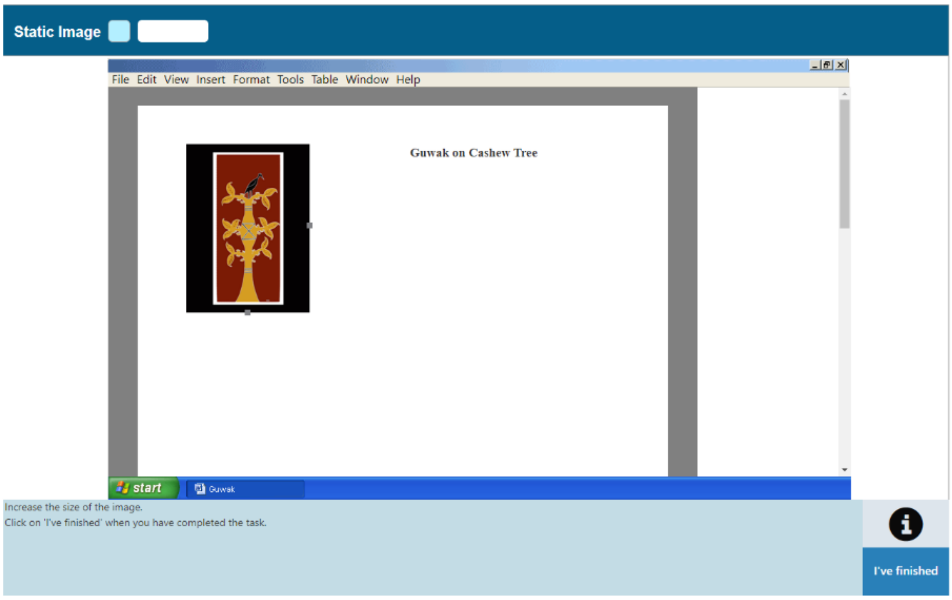
We now need to check that animation items of the type the students will see during the assessment will display correctly on this computer. On clicking the link below, the animation will open in a new browser window or tab (which you can close once viewed). If the animation does not run automatically, please press the triangular play button.
Click to run animation item

**Could you view the animation?** ○ **Yes** ○ **No**

**Please describe your experience (errors seen, page blank etc.)**

## Step 3. Static image item

We now need to check that images of the type the students will see during the assessment will display correctly on this computer. On clicking the link below, the image will open in a new browser window or tab (which you can close once viewed) and is not interactive.
Please compare the screenshot below to the image that opens.
Click to run static image item




**Did the item look like the above image?** ○ Yes ○ No

**Please describe your experience (errors seen, page blank etc.)**

**Please submit your results and repeat this short device check on as many of the student devices as possible. Once you have completed the device checks, you should submit your IT Feedback Questionnaire.**

Submit Form

If at any stage you need assistance, please contact the ACER NAP-ICTL helpdesk on 1800 599 426 or ictl@acer.org.

## Appendix C: Quality Monitor report template

# NAP–ICTL Main Study 2022 – QUALITY MONITOR REPORT

| | | | |
|---|---|---|---|
| **Quality Monitor** | | | |
| **School Name** | | | |
| **State/Territory** | | **Sector** | |
| **Year Level** | | **Date** | |
| **Number of Students Present** | | | |

### 1. Staff Present

Who was present for the assessment session? (please check all that apply and indicate whether they were present for all or part of the test session)

| Staff Member | Present for all of session (X) | Present for part of session (X) |
|---|---|---|
| **Test Administrator** | | |
| **School Contact** | | |
| **School Technical Support Officer** | | |
| **Principal** | | |
| **Other (please specify)** ________________________ | | |

Were the School Contact and Test Administrator roles held by the same person?

☐ Yes, same person ☐ No, different people

### 2. Timing

***Room Set Up and Logging in***

How long did it take for the computers to be switched on and logged into? _____ (mins)

Did the STSO or other school staff member assist the TA in setting up the computers?

☐ No ☐Yes

Was the room suitably set up for the assessment and for students' optimal participation?

☐ No ☐Yes

If No, please provide further comment.

______________________________________________________________

______________________________________________________________

***Instructions***

How long did it take the TA to lead students through the assessment instructions and practice questions? ______ (mins)

Please provide further comment if actual time was **significantly** different to the expected time of 10 mins.

______________________________________________________________

______________________________________________________________

______________________________________________________________

***Assessment Session***

Students are given a set time allowance to complete the assessment (20 mins for each module). For the majority of students in this test session, was this time allowance:

☐ Too generous ☐ Just right ☐Too short

How many students were unable to complete a module in the allocated time?

☐ No students were able to complete their modules in time.

☐ A minority of students were able to complete their modules in time.

☐ The majority of students were able to complete their modules in time.

☐ All students were able to complete their modules in time.

Please provide further comment on module/test time, if needed.

______________________________________________________________

______________________________________________________________

______________________________________________________________

***Survey* (untimed, but suggested time of 15 mins)**

How long did it take most of the students to complete the survey? ______ (mins)

How long did it take the slowest student to complete the survey? ______ (mins)

Please provide further comment on survey timing, if needed.

______________________________________________________________

______________________________________________________________

______________________________________________________________

## 3. Test Instructions

Was the script followed according to the Test Administrator Handbook?

☐ No ☐Yes

If changes were made, were they

☐ Major ☐Minor

Why do you think the TA made changes to the script?

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

Do you think the variation to the script affected the performance of students?

☐ No ☐Yes

If Yes, please provide further comment.

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

## 4. Assistance Given

Were there any particular test questions that students asked for clarification about?

☐ No ☐Yes

Please provide a general description of the item and a brief description of the issue/clarification requested:

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

In your opinion, did the Test Administrator follow the instructions in the TA Manual when assisting students with their questions?

☐ No ☐Yes

If No, please provide further comment.

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

Was any extra assistance given to any students with special needs?

☐ No ☐Yes

If Yes, please provide further comment.

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

## 5. Technical Matters

What devices did students use to sit the assessment? (Check all that apply)

☐ Desktop computers
☐ Laptop computers
☐ iPads/tablets
☐ Chromebooks

If iPads/tablets were used, did students use an external keyboard?

☐ Yes, all iPad/tablet users had an external keyboard.
☐ No, no iPad/tablet users had an external keyboard. They used the onscreen ('pop up') keyboard instead.
☐ Amongst iPad/tablet users, there was a mix of external keyboards and onscreen ('pop up') keyboard use.

Were any technical issues experienced at this school before or during the assessment session?

☐ No ☐Yes

If Yes, were they

☐ Major ☐ Minor

If technical issues were experienced, please describe what they were.

________________________________________________________

________________________________________________________

________________________________________________________

Do you think the technical issues affected the performance of students?

☐ No ☐Yes

If Yes, please provide further comment.

________________________________________________________

________________________________________________________

________________________________________________________

| 6. Student Behaviour | No students | Some students | Most students |
|---|---|---|---|
| a) How many students appeared to be engaged in the test material? | ☐ | ☐ | ☐ |
| b) How many students made noise or moved around, causing disruption to other students during the session? | ☐ | ☐ | ☐ |
| c) How many students attempted to navigate to other websites or access their mobile phones during the session? | ☐ | ☐ | ☐ |
| d) How many students appeared to struggle with understanding how to navigate the test interface? | ☐ | ☐ | ☐ |

## 7. Outside Interruptions

Were the students distracted or impacted by any outside interruptions? For example:

- Announcements over the PA or intercom system
- Noise from other classes in the school
- Distractions from other students not participating in the test session within the classroom
- Students or teachers visiting the testing room

☐ No ☐Yes

If yes, please specify the disruption:

______________________________________________________________

______________________________________________________________

______________________________________________________________

## 8. School Receptiveness

How receptive was the school towards participating in NAP–ICT Literacy? What do you perceive to be the school's overall attitude and level of commitment towards the assessment?

______________________________________________________________

______________________________________________________________

______________________________________________________________

As a visitor, were you made to feel welcome by the school?

______________________________________________________________

______________________________________________________________

______________________________________________________________

## 9. Other Comments

Please provide any other comments that you feel would help us improve this assessment and its administration.

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

**Thank you very much for recording these observations.**

**Please transpose your observations to the online ACER Questionnaire as soon as possible following the assessment session using the below link or QR code.**

# [http://survey.qa/FXKl1f](http://survey.qa/FXKl1f)

# Appendix D: School summary report instructions

acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

ACER

The NAP-ICT Literacy 2022 report for your school is provided on the Report tab of this spreadsheet.

