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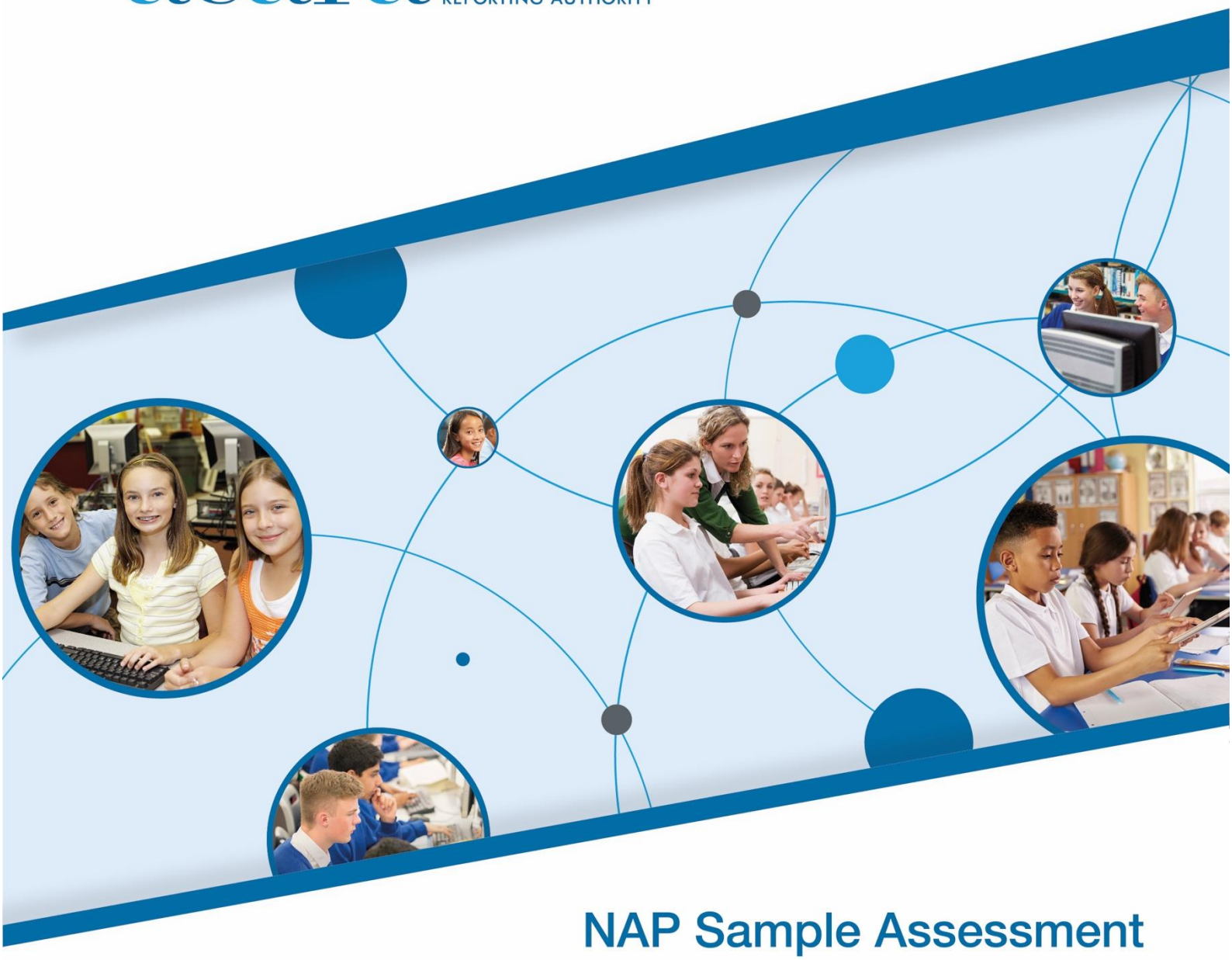

NAP Sample Assessment ICT Literacy

Technical Report

November 2018

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NAP–ICT 2017 Literacy Project Staff

Julian Fraillon and Eveline Gebhardt from the Australian Council for Educational Research (ACER) were Project Directors of NAP–ICT Literacy 2017. Kate O'Malley was the Project Manager. Melissa Hughes and Daniel Duckworth led the test development team. Data analysis was led by Eveline Gebhardt and sampling was led by Martin Murphy.