Below is a brief description of the contents of each of the fields shown in this report.

| | |
|---|---|
| **Module Name** | Each module has a central theme and a variety of related tasks. Every student is randomly assigned a set of four modules in total. |
| **Descriptor** | Briefly describes what students need to do in order to complete a task. Each row refers to a single task in the assessment. |
| **Framework Aspect** | Refers to the NAP – ICT Literacy Assessment Framework content assessed by each task. Hovering over the data cell will display the framework aspect. |
| **ICT GC Element** | Refers to the Australian Curriculum: ICT General Capability organising elements. Hovering over the data cell will display the full description. |
| **Digital Technology summary statement** | Refers to the Australian Curriculum: Digital Technology summary statements presented in the NAP – ICT Literacy Assessment Framework. References are included only for those tasks that overlap with Australian Curriculum: Digital Technology content. Hovering over the data cell will display the statement. |
| **Strand** | Refers to one of the four NAP – ICT Literacy Assessment Framework strands assessed by each task. Hovering over the data cell will display the strand. |
| **Percent Correct** | This shows an estimate of the national percentage of students who responded to the task correctly. For tasks with a maximum score of more than 1, you will see more than one percentage. Each percentage denotes the number of students that reached each score or higher. For example, if a task has a maximum score of 2, the first number is the percentage of students that received a score of 1 or 2, the second number is the percentage of students that received a score of 2. |
| **Max Score** | This shows the maximum score possible for each task. |

The scores for each task are listed under the names of each student. There are four possible displays of the score for each task:

i. Blank: The task was not in a module assigned to that student.

ii. Red (0): The student responded to the task incorrectly.

iii. Green (1, 2, 3): The student responded to the task correctly (or partially correctly). The number refers to the score the student received for their response to the task. This can be compared to the maximum score for that task.

iv. Grey (N): The task was assigned to that student, but the student did not provide a response.

The report has a set of clickable filters, so you can manipulate how you would like to view the data. For example, view students grouped by module, content area or score awarded.

# Appendix E: Excerpt from a sample school summary report

AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

| Module Name | Descriptor | Framework Aspect | Strand | ICT GC Element | Digital Technology Summary Statement | Percent Correct | Max Score | Student01 M 111000103 | Student02 M 111000105 | Student03 F 111000107 | Student04 M 111000108 | Student05 M 111000110 | Student06 F 111000111 | Student07 F 111000112 | Student08 M 11100011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Park design | Create a team name in a collaboration application | 1.1 | 1 | A2 | | 67 | 1 | 1 | 1 | | 0 | 1 | 1 | 1 | N |
| Park design | Change privacy setting in a collaboration application | 1.1 | 1 | A2 | | 79 | 1 | 1 | 1 | | 0 | 1 | 1 | 1 | N |
| Park design | Identifies a disadvantage of allowing any user to edit documents in a collaboration application | 4.1 | 4 | E2 | S5.1 | 82 | 1 | 1 | 1 | | 0 | 1 | 1 | 1 | 1 |
| Park design | Adds a specified person as a member to a team in a collaboration application | 1.1 | 1 | A2 | | 84 | 1 | N | 1 | | 1 | N | 1 | 1 | 1 |
| Park design | Explains how to use the features of a collaboration application to make another member feel welcome | 4.1 | 4 | E4 | S5.1 | 75 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| Park design | Locates and clicks a link to a website embedded in a post in a collaboration application | 1.1 | 1 | B2a | | 90 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| Park design | Navigates to a specified webpage in a website | 2.1 | 2 | B2a | | 79 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| Park design | Explains how to share information from a webpage with a team in a collaboration application | 1.1 | 1 | A2 | | 77, 46 | 2 | 2 | 1 | | 2 | 2 | 2 | 1 | 1 |
| Park design | Opens a document embedded in a conversation thread in a collaboration application | 1.1 | 1 | A2 | | 86 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| Park design | Edits a document according to a conversation thread by team members | 3.1 | 3 | D1 | S4.2 | 78 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | N |
| Park design | Designs a park with adequate amenities by following stated guidelines | 3.1 | 3 | C2 | S3.2 | 80, 67 | 2 | 2 | 2 | | 2 | 2 | 0 | 2 | 2 |
| Park design | Designs a park with amenities located a set distance from a pathway | 3.1 | 3 | C2 | S3.2 | 57, 32 | 2 | 2 | 1 | | 2 | 2 | 0 | 0 | 1 |
| Park design | Designs a park with a sufficient number of pathways | 3.1 | 3 | C2 | S3.2 | 75, 59 | 2 | 2 | 2 | | 2 | 2 | 0 | 2 | 2 |
| Park design | Designs a park with adequate green space | 3.1 | 3 | C2 | S3.2 | 76 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| Park design | Designs a park with pond features as per stated guidelines | 3.1 | 3 | C2 | S3.2 | 79, 63, 28 | 3 | 3 | 2 | | 2 | 3 | 2 | 1 | 0 |
| Park design | Designs a park that incorporates ideas from other team members | 3.1 | 3 | C2 | S3.2 | 88, 82 | 2 | 2 | 2 | | 2 | 2 | 2 | 2 | 2 |
| Park design | Designs a park to budget | 3.1 | 3 | C2 | S3.2 | 81, 71 | 2 | 2 | 2 | | 2 | 2 | 1 | 2 | 2 |
| Interactive story | Identifies who is assigned to a task in a gantt chart | 1.1 | 1 | A2 | | 90 | 1 | 1 | 1 | 1 | 1 | | | | 1 |
| Interactive story | Identifies a task according to its duration in a gantt chart | 1.1 | 1 | A2 | | 83 | 1 | 1 | 1 | 1 | 1 | | | | 1 |
| Interactive story | Changes the duration of a task in a gantt chart according to criteria | 1.1 | 1 | A2 | | 65 | 1 | 1 | 1 | 1 | 1 | | | | 1 |
| Interactive story | Explains how a sorting tool works | 1.2 | 1 | A2 | S1.1 | 41 | 1 | 1 | 0 | 0 | 1 | | | | 1 |
| Interactive story | Identifies comments incorrectly labelled by an incorrectly configured sorting tool | 1.2 | 1 | A3 | | 77, 72 | 2 | 2 | 2 | 0 | 2 | | | | 2 |
| Interactive story | Configures the word lists of a sorting tool to correctly label texts as positive and negative | 1.2 | 1 | A3 | S1.1 | 68, 28 | 2 | 2 | 1 | 1 | 2 | | | | 1 |
| Interactive story | Identifies a text phrase that would be incorrectly labelled by a sorting tool | 1.2 | 1 | A2 | | 73 | 1 | 1 | 1 | 1 | 1 | | | | 0 |
| Interactive story | Arranges buttons in a UI to improve usability | 3.2 | 3 | D2 | S3.2 | 27, 7 | 2 | 1 | 0 | 1 | 0 | | | | N |
| Interactive story | Explains how an arrangement of buttons in a UI is an improvement | 2.3 | 2 | C1 | | 55 | 1 | 1 | 0 | 1 | 0 | | | | N |
| Interactive story | Explains why the choice of background for a UI could cause a | 2.3 | 2 | C1 | | 64, 41 | 2 | 2 | 1 | 2 | 2 | | | | 2 |

## Appendix F: Item difficulties

Table A 1: NAP–ICTL 2022 Item difficulties

| Item | Scores | Vertical link | Horizontal link | Difficulty RP=0.5 | Difficulty RP=0.62 | Difficulty ICTL Scale | Threshold 1 RP=0.5 | Threshold 1 ICTL Scale | Threshold 2 RP=0.5 | Threshold 2 ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NI13M5Q01 | 1 | Year 6 | No | -0.94 | -0.45 | 387 | -0.94 | 387 | | | 64 | | 1.11 | |
| NI13M5Q02 | 1 | Year 6 | No | -0.26 | 0.23 | 453 | -0.26 | 453 | | | 51 | | 1.21 | |
| NI13M5Q03 | 2 | Year 6 | Yes | -0.07 | 0.42 | 471 | -1.62 | 322 | 1.48 | 620 | 47 | | 1.02 | |
| NI13M5Q06 | 1 | Year 6 | No | -0.09 | 0.40 | 469 | -0.09 | 469 | | | 48 | | 1.12 | |
| NI13M5Q07 | 1 | Year 6 | No | 0.17 | 0.66 | 495 | 0.17 | 495 | | | 42 | | 1.18 | |
| NI13M5Q08 | 1 | Year 6 | No | 0.34 | 0.83 | 511 | 0.34 | 511 | | | 39 | | 1.04 | |
| NI13M5Q09 | 1 | Year 6 | Yes | -1.15 | -0.66 | 368 | -1.15 | 368 | | | 67 | | 0.91 | |
| NI13M5Q13 | 1 | Year 6 | Yes | -1.55 | -1.06 | 329 | -1.55 | 329 | | | 74 | | 0.98 | |
| NI13M5Q15 | 1 | Year 6 | Yes | 0.33 | 0.82 | 509 | 0.33 | 509 | | | 39 | | 0.97 | |
| NI13M5Q17 | 1 | Year 6 | No | -0.64 | -0.15 | 416 | -0.64 | 416 | | | 58 | | 1.04 | |
| NI13M5Q18 | 1 | Year 6 | Yes | -1.15 | -0.66 | 368 | -1.15 | 368 | | | 67 | | 1.07 | |
| NI13M5Q19 | 1 | Year 6 | Yes | -1.50 | -1.01 | 334 | -1.50 | 334 | | | 72 | | 0.93 | |
| NI13M5Q20A | 1 | Year 6 | Yes | 0.13 | 0.62 | 490 | 0.13 | 490 | | | 42 | | 0.92 | |
| NI13M5Q20B | 1 | Year 6 | Yes | -0.17 | 0.32 | 462 | -0.17 | 462 | | | 48 | | 0.90 | |
| NI13M5Q20C | 2 | Year 6 | Yes | 2.10 | 2.59 | 679 | 0.22 | 499 | 3.97 | 860 | 21 | | 0.85 | |
| NI13M5Q20D | 1 | Year 6 | Yes | 0.47 | 0.96 | 523 | 0.47 | 523 | | | 36 | | 0.87 | |
| NI13M5Q20E | 2 | Year 6 | Yes | 2.82 | 3.31 | 749 | 1.25 | 598 | 4.38 | 899 | 12 | | 0.95 | |

| | | | | Difficulty | | | Threshold 1 | | Threshold 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Scores | Vertical link | Horizontal link | RP=0.5 | RP=0.62 | ICTL Scale | RP=0.5 | ICTL Scale | RP=0.5 | ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
| NI13M5Q20F | 1 | Year 6 | Yes | -0.48 | 0.01 | 432 | -0.48 | 432 | | | 54 | | 0.87 | |
| NI13M5Q20G | 1 | Year 6 | Yes | -0.42 | 0.07 | 437 | -0.42 | 437 | | | 53 | | 0.85 | |
| NI13M5Q20H | 2 | Year 6 | Yes | 3.06 | 3.55 | 772 | 1.64 | 636 | 4.49 | 909 | 9 | | 0.96 | |
| NI13M5Q20I | 1 | Year 6 | Yes | 0.30 | 0.79 | 506 | 0.30 | 506 | | | 39 | | 0.86 | |
| NI13M5Q20J | 2 | Year 6 | No | 2.60 | 3.09 | 728 | 1.12 | 585 | 4.09 | 871 | 13 | | 0.89 | |
| NI17M2Q01 | 1 | Year 10 | No | -1.20 | -0.71 | 363 | -1.20 | 363 | | | | 81 | | 0.97 |
| NI17M2Q01 | 1 | Year 6 | No | -1.70 | -1.21 | 314 | -1.70 | 314 | | | 76 | | 0.97 | |
| NI17M2Q02 | 1 | Year 6 | No | 0.76 | 1.25 | 551 | 0.76 | 551 | | | 31 | | 1.15 | |
| NI17M2Q02 | 1 | Year 10 | No | -0.07 | 0.42 | 471 | -0.07 | 471 | | | | 65 | | 1.12 |
| NI17M2Q03 | 1 | Link | Yes | -0.35 | 0.14 | 444 | -0.35 | 444 | | | 53 | 63 | 1.08 | 1.16 |
| NI17M2Q04 | 1 | Year 6 | No | -0.07 | 0.42 | 472 | -0.07 | 472 | | | 47 | | 0.93 | |
| NI17M2Q04 | 1 | Year 10 | No | -0.74 | -0.25 | 407 | -0.74 | 407 | | | | 75 | | 0.85 |
| NI17M2Q05 | 1 | Link | No | -2.77 | -2.28 | 212 | -2.77 | 212 | | | 88 | 93 | 0.80 | 0.79 |
| NI17M2Q06 | 1 | Link | Yes | -1.80 | -1.31 | 305 | -1.80 | 305 | | | 77 | 84 | 0.98 | 1.11 |
| NI17M2Q07 | 1 | Link | Yes | -2.18 | -1.69 | 268 | -2.18 | 268 | | | 82 | 90 | 0.92 | 0.91 |
| NI17M2Q08 | 2 | Link | No | 0.47 | 0.96 | 523 | -0.43 | 437 | 1.38 | 610 | 37 | 48 | 1.20 | 1.24 |
| NI17M2Q09 | 1 | Link | Yes | 0.58 | 1.07 | 534 | 0.58 | 534 | | | 35 | 53 | 0.94 | 0.92 |
| NI17M2Q10 | 1 | Link | Yes | -1.97 | -1.48 | 288 | -1.97 | 288 | | | 79 | 86 | 0.87 | 1.03 |
| NI17M2Q11 | 1 | Link | Yes | -2.02 | -1.53 | 284 | -2.02 | 284 | | | 80 | 87 | 0.89 | 0.96 |

| Item | Scores | Vertical link | Horizontal link | Difficulty RP=0.5 | Difficulty RP=0.62 | Difficulty ICTL Scale | Threshold 1 RP=0.5 | Threshold 1 ICTL Scale | Threshold 2 RP=0.5 | Threshold 2 ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NI17M2Q12 | 1 | Link | Yes | 1.35 | 1.84 | 607 | 1.35 | 607 | | | 22 | 36 | 0.99 | 1.04 |
| NI17M2Q13 | 1 | Link | Yes | 0.59 | 1.08 | 535 | 0.59 | 535 | | | 34 | 52 | 1.14 | 1.17 |
| NI17M2Q14 | 1 | Link | Yes | 1.88 | 2.37 | 658 | 1.88 | 658 | | | 15 | 36 | 1.07 | 1.31 |
| NI17M2Q16A | 1 | Link | Yes | -0.27 | 0.22 | 452 | -0.27 | 452 | | | 50 | 72 | 0.86 | 0.72 |
| NI17M2Q16B | 1 | Link | Yes | 1.56 | 2.05 | 628 | 1.56 | 628 | | | 18 | 38 | 0.90 | 0.96 |
| NI17M2Q16D | 1 | Link | No | 0.17 | 0.66 | 495 | 0.17 | 495 | | | 41 | 64 | 0.92 | 0.84 |
| NI17M2Q16E | 2 | Link | No | 0.73 | 1.22 | 548 | -1.96 | 289 | 3.42 | 806 | 40 | 46 | 1.05 | 1.37 |
| NI17M2Q16F | 1 | Link | No | -1.92 | -1.43 | 293 | -1.92 | 293 | | | 77 | 85 | 1.04 | 1.31 |
| NI17M2Q16G | 1 | Link | Yes | 0.43 | 0.92 | 519 | 0.43 | 519 | | | 36 | 63 | 0.86 | 0.80 |
| NI17M2Q16H | 2 | Link | No | 1.96 | 2.45 | 666 | 0.69 | 544 | 3.22 | 788 | 17 | 34 | 1.01 | 1.21 |
| NI17M3Q01 | 1 | Year 10 | Yes | 0.91 | 1.40 | 565 | 0.91 | 565 | | | | 47 | | 1.05 |
| NI17M3Q02 | 1 | Year 10 | Yes | -1.01 | -0.52 | 381 | -1.01 | 381 | | | | 80 | | 1.08 |
| NI17M3Q03 | 1 | Year 10 | Yes | 1.02 | 1.51 | 576 | 1.02 | 576 | | | | 44 | | 1.06 |
| NI17M3Q04 | 1 | Year 10 | Yes | 0.92 | 1.41 | 566 | 0.92 | 566 | | | | 47 | | 1.06 |
| NI17M3Q06 | 1 | Year 10 | Yes | -1.42 | -0.93 | 341 | -1.42 | 341 | | | | 84 | | 1.06 |
| NI17M3Q08 | 1 | Year 10 | Yes | -1.26 | -0.77 | 357 | -1.26 | 357 | | | | 82 | | 1.01 |
| NI17M3Q09 | 2 | Year 10 | Yes | 0.80 | 1.29 | 555 | -0.24 | 455 | 1.85 | 655 | | 49 | | 1.14 |
| NI17M3Q10 | 1 | Year 10 | Yes | 0.81 | 1.30 | 556 | 0.81 | 556 | | | | 48 | | 0.91 |
| NI17M3Q13A | 2 | Year 10 | Yes | 1.52 | 2.01 | 624 | 1.17 | 590 | 1.87 | 657 | | 31 | | 1.15 |