The Technical Report was written by: Julian Fraillon, Eveline Gebhardt, Kate O'Malley, Martin Murphy, Renee Kwong, Daniel Duckworth, Tim Friedman, Jorge Fallas and Louise Ockwell.

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Chapter 1: Introduction

The National Assessment Program (NAP) commenced 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).

NAP was established to measure student achievement and to report this against key performance measures (KPMs) in relation to the national goals, using nationally comparable data in each of literacy, numeracy, science, information and communication technologies (ICT), and civics and citizenship.

Under NAP, literacy and numeracy achievements are measured and reported via the National Assessment Program – Literacy and Numeracy (NAPLAN), and achievement in science, civics and citizenship, and ICT literacy are assessed under the NAP – sample assessment program. These assessments are developed and managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA) under the auspices of the Education Council.

In 2008, the Adelaide Declaration was superseded by the Melbourne Declaration on the Educational Goals for Young Australians (Melbourne Declaration). The Melbourne Declaration established a revised set of goals intended to set the direction for Australian schooling for the next decade, stating as part of those goals 'that young people need to be highly skilled in the use of ICT and that successful learners are creative and productive users of technology, especially ICT'.

The first collection of data from students in the National Assessment Program – ICT Literacy (NAP–ICT Literacy) was in 2005; subsequent cycles of assessment have been conducted in 2008, 2011, 2014 and 2017.

NAP–ICT Literacy was based on a definition of ICT literacy adopted by MCEETYA. ICT literacy was defined as:

> The ability of individuals to use ICT appropriately to access, manage, integrate and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society (MCEETYA, 2005).

This definition formed the basis of the NAP–ICT Literacy Assessment Domain (MCEETYA, 2005). It was elaborated first through a set of five key processes and then through three broad strands.

As part of the work on NAP–ICT Literacy 2014, the assessment domain was revised to create the NAP–ICT Literacy Assessment Framework. The assessment framework is consistent with the definitions and structures established in the assessment domain. As part of the work on NAP–ICT Literacy 2017, the NAP–ICT Literacy Assessment Framework was revised to acknowledge and explain the conceptual connections between ICT literacy as measured in NAP–ICT Literacy and in the Australian Curriculum: ICT Capability and Australian Curriculum: Digital Technologies. The NAP–ICT Literacy Assessment Framework was released in 2017.

This report reviews procedures, processes and technical aspects of the NAP–ICT Literacy 2017 and should be read in conjunction with *NAP–ICT Literacy Public Report 2017*, which focuses on results and interpretation of results from that assessment (ACARA, 2018).

NAP–ICT LITERACY 2017 ASSESSMENT INSTRUMENT

The NAP–ICT Literacy 2017 assessment was computer-based and included a broad range of task formats, including multiple-choice, short text response, and simulated and authentic software applications. These were presented in seven modules, each with its own unifying theme that provided a real-world rationale for completing the tasks beyond their inclusion in a test. Each student completed four modules. Six of the seven modules were delivered to students in each of Years 6 and 10. One module was delivered to students in Year 10 only. The modules were allocated in a balanced incomplete design with each module appearing once in each of the four available positions in the test design. This was consistent with the design used in previous cycles of NAP–ICT Literacy.

The assessment was created to be congruent with the previous four assessment cycles (2005, 2008, 2011 and 2014) to enable the 2017 results to be reported against the existing NAP–ICT Literacy scale. Four of the seven modules were secure trend modules that had been used in at least one previous cycle of NAP–ICT Literacy. The module Friend's PC was used in 2008, 2011 and 2014. The other three trend modules, Technology on the Go, Slide Show and Animation Video were first used in 2014. Each student completed two or three of the four available trend modules. All trend modules were administrated to Year 6 and 10 students. Descriptions of the seven test modules are included in the *NAP–ICT Literacy Public Report*.