| Item | Scores | Vertical link | Horizontal link | Difficulty | | | Threshold 1 | | Threshold 2 | | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RP=0.5 | RP=0.62 | ICTL Scale | RP=0.5 | ICTL Scale | RP=0.5 | ICTL Scale | | | | |
| NI17M3Q13B | 1 | Year 10 | No | 1.37 | 1.86 | 610 | 1.37 | 610 | | | | 37 | | 0.96 |
| NI17M3Q13C | 1 | Year 10 | No | 1.22 | 1.71 | 595 | 1.22 | 595 | | | | 40 | | 0.96 |
| NI17M3Q13D | 1 | Year 10 | Yes | 0.59 | 1.08 | 535 | 0.59 | 535 | | | | 52 | | 0.93 |
| NI17M3Q13E | 1 | Year 10 | No | 0.90 | 1.39 | 564 | 0.90 | 564 | | | | 46 | | 0.95 |
| NI17M3Q13F | 1 | Year 10 | No | 2.29 | 2.78 | 698 | 2.29 | 698 | | | | 22 | | 1.01 |
| NI20M1Q01 | 1 | Link | No | 0.20 | 0.68 | 497 | 0.20 | 497 | | | 42 | 59 | 0.95 | 0.96 |
| NI20M1Q02 | 1 | Link | No | -1.25 | -0.76 | 357 | -1.25 | 357 | | | 69 | 85 | 0.87 | 0.76 |
| NI20M1Q04a | 1 | Link | No | -1.13 | -0.64 | 370 | -1.13 | 370 | | | 67 | 82 | 1.02 | 0.93 |
| NI20M1Q04b | 1 | Link | No | -1.23 | -0.74 | 359 | -1.23 | 359 | | | 69 | 82 | 1.03 | 0.97 |
| NI20M1Q05 | 1 | Link | No | 0.14 | 0.63 | 491 | 0.14 | 491 | | | 43 | 55 | 1.09 | 1.24 |
| NI20M1Q06 | 1 | Year 10 | No | 0.20 | 0.68 | 497 | 0.20 | 497 | | | | 60 | | 1.07 |
| NI20M1Q06 | 1 | Year 6 | No | -0.38 | 0.11 | 442 | -0.38 | 442 | | | 53 | | 1.03 | |
| NI20M1Q07 | 1 | Link | No | 1.04 | 1.53 | 578 | 1.04 | 578 | | | 27 | 50 | 1.12 | 1.11 |
| NI20M1Q08 | 1 | Link | No | -1.23 | -0.74 | 359 | -1.23 | 359 | | | 69 | 83 | 0.87 | 0.78 |
| NI20M1Q09 | 1 | Link | No | -1.72 | -1.23 | 313 | -1.72 | 313 | | | 76 | 88 | 0.89 | 0.89 |
| NI20M1Q10 | 1 | Link | No | 1.24 | 1.73 | 597 | 1.24 | 597 | | | 23 | 37 | 1.07 | 1.17 |
| NI20M1Q11 | 1 | Link | No | 0.30 | 0.79 | 507 | 0.30 | 507 | | | 40 | 59 | 0.93 | 0.91 |
| NI20M1Q13 | 1 | Year 6 | No | 2.17 | 2.65 | 686 | 2.17 | 686 | | | 12 | | 0.92 | |
| NI20M1Q13 | 1 | Year 10 | No | 1.45 | 1.93 | 617 | 1.45 | 617 | | | | 36 | | 1.04 |

| | | | | Difficulty | | | Threshold 1 | | Threshold 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Scores | Vertical link | Horizontal link | RP=0.5 | RP=0.62 | ICTL Scale | RP=0.5 | ICTL Scale | RP=0.5 | ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
| NI20M1Q14 | 1 | Link | No | -0.50 | -0.01 | 430 | -0.50 | 430 | | | 54 | 66 | 1.17 | 1.34 |
| NI20M1Q16 | 1 | Year 10 | No | 0.92 | 1.41 | 566 | 0.92 | 566 | | | | 46 | | 1.13 |
| NI20M1Q16 | 1 | Year 6 | No | 0.09 | 0.58 | 486 | 0.09 | 486 | | | 43 | | 1.13 | |
| NI20M1Q17 | 1 | Link | No | -1.33 | -0.84 | 350 | -1.33 | 350 | | | 67 | 79 | 0.95 | 1.12 |
| NI20M1Q18a | 1 | Link | No | 0.25 | 0.74 | 502 | 0.25 | 502 | | | 36 | 58 | 0.96 | 0.90 |
| NI20M1Q18b | 1 | Year 6 | No | 3.05 | 3.54 | 771 | 3.05 | 771 | | | 5 | | 0.94 | |
| NI20M1Q18b | 1 | Year 10 | No | 2.15 | 2.64 | 684 | 2.15 | 684 | | | | 23 | | 0.89 |
| NI20M1Q18c | 1 | Year 6 | No | 2.59 | 3.08 | 726 | 2.59 | 726 | | | 7 | | 0.99 | |
| NI20M1Q18c | 1 | Year 10 | No | 2.07 | 2.56 | 677 | 2.07 | 677 | | | | 24 | | 0.92 |
| NI20M1Q18d | 1 | Link | No | 1.86 | 2.35 | 657 | 1.86 | 657 | | | 13 | 32 | 1.06 | 1.07 |
| NI20M1Q18e | 1 | Link | No | 3.18 | 3.67 | 784 | 3.18 | 784 | | | 4 | 14 | 1.08 | 1.26 |
| NI20M1Q18g1 | 1 | Year 6 | No | 2.13 | 2.62 | 682 | 2.13 | 682 | | | 11 | | 1.01 | |
| NI20M1Q18g1 | 1 | Year 10 | No | 1.47 | 1.96 | 619 | 1.47 | 619 | | | | 35 | | 0.89 |
| NI20M1Q18g2 | 1 | Year 6 | No | 1.93 | 2.42 | 663 | 1.93 | 663 | | | 13 | | 1.01 | |
| NI20M1Q18g2 | 1 | Year 10 | No | 1.35 | 1.84 | 608 | 1.35 | 608 | | | | 37 | | 0.88 |
| NI20M1Q18g3 | 1 | Year 6 | No | 2.12 | 2.61 | 682 | 2.12 | 682 | | | 11 | | 1.00 | |
| NI20M1Q18g3 | 1 | Year 10 | No | 1.39 | 1.88 | 612 | 1.39 | 612 | | | | 36 | | 0.88 |
| NI20M1Q18g4 | 1 | Year 6 | No | 2.07 | 2.56 | 677 | 2.07 | 677 | | | 11 | | 1.05 | |
| NI20M1Q18g4 | 1 | Year 10 | No | 1.56 | 2.05 | 628 | 1.56 | 628 | | | | 33 | | 0.94 |

| | | | | Difficulty | | | Threshold 1 | | Threshold 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Scores | Vertical link | Horizontal link | RP=0.5 | RP=0.62 | ICTL Scale | RP=0.5 | ICTL Scale | RP=0.5 | ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
| NI20M2Q01a | 1 | Link | No | -0.04 | 0.45 | 474 | -0.04 | 474 | | | 47 | 67 | 0.97 | 0.93 |
| NI20M2Q01b | 1 | Link | No | -0.84 | -0.35 | 397 | -0.84 | 397 | | | 62 | 78 | 0.99 | 0.91 |
| NI20M2Q02 | 1 | Link | No | -1.36 | -0.87 | 347 | -1.36 | 347 | | | 71 | 82 | 0.91 | 0.99 |
| NI20M2Q03 | 1 | Link | No | -1.47 | -0.98 | 336 | -1.47 | 336 | | | 73 | 84 | 0.92 | 0.88 |
| NI20M2Q05 | 1 | Year 10 | No | -0.71 | -0.22 | 409 | -0.71 | 409 | | | | 75 | | 1.01 |
| NI20M2Q05 | 1 | Year 6 | No | -1.20 | -0.71 | 363 | -1.20 | 363 | | | 69 | | 0.96 | |
| NI20M2Q06 | 1 | Link | No | -2.09 | -1.60 | 277 | -2.09 | 277 | | | 81 | 90 | 0.91 | 0.75 |
| NI20M2Q07 | 1 | Link | No | -0.87 | -0.38 | 394 | -0.87 | 394 | | | 63 | 78 | 0.91 | 0.84 |
| NI20M2Q08 | 2 | Link | No | 0.31 | 0.80 | 508 | -0.43 | 436 | 1.06 | 580 | 39 | 62 | 1.11 | 1.04 |
| NI20M2Q09 | 1 | Link | No | 0.28 | 0.77 | 505 | 0.28 | 505 | | | 40 | 62 | 0.95 | 0.87 |
| NI20M2Q10 | 1 | Link | No | -1.93 | -1.44 | 292 | -1.93 | 292 | | | 79 | 87 | 0.88 | 0.98 |
| NI20M2Q11 | 1 | Link | No | -0.77 | -0.28 | 404 | -0.77 | 404 | | | 61 | 77 | 0.79 | 0.74 |
| NI20M2Q12A1 | 1 | Link | No | -0.57 | -0.08 | 423 | -0.57 | 423 | | | 56 | 67 | 1.12 | 1.17 |
| NI20M2Q12A2 | 1 | Link | No | 0.29 | 0.78 | 506 | 0.29 | 506 | | | 40 | 56 | 1.14 | 1.06 |
| NI20M2Q12A3 | 1 | Link | No | -1.05 | -0.56 | 377 | -1.05 | 377 | | | 64 | 74 | 1.13 | 1.18 |
| NI20M2Q12A4 | 1 | Year 10 | No | -0.73 | -0.24 | 408 | -0.73 | 408 | | | | 75 | | 0.98 |
| NI20M2Q12A4 | 1 | Year 6 | No | -1.36 | -0.87 | 348 | -1.36 | 348 | | | 69 | | 1.10 | |
| NI20M2Q12A5 | 2 | Link | No | 0.10 | 0.59 | 488 | -1.34 | 349 | 1.55 | 626 | 44 | 53 | 1.18 | 1.24 |
| NI20M2Q12A7 | 1 | Year 10 | No | -1.23 | -0.74 | 359 | -1.23 | 359 | | | | 81 | | 0.85 |

| | | | | Difficulty | | | Threshold 1 | | Threshold 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Scores | Vertical link | Horizontal link | RP=0.5 | RP=0.62 | ICTL Scale | RP=0.5 | ICTL Scale | RP=0.5 | ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
| NI20M2Q12A7 | 1 | Year 6 | No | -1.79 | -1.30 | 306 | -1.79 | 306 | | | 75 | | 0.99 | |
| NI20M2Q12A8 | 1 | Year 10 | No | -0.44 | 0.05 | 436 | -0.44 | 436 | | | | 70 | | 0.97 |
| NI20M2Q12A8 | 1 | Year 6 | No | -1.01 | -0.52 | 381 | -1.01 | 381 | | | 64 | | 1.02 | |
| NI20M3Q01 | 1 | Link | No | -1.85 | -1.36 | 300 | -1.85 | 300 | | | 77 | 90 | 0.92 | 0.77 |
| NI20M3Q02 | 1 | Link | No | -0.94 | -0.45 | 388 | -0.94 | 388 | | | 63 | 83 | 1.02 | 0.82 |
| NI20M3Q03 | 1 | Link | No | -0.04 | 0.45 | 474 | -0.04 | 474 | | | 45 | 64 | 1.03 | 1.09 |
| NI20M3Q04 | 1 | Link | No | 1.23 | 1.72 | 596 | 1.23 | 596 | | | 23 | 41 | 1.00 | 1.04 |
| NI20M3Q05 | 2 | Year 10 | No | -0.30 | 0.19 | 449 | -0.38 | 442 | -0.22 | 457 | | 74 | | 1.22 |
| NI20M3Q05 | 2 | Year 6 | No | -0.89 | -0.40 | 393 | -0.97 | 385 | -0.81 | 400 | 66 | | 1.13 | |
| NI20M3Q06 | 2 | Link | No | 0.74 | 1.23 | 549 | 0.04 | 482 | 1.44 | 616 | 29 | 48 | 1.08 | 1.02 |
| NI20M3Q07 | 1 | Link | No | -0.59 | -0.10 | 422 | -0.59 | 422 | | | 56 | 73 | 0.98 | 0.92 |
| NI20M3Q08a | 2 | Link | No | 2.08 | 2.57 | 678 | 1.45 | 617 | 2.72 | 739 | 10 | 18 | 1.00 | 0.91 |
| NI20M3Q08b | 1 | Link | No | 0.32 | 0.81 | 509 | 0.32 | 509 | | | 38 | 54 | 0.94 | 0.93 |
| NI20M3Q09 | 2 | Link | No | 0.44 | 0.93 | 520 | 0.04 | 481 | 0.84 | 559 | 33 | 53 | 1.15 | 1.11 |
| NI20M3Q10 | 1 | Link | No | -2.12 | -1.63 | 274 | -2.12 | 274 | | | 79 | 89 | 0.97 | 0.91 |
| NI20M3Q11 | 1 | Link | No | -0.34 | 0.15 | 445 | -0.34 | 445 | | | 49 | 71 | 1.11 | 0.99 |
| NI20M3Q12 | 1 | Link | No | 2.37 | 2.86 | 706 | 2.37 | 706 | | | 9 | 16 | 1.00 | 0.94 |
| NI20M4Q01 | 2 | Year 6 | No | -1.73 | -1.24 | 311 | -2.63 | 225 | -0.84 | 398 | 76 | | 1.24 | |
| NI20M4Q02 | 2 | Year 6 | No | 1.11 | 1.60 | 585 | 0.05 | 482 | 2.18 | 687 | 26 | | 1.12 | |

| | | | | Difficulty | | | Threshold 1 | | Threshold 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Scores | Vertical link | Horizontal link | RP=0.5 | RP=0.62 | ICTL Scale | RP=0.5 | ICTL Scale | RP=0.5 | ICTL Scale | Correct Year 6 | Correct Year 10 | Weighted fit (MNSQ) Year 6 | Weighted fit (MNSQ) Year 10 |
| NI20M4Q03 | 2 | Year 6 | No | -1.88 | -1.39 | 297 | -2.61 | 227 | -1.15 | 368 | 79 | | 1.16 | |
| NI20M4Q04 | 2 | Year 6 | No | -0.77 | -0.28 | 403 | -1.53 | 331 | -0.02 | 476 | 61 | | 1.10 | |
| NI20M4Q05 | 2 | Year 6 | No | 0.13 | 0.62 | 490 | -0.05 | 473 | 0.31 | 508 | 40 | | 0.87 | |
| NI20M4Q06 | 2 | Year 6 | No | 0.14 | 0.63 | 491 | -0.14 | 465 | 0.41 | 518 | 40 | | 0.88 | |
| NI20M4Q07 | 2 | Year 6 | No | 0.24 | 0.73 | 501 | -0.29 | 450 | 0.78 | 553 | 38 | | 0.98 | |
| NI20M4Q08 | 1 | Year 6 | No | -0.39 | 0.10 | 440 | -0.39 | 440 | | | 50 | | 1.12 | |
| NI20M4Q09 | 1 | Year 6 | No | 2.13 | 2.62 | 683 | 2.13 | 683 | | | 10 | | 1.06 | |
| NI20M4Q10 | 2 | Year 6 | No | 1.09 | 1.58 | 583 | 0.17 | 495 | 2.01 | 671 | 21 | | 1.26 | |
| NI20M5Q01 | 1 | Year 10 | No | 1.35 | 1.84 | 608 | 1.35 | 608 | | | | 36 | | 1.13 |
| NI20M5Q02 | 1 | Year 10 | No | 0.77 | 1.25 | 551 | 0.77 | 551 | | | | 48 | | 1.16 |
| NI20M5Q03 | 1 | Year 10 | No | -0.46 | 0.03 | 434 | -0.46 | 434 | | | | 71 | | 0.90 |
| NI20M5Q05 | 1 | Year 10 | No | 0.82 | 1.31 | 556 | 0.82 | 556 | | | | 47 | | 1.05 |
| NI20M5Q06 | 1 | Year 10 | No | 1.65 | 2.14 | 637 | 1.65 | 637 | | | | 31 | | 1.15 |
| NI20M5Q07 | 1 | Year 10 | No | 2.24 | 2.73 | 693 | 2.24 | 693 | | | | 21 | | 0.92 |
| NI20M5Q08 | 1 | Year 10 | No | 0.25 | 0.74 | 502 | 0.25 | 502 | | | | 58 | | 1.24 |
| NI20M5Q09 | 2 | Year 10 | No | 0.07 | 0.56 | 485 | -0.31 | 448 | 0.46 | 522 | | 64 | | 1.15 |
| NI20M5Q10 | 2 | Year 10 | No | 1.66 | 2.15 | 637 | 1.49 | 621 | 1.83 | 653 | | 27 | | 1.13 |
| NI20M5Q11 | 2 | Year 10 | No | 1.71 | 2.20 | 642 | 1.59 | 630 | 1.83 | 654 | | 24 | | 1.04 |