NAP–ICT LITERACY STUDENT SURVEY

The student survey collected information about students' access to and use of digital devices in school and outside of school. In NAP–ICT Literacy 2017, the survey collected information relating to the following areas:

- student experience in using ICT
- different types of ICT used, and where they 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 and what ICT-related issues are being taught to students
- students' reported experience of computational thinking–related learning at school.

The student survey was completed on computer by all Year 6 and Year 10 students immediately following the test. The student survey was designed to be completed by most students in about 20 minutes. Unlike the test, the student survey was not timed and students could take as long as required to complete the survey.

DELIVERING THE ASSESSMENTS

The NAP–ICT Literacy 2017 assessment was delivered using an online delivery system. However, in cases where schools did not have sufficient resources to support delivery of an online assessment, alternatives were offered such as delivery on USB drives connected to local school computers (the USB drive acting as a web server to the student's computer) or using a set of portable computers (mini-lab). This mix of delivery modes ensured an equivalent test-taking experience for each participating student and avoided problems with low connection speeds or insufficient computer resources at school.

In preparation for the assessment, schools were contacted to assess their preparedness to use the online delivery mode. Schools were required to run an online Technical Readiness Test (TRT) on the computers designated for testing.

STUDENT BACKGROUND

Data regarding individual student background characteristics were provided by education authorities in jurisdictions. The data were either gathered from school records or supplied directly from schools.

SAMPLE

The NAP–ICT Literacy 2017 was based on a nationally representative sample of 640 schools with 10,324 participating students, of which 5,439 were from Year 6 and 4,885 were from Year 10. The student data represent 86 per cent of the sampled Year 6 students and 78 per cent of the sampled Year 10 students.

Sampling followed a two-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 OF THE ASSESSMENT RESULTS

The results of the assessment are reported in the *National Assessment Program – ICT Literacy Years 6 and 10 Report 2017* (ACARA, 2018).

A reporting scale for ICT literacy was established, using methods based on the one-parameter item response theory model (the Rasch model). 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.

Using common item-equating procedures (for items from the trend modules) based on Rasch theory enabled the recoding of the results for NAP–ICT Literacy 2017 on the scale that had been established in 2005. Consequently, the results from NAP–ICT Literacy 2017 are directly comparable with those from all four previous cycles of NAP–ICT Literacy (2014, 2011, 2008 and 2005). In practice, 30 items performed in a sufficiently uniform manner across the 2017 and 2014 cycles could be used for equating the results of NAP–ICT Literacy 2017 to the ICT literacy scale established in 2005.

It was also possible to describe students' ICT literacy in terms of achievement levels. Six achievement 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 developed to characterise typical student performance at each level. The newly developed assessment modules for NAP–ICT Literacy 2017 provided additional examples of ICT literacy achievement, which were added to the progress map but did not require changes to the already established scale descriptions.

In addition to deriving the ICT literacy achievement scale, proficient standards were established in 2005 for Year 6 and Year 10. The proficient standards represent points on the achievement scale that represent a challenging but reasonable expectation for typical Year 6 and Year 10 students to have reached at each of those year levels. 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 2017, 53 per cent of Year 6 students reached or exceeded the Year 6 proficient standard, whereas 54 per cent of Year 10 students were at or above the proficient standard for this year level.

STRUCTURE OF THE TECHNICAL REPORT

This report describes the technical aspects of the NAP–ICT Literacy 2017 sample assessment and summarises the main activities involved in the data collection, the data collection 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.

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 participation rates.

Chapter 4 summarises the field administration of the assessment.

Chapter 5 deals with management procedures, including quality control and the cleaning and coding of the data.

Chapter 6 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 (2017 to 2014, 2011, 2008 and 2005) equating and the procedures for estimating equating errors.