# Appendix G: Variables for conditioning

Table A 2: Variables for conditioning

| Variable | Name | Values | Coding | Regressor |
| --- | --- | --- | --- | --- |
| Adjusted school mean achievement | sch_adj_mn | Adjusted school mean | Logits | Direct |
| State and territory by sector | State, Sector | ACT, Government | 10000000000000000000000 | Direct |
| | | ACT, Catholic | 01000000000000000000000 | |
| | | ACT, Independent | 00100000000000000000000 | |
| | | NSW, Government | 00000000000000000000000 | |
| | | NSW, Catholic | 00010000000000000000000 | |
| | | NSW, Independent | 00001000000000000000000 | |
| | | NT, Government | 00000100000000000000000 | |
| | | NT, Catholic | 00000010000000000000000 | |
| | | NT, Independent | 00000001000000000000000 | |
| | | QLD, Government | 00000000100000000000000 | |
| | | QLD, Catholic | 00000000010000000000000 | |
| | | QLD, Independent | 00000000001000000000000 | |
| | | SA, Government | 00000000000100000000000 | |
| | | SA, Catholic | 00000000000010000000000 | |
| | | SA, Independent | 00000000000001000000000 | |
| | | TAS, Government | 00000000000000100000000 | |
| | | TAS, Catholic | 00000000000000010000000 | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| | | TAS, Independent | 00000000000000001000000 | |
| | | VIC, Government | 00000000000000000100000 | |
| | | VIC, Catholic | 00000000000000000010000 | |
| | | VIC, Independent | 00000000000000000001000 | |
| | | WA, Government | 00000000000000000000100 | |
| | | WA, Catholic | 00000000000000000000010 | |
| | | WA, Independent | 00000000000000000000001 | |
| School geographic location | Geolocation (Year 6) | Major Cities of Australia | 0000 | Direct |
| | | Inner Regional Australia | 1000 | |
| | | Outer Regional Australia | 0100 | |
| | | Remote Australia | 0010 | |
| | | Very Remote Australia | 0001 | |
| | Geolocation (Year 10) | Major Cities of Australia | 000 | Direct |
| | | Inner Regional Australia | 100 | |
| | | Outer Regional Australia | 010 | |
| | | Remote Australia | 001 | |
| SEIFA levels | SEIFA | Mode of year level | 000000000 | Direct |
| | | Other category 1 | 010000000 | |
| | | Other category 2 | 001000000 | |
| | | Other category 3 | 000100000 | |
| | | Other category 4 | 000010000 | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| | | Other category 5 | 000000000 | |
| | | Other category 6 | 000001000 | |
| | | Other category 7 | 000000100 | |
| | | Other category 8 | 000000010 | |
| | | Other category 9 | 000000001 | |
| Digital Technology module position | DT_pos | None | 00 | Direct |
| | | First half of the booklet | 10 | |
| | | Second half of the booklet | 01 | |
| Gender | Gender | Male | 00 | Direct |
| | | Female | 10 | |
| | | Other | 01 | |
| Indigenous status indicator | INDIG | Indigenous | 10 | Direct |
| | | Non-Indigenous | 00 | |
| | | Missing | 01 | |
| LOTE spoken at home | LBOTE | Yes | 10 | Direct |
| | | No | 00 | |
| | | Missing | 01 | |
| Parental highest occupation group | POCC | Mode of year level | 00000 | Direct |
| | | Other category 1 | 10000 | |
| | | Other category 2 | 01000 | |
| | | Other category 3 | 00100 | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| | | Other category 4 | 00010 | |
| | | Not stated or unknown | 00001 | |
| Highest level of parental education | PARED | Mode of year level | 0000000 | Direct |
| | | Other category 1 | 1000000 | |
| | | Other category 2 | 0100000 | |
| | | Other category 3 | 0010000 | |
| | | Other category 4 | 0001000 | |
| | | Other category 5 | 0000100 | |
| | | Other category 6 | 0000010 | |
| | | Not stated or unknown | 0000001 | |
| Age | AGE | Value | Copy, Mean | PCA |
| | | Missing | 0, 1 | |
| Experience with computers | Q01A | Never or less than one year | Five dummies with the year level mode as the reference category | PCA |
| | | At least one year but less than 3 years | | |
| | | At least 3 years but less than 5 years | | |
| | | At least 5 years but less than 7 years | | |
| | | Seven years or more | | |
| | | Missing | | |
| Use of computer (desktop or laptop) – at school | Q02A1 | Yes (Box checked) | One dummy for each variable with the year level | PCA |

| Variable | Name | Values | Coding | Regressor |
| --- | --- | --- | --- | --- |
| Use of tablet – at school | Q02B1 | No (Box not checked) | mode as the reference category | |
| Use of smartphone (to access the internet or use apps) – at school | Q02C1 | | | |
| Use of digital devices – none – at school | Q02D1 | | | |
| Use of computer (desktop or laptop) – outside of school | Q02A2 | Yes (Box checked) | One dummy for each variable with the year level mode as the reference category | PCA |
| Use of tablet – outside of school | Q02B2 | No (Box not checked) | | |
| Use of smartphone (to access the internet or use apps) – outside of school | Q02C2 | | | |
| Use of digital devices – none – outside of school | Q02D2 | | | |
| Own computer used in class | Q03A | No | Four dummies for each variable with the year level mode as the reference category | PCA |
| | | Yes, my school provides me with the device | | |
| | | Yes, the school tells me what brand of model of device I may bring | | |
| | | Yes, I can bring any brand or model of device to school | | |
| Own tablet used in class | Q03B | Missing | | |
| Frequency use of desktop or laptop computer – at school | QN04A1 | Several times every day | Five dummies for each variable with the year level mode as the reference category | PCA |
| | | Once a day | | |
| | | Almost every day | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Frequency use of tablet – at school | QN04B1 | A few times each week | | |
| Frequency use of desktop or laptop computer – outside of school | QN04A2 | Once a week or less | | |
| Frequency use of tablet – outside of school | QN04B2 | Missing | | |
| Help me improve the quality of my work | Q05A | Strongly agree | Four dummies for each variable with the year level mode as the reference category | PCA |
| Make work easier | Q05B | Agree | | |
| Help me to work with others | Q05C | Disagree | | |
| Prefer to work alone | Q05D | Strongly disagree | | |
| Help me communicate with my friends | Q05E | Missing | | |
| Find new ways to do things | Q05F | | | |
| Important to work with an ICT device | Q05G | | | |
| Search the Internet – at school | QN06A1 | At least once every day | Recode to 5,4,3,2,1,0; missing replaced by the year level mode; dummies for missing | PCA |
| Search the Internet – outside of school | QN06A2 | Almost every day | | |
| Use word processing software or apps – at school | QN06B1 | A few times each week | | |
| Use word processing software or apps – outside of school | QN06B2 | Between once a week and once a month | | |
| Use spreadsheets – at school | QN06C1 | Less than once a month | | |
| Use spreadsheets – outside of school | QN06C2 | Never | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Use mathematics, language or other learning programs – at school | QN06D1 | Missing | | |
| Use mathematics, language or other learning programs – outside of school | QN06D2 | | | |
| Enter data in a spreadsheet – at school | QN06E1 | | | |
| Enter data in a spreadsheet – outside of school | QN06E2 | | | |
| Create presentations – at school | QN06F1 | | | |
| Create presentations – outside of school | QN06F2 | | | |
| Watch online videos – at school | QN06G1 | | | |
| Watch online videos – outside of school | QN06G2 | | | |
| Listen to podcasts or audiobooks – at school | QN06H1 | | | |
| Listen to podcasts or audiobooks – outside of school | QN06H2 | | | |
| Use a learning or school management system – at school | QN06I1 | | | |
| Use a learning or school management system – outside of school | QN06I2 | | | |
| Record your reflections on learning – at school | QN06J1 | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Record your reflections on learning – outside of school | QN06J2 | | | |
| Watch videos for entertainment – at school | QN07A1 | At least once every day | 5,4,3,2,1,0; missing replaced by the year level mode; dummies for missing | PCA |
| Watch videos for entertainment – outside of school | QN07A2 | Almost every day | | |
| Play video games - at school | QN07B1 | A few times each week | | |
| Play video games – outside of school | QN07B2 | Between once a week and once a month | | |
| Use software to create sounds/music, movies, animations or artwork – at school | QN07C1 | Less than once a month | | |
| Use software to create sounds/music, movies, animations or artwork – outside of school | QN07C2 | Never | | |
| Listen to music for entertainment – at school | QN07D1 | Missing | | |
| Listen to music for entertainment – outside of school | QN07D2 | | | |
| Listen to podcasts, audiobooks or internet radio for entertainment – at school | QN07E1 | | | |
| Listen to podcasts, audiobooks or internet radio for entertainment – outside of school | QN07E2 | | | |
| Search for online information about things you are interested – at school | QN07F1 | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Search for online information about things you are interested – outside of school | QN07F2 | | | |
| Use email – at school | QN08A1 | At least once every day | 5,4,3,2,1,0; missing replaced by the year level mode; dummies for missing | PCA |
| Use email – outside of school | QN08A2 | Almost every day | | |
| Use chat or messaging apps – at school | QN08B1 | A few times each week | | |
| Use chat or messaging apps – outside of school | QN08B2 | Between once a week and once a month | | |
| Write or reply to blogs or forum posts – at school | QN08C1 | Less than once a month | | |
| Write or reply to blogs or forum posts – outside of school | QN08C2 | Never | | |
| Use voice or video calls to communicate with people online – at school | QN08D1 | Missing | | |
| Use voice or video calls to communicate with people online – outside of school | QN08D2 | | | |
| Create and share content with others on social media – at school | QN08E1 | | | |
| Create and share content with others on social media – outside of school | QN08E2 | | | |
| Create and share content with others on social media – at school | QN08F1 | | | |