Chapter 7 outlines the achievement levels and proficiency standards.

Chapter 8 discusses 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 2017.

Chapter 2: Assessment framework and instrument development

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 two 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, 2012b) 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 make clear 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.

The NAP–ICT Literacy 2017 Assessment Framework was the central reference for development of the assessment instrument. The described achievement scale generated using the 2005 data (and supplemented with item data from 2008, 2011 and 2014) was used as an indicator of item and task difficulty to inform instrument development, but the assessment framework was used as the substantive bases for instrument construction, and all items in the instrument were referenced to the strands in the framework.

Summary of the assessment framework

The Council of Australian Governments (COAG) Education Council defines ICT literacy, for use in the National Assessment Program, as:

> 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.

The assessment framework describes ICT literacy as comprising a set of six key processes:

1. accessing information (identifying information requirements and knowing how to find and retrieve information)
2. managing information (organising and storing information for retrieval and re-use)
3. evaluating (reflecting on the processes used to design and construct ICT solutions and judgements regarding the integrity, relevance and usefulness of information)
4. developing new understandings (creating information and knowledge by synthesising, adapting, applying, designing, inventing or authoring)
5. communicating (exchanging information by sharing knowledge and creating information products to suit the audience, the context and the medium)
6. using ICT appropriately (critical, reflective and strategic ICT decisions and considering social, legal and ethical issues).

The NAP–ICT Literacy assessment content is organised according to three strands:

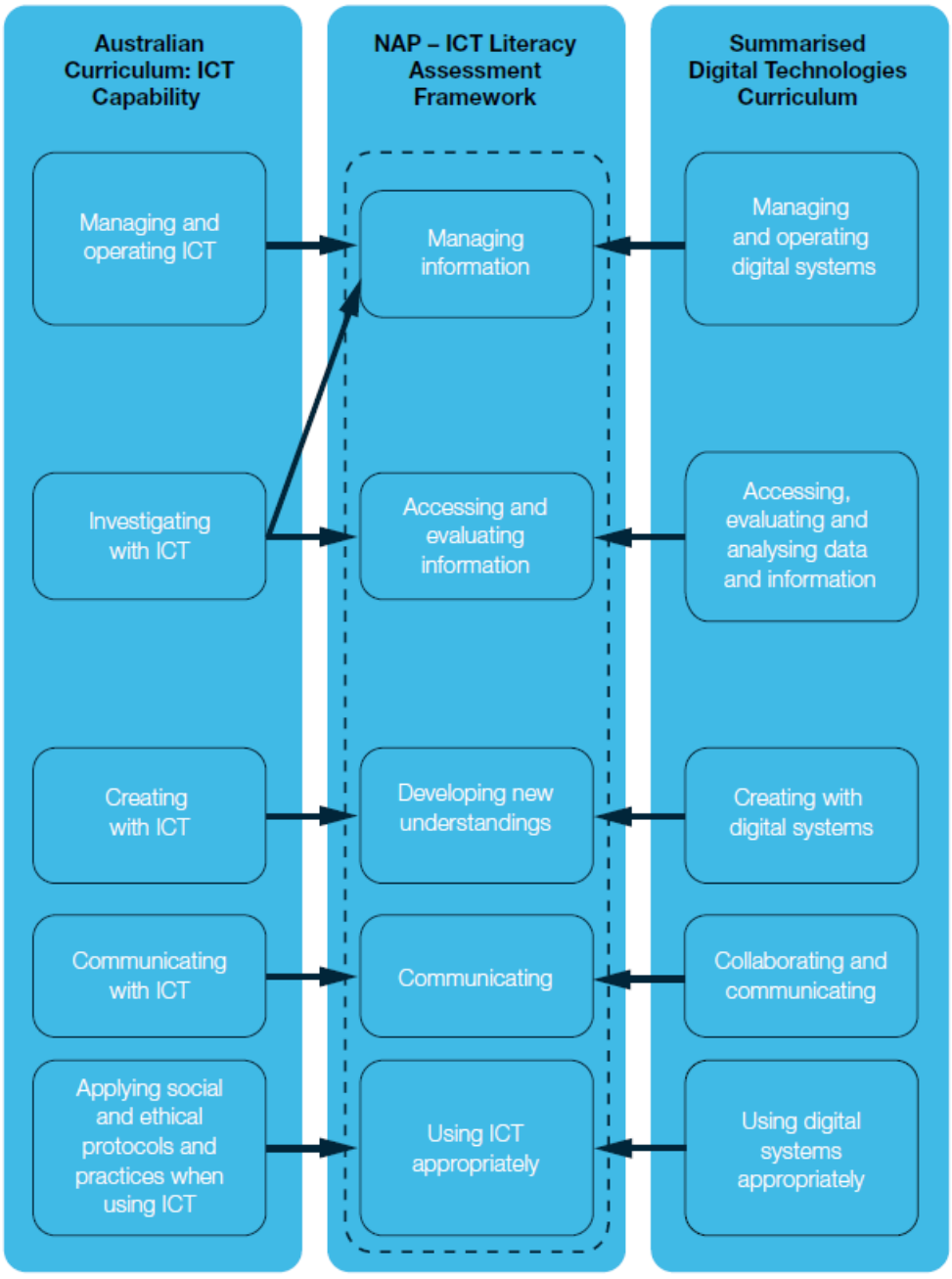
1. Strand A – working with information
2. Strand B – creating and sharing information
3. Strand C – using ICT responsibly.