| Variable | Name | Values | Coding | Regressor |
| --- | --- | --- | --- | --- |
| Create and share content with others on social media – outside of school | QN08F2 | | | |
| Create programs with a visual programming tool – at school | QN09A1 | At least once every day | 5,4,3,2,1,0; missing replaced by the year level mode; dummies for missing | PCA |
| Create programs with a visual programming tool – outside of school | QN09A2 | Almost every day | | |
| Write code, programs or macros – at school | QN09B1 | A few times each week | | |
| Write code, programs or macros – outside of school | QN09B2 | Between once a week and once a month | | |
| Publish media you have created on a website – at school | QN09C1 | Less than once a month | | |
| Publish media you have created on a website – outside of school | QN09C2 | Never | | |
| Create or edit a website using a website editor – at school | QN09D1 | Missing | | |
| Create or edit a website using a website editor – outside of school | QN09D2 | | | |
| Use drawing, painting or graphics programs – at school | QN09E1 | | | |
| Use drawing, painting or graphics programs – outside of school | QN09E2 | | | |
| Change application settings to suit your purposes – at school | QN09F1 | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Change application settings to suit your purposes – outside of school | QN09F2 | | | |
| Combine music, video, or images to create digital content – at school | QN09G1 | | | |
| Combine music, video, or images to create digital content – outside of school | QN09G2 | | | |
| Edit digital photographs or other graphic images | QN10A | I can do this easily by myself | Four dummies for each variable with the year level mode as the reference category | PCA |
| Create a database | QN10B | I can do this with a bit of effort | | |
| Enter data in a spreadsheet | QN10C | I know what this means but I cannot do it | | |
| Plot a graph using spreadsheet software | QN10D | I don't know what this means | | |
| Download music from the Internet | QN10E | Missing | | |
| Create a multimedia presentation | QN10F | | | |
| Use a website builder to create or edit websites | QN10G | | | |
| Post content on social media | QN10H | | | |
| Post content on social media | QN10I | | | |
| Use a collaborative workspace to work with others on a shared project | QN10J | | | |
| Use videoconferencing software for communication purposes | QN10K | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Using an online learning management system | QN10L | | | |
| The need to provide references to content from webpages that you include in your schoolwork | QN11A | Yes | Two dummies for each variable with the year level mode as the reference category | PCA |
| Where you can get reliable information and help about dealing with cyberbullying and/or suspicious online contact | QN11B | No | | |
| How to protect your personal safety when communicating with strangers online | QN11C | Missing | | |
| The need to know whether you have copyright permission to share music or video | QN11D | | | |
| The problems of using software to illegally copy or download games or videos for free | QN11E | | | |
| Reading licence or usage agreements before you click on "I agree" to install new software | QN11F | | | |
| Opening email attachments from safe sources | QN11G | | | |
| Checking where a message is from before clicking on links | QN11H | | | |
| Reporting spam to an authority | QN11I | | | |
| How to create secure passwords for internet services | QN11J | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Security risks when using the internet | QN11K | | | |
| How to decide where to look for information about an unfamiliar topic | QN11L | | | |
| How to look for different types of digital information on a topic | QN11M | | | |
| How to judge the relevance of information to include in schoolwork | QN11N | | | |
| How to judge whether information on the internet can be trusted | QN11O | | | |
| Responsible use of social media | QN11P | | | |
| Respectful online relationships | QN11Q | | | |
| How to spot cyberbullying | QN11R | | | |
| How to report cyberbullying or image-based abuse | QN11S | | | |
| Creating programs with a visual coding tool | QN12A | Yes | Two dummies for each variable with the year level mode as the reference category | PCA |
| Creating a digital game | QN12B | No | | |
| Working with others to create a digital solution to a problem | QN12C | Missing | | |
| Designing a program to control a robotic device | QN12D | | | |
| Using a virtual reality (VR) program | QN12E | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Using an augmented reality (AR) program | QN12F | | | |
| Using tools to organise and make sense of data | QN12G | | | |
| Learning about the components of a digital system | QN12H | | | |
| Examining the way big data are being used to inform decisions | QN12I | | | |
| Word processing software | QN13A | Never | Four dummies for each variable with the year level mode as the reference category | PCA |
| Spreadsheet software | QN13B | Less than once a month | | |
| Presentation software | QN13C | At least once a month but not every week | | |
| Software for capturing and editing media | QN13D | At least once a week | | |
| Graphic design or drawing software | QN13E | Missing | | |
| Text-based information websites | QN13F | | | |
| Video-based information resources | QN13G | | | |
| Digital journals | QN13H | | | |
| Data logging or monitoring tools | QN13I | | | |
| Concept mapping software | QN13J | | | |
| Simulations and modelling software | QN13K | | | |
| Social media (e.g. Kidzworld, Popjam, LegoLife or similar) | QN13L | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Social media (e.g. Instagram, Snapchat, Twitter, Facebook) | QN13M | | | |
| Robotic devices | QN13N | | | |
| 3D printers | QN13O | | | |
| Computer-aided drawing (CAD) software | QN13P | | | |
| Communications software | QN13Q | | | |
| 3D design software | QN13R | | | |
| Visual programming tools | QN13S | | | |
| Software to create, compile and execute text-based programs | QN13T | | | |
| My teacher uses ICT devices to present information to the class | QN14A | Never | Five dummies for each variable with the year level mode as the reference category | PCA |
| We use ICT devices to present information to the class | QN14B | Less than once a month | | |
| My teacher uses ICT devices to provide feedback on our work | QN14C | At least once a month but not every week | | |
| We use ICT devices to collaborate with each other on projects | QN14D | At least once a week but not every day | | |
| We use ICT devices to collaborate with students from other schools on projects | QN14E | At least once a day | | |
| We use ICT devices to complete tests | QN14F | Missing | | |
| We use ICT devices to work on short assignments (i.e. within one week) | QN14G | | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| We use ICT devices to work on extended projects (i.e. projects that last longer than one week) | QN14H | | | |
| We use the internet to contact students from other schools about projects | QN14I | | | |
| We use the internet to contact experts outside the school | QN14J | | | |
| We use ICT devices to collect data for a project | QN14K | | | |
| We use ICT devices to analyse data | QN14L | | | |
| We use ICT devices to produce or edit audio | QN14M | | | |
| We create or edit visual products | QN14N | | | |
| We create or program robotic devices | QN14O | | | |
| We use ICT devices to submit assessments and gather feedback from my teacher | QN14P | | | |
| Breaking a complex problem into smaller parts | QN15A | To a large extent | Four dummies for each variable with the year level mode as the reference category | PCA |
| Planning tasks by setting out the steps needed to complete them | QN15B | To a moderate extent | | |
| Developing algorithms | QN15C | To a small extent | | |
| Using ICT devices to present information to the class | QN15D | Not at all | | |
| Writing code, programs or macros | QN15E | Missing | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| Checking code, programs or macros | QN15F | | | |
| Developing applications (apps) | QN15G | | | |
| Making changes to code to improve efficiency | QN15H | | | |
| Debugging code | QN15I | | | |
| Creating visual displays of information or processes | QN15J | | | |
| Displaying data to help understand and solve problems | QN15K | | | |
| Making sense of data to help understand and solve problems | QN15L | | | |
| Use ICT for remote or home learning in the past 2 years | QN16A | Yes | Two dummies for each variable with the year level mode as the reference category | PCA |
| | | No | | |
| | | Missing | | |
| What ICT device did you mostly use for remote or home learning in the past 2 years? | QN17A | I did not use an ICT device for remote or home learning | Four dummies for each variable with the year level mode as the reference category | PCA |
| | | An ICT device supplied to me by my school | | |
| | | An ICT device from home which was my own to use | | |
| | | An ICT device from home that was shared with others in my family | | |
| | | Missing | | |

| Variable | Name | Values | Coding | Regressor |
|---|---|---|---|---|
| How prepared do you feel to use ICT to participate in remote or home learning in 2021 if necessary? | QN18A | Not at all prepared | Four dummies for each variable with the year level mode as the reference category | PCA |
| | | Not very prepared | | |
| | | Quite prepared | | |
| | | Very prepared | | |
| | | Missing | | |

# Appendix H: Proficiency level descriptions

Table A 3: NAP–ICT Literacy proficiency level descriptions with examples

| Proficiency level | Proficiency level description | Examples of student achievement at this level |
|---|---|---|
| Level 6 | Students working at level 6 create information products that show evidence of technical proficiency, careful planning and review, and digital technologies skills. They use software features to organise information, and to synthesise and represent data as integrated complete information products, and develop algorithms and apply computational thinking. They design information products consistent with the conventions of specific communication modes and audiences, and use available software features to enhance the communicative effect of their work. | • Create an information product in which the flow of information is clear, logical and integrated to make the product unified and complete.<br>• Select appropriate key points and data from available resources and use their own words to include and explicate them in an information product.<br>• Use graphics and text software editing features, such as font formats, colour, animations and page transitions, in ways that enhance the structure and communicative purpose of an information product.<br>• Include relevant tables and charts to enhance an information product and support these representations of data with text that clearly explains their purpose and contents.<br>• Apply computational thinking and algorithm development to solve complex problems in various contexts.<br>• Design and create digital solutions using various software tools, programming languages and platforms, focusing on user experience and interface design. |
| Level 5 | Students working at level 5 evaluate the credibility of information from electronic sources and select the most relevant information to use for a specific communicative purpose. They create information products that show evidence of planning and technical competence, and digital technologies understanding. They use software features to reshape and present information graphically consistent with presentation conventions. They design information products that combine different elements and accurately represent their source data, and apply computational thinking to develop digital solutions. They use available software features to enhance the appearance of their information products and user interfaces. They employ file management practices to support workflow management when creating information products. They can explain how components of a digital system are connected to transmit data and interpret the data outputs. | • Create an information product in which the information flow is clear and logical, and the tone and style are consistent and appropriate to a specified audience.<br>• Use video/animation editing techniques to control the timing of events and transitions to create a sense of continuity.<br>• Select and include information from electronic resources in an information product to suit an explicit communicative purpose.<br>• Use graphics and text software editing features such as font formats, colour and animations consistently within an information product to suit a specified audience.<br>• Create tables and charts that accurately represent data and include them in an information product with text that refers to their contents.<br>• Apply specialised software and file management functions such as using the history function on a web browser to return to a previously visited page or moving and organising image files into a dedicated folder for the purpose of importing the images into an application.<br>• Explain the advantages and disadvantages of different file formats (e.g. PDF or DOCX).<br>• Demonstrate an understanding of basic programming concepts and apply them to develop digital solutions in various contexts.<br>• Design and implement simple digital solutions such as designing user interfaces, using a variety of software tools and platforms that ensure the solution is easy to navigate and interpret for the user.<br>• Explain how data is transferred between components of a digital system to perform a given function e.g. how wi-fi can be used to communicate with a device. |

| Proficiency level | Proficiency level description | Examples of student achievement at this level |
|---|---|---|
| Level 4 | Students working at level 4 generate simple general search questions and select the best information source to meet a specific purpose. They retrieve information and interpret data reports from given electronic sources to answer specific, concrete questions. They can implement solutions to collect information from users. They assemble information in a simple linear and logical order to create information products. They use conventionally recognised software commands to edit and reformat information products, and begin to explore digital technologies concepts. They recognise common examples in which ICT misuse may occur and suggest ways of avoiding them. | • Create an information product in which the flow of information is clear and the tone is controlled to suit a specified audience.<br>• Generate searches that target relevant resources, apply search engine filtering parameters to improve search results and then select relevant sections of these resources to include, with some modification and supporting text, in an information product.<br>• Use simple web forms to collect information from users.<br>• Apply graphics and text software editing features, such as font formats, colour and image placement, consistently across a simple information product.<br>• Apply specialised file management and software functions, such as sorting files by type and date, locating an appropriate folder location for software installation or enabling a specified hidden toolbar in a word processor.<br>• Explain basic digital technologies concepts, such as simple programming and algorithm design, in the context of problem-solving tasks.<br>• Begin to develop digital solutions using a variety of software tools and platforms, with guidance and support. |
| Level 3 | Students working at level 3 generate simple general search questions and select the best information source to meet a specific purpose. They retrieve information and interpret data reports from given electronic sources to answer specific, concrete questions. They can use simple digital forms and identify mistakes in software tools used to collect information from users. They assemble information in a simple linear and logical order to create information products. They use conventionally recognised software commands to edit and reformat information products and begin to explore basic digital technologies concepts. They can correctly connect components of a simple digital system. They can use a range of communication tools for participating in collaborative online environments. They recognise common examples in which ICT misuse may occur and suggest ways of avoiding them. | • Create an information product that follows a prescribed explicit structure.<br>• Identify the difference between paid and nonpaid search engine generated results when conducting research.<br>• Select clear, simple, relevant information from given information sources and include it in an information product.<br>• Collect information from users.<br>• Make recommendations to improve the navigability of a website.<br>• Identify a potential problem with a website based on a web traffic report.<br>• Use design software editing features to manipulate aspects such as colour, image size and placement in simple information products.<br>• Identify problems with the features employed in a user interface.<br>• Apply software and file management functions, using common conventions such as left aligning selected text, adding questions to an online survey, or creating and naming a new file on the desktop.<br>• Recognise the potential for ICT misuse, such as plagiarism, computer viruses and deliberate identity concealment, and suggest measures to protect against them.<br>• Develop an understanding of foundational digital technologies concepts, such as basic programming structures and digital systems, in a guided setting.<br>• Create simple digital solutions with support, using a limited range of software communication tools (e.g. interactive charts and presentations) and platforms.<br>• Identify how components of a simple digital systems are connected. |

| Proficiency level | Proficiency level description | Examples of student achievement at this level |
|---|---|---|
| Level 2 | Students working at level 2 locate simple, explicit information from within a given electronic source. They add content to and make simple changes to existing information products when instructed. They edit information products to create products that show limited consistency of design and information management. They recognise and identify basic ICT electronic security and health and safety usage issues and practices, and gain exposure to basic digital technologies concepts. They can interpret data represented in a range of communication tools for participating in collaborative online environments. They examine the main components of familiar digital systems and identify their functions. | • Locate explicit relevant information or links to information from within a webpage.<br>• Use metadata, such as date, to help identify and select relevant files.<br>• Make changes to some presentation elements in an information product.<br>• Apply simple software and file management functions, such as copying and pasting information from one column of a spreadsheet to another column, adding a webpage to a list of favourites (bookmarks) in a web browser or opening an email attachment.<br>• Recognise common computer-use conventions and practices, such as the use of the .edu suffix in the URL of a school's website, the need to keep anti-virus software up-to-date and the need to maintain good posture when using a computer.<br>• Explain the purpose of specific school ICT use and social media use policies.<br>• Identify basic digital technologies concepts, such as simple programming structures and digital systems, in a guided setting.<br>• Explore simple digital solutions with support, using a limited range of software communication tools (e.g. interactive charts and presentations) and platforms.<br>• Examine components of familiar digital systems and their function (e.g. microphones, wi-fi devices, sensors). |
| Level 1 | Students working at level 1 perform basic tasks using computers and software. They implement the most commonly used file management and software commands when instructed. They recognise the most commonly used ICT terminology and functions, and gain initial exposure to basic digital technologies concepts. | • Apply graphics editing software functions, such as adding and moving predefined shapes and adjusting property sliders, to control the basic appearance of an image.<br>• Apply basic file and computer management functions, such as opening, and dragging and dropping files on the desktop.<br>• Apply generic software commands, such as the "save as" and "paste" functions, clicking on a hyperlink to go to a webpage or selecting all the text on a page. Recognise basic computer-use conventions, such as identifying the main parts of a computer and that the "shut-down" command is a safe way to turn off a computer.<br>• Become familiar with simple digital technologies concepts, such as basic programming structures and digital systems, in a highly guided setting (e.g. decision trees).<br>• Participate in guided activities to explore simple digital solutions, using a limited range of software tools and platforms. |