Strands A and B are logical process groupings of ICT use, while Strand C focuses on understandings of responsible ICT use. Further detail of the strands can be found in the NAP–ICT Literacy Assessment Framework.

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. Figure 2.1 shows a summary of the outcomes of this detailed mapping.

Figure 2.1: Mapping of the Australian Curriculum: ICT Capability and the Australian Curriculum: Digital Technologies summary statements to the NAP–ICT Literacy processes

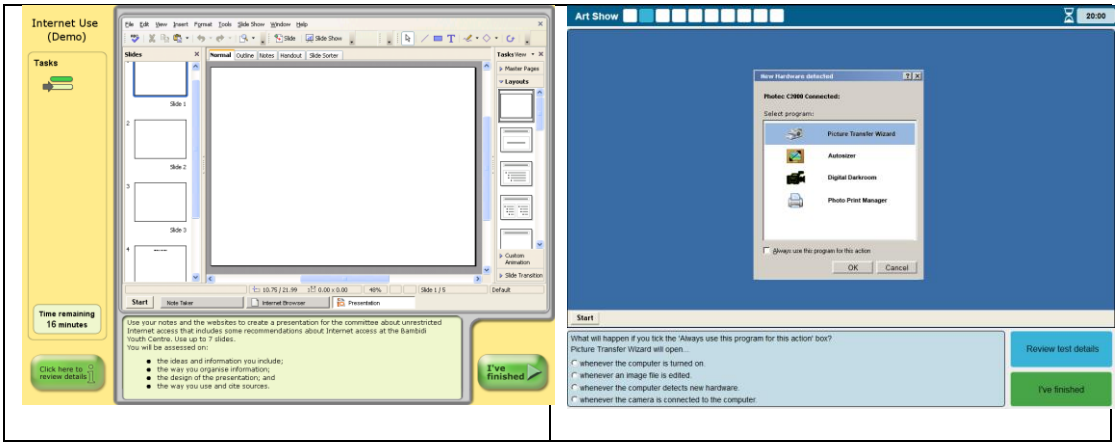


Assessment delivery system

The assessment delivery system contained all the assessment modules and a management system that confirmed the identity of the selected student, asked basic registration information, assigned each student to four modules appropriate to their year level and collected responses to the student survey. All participating schools undertook the NAP–ICT Literacy 2017 assessment via an online delivery system. Students used either desktop or laptop 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.

The on-screen environment experienced by the student was consistent throughout the first three cycles of NAP–ICT Literacy. The student screen had three main sections: a surrounding border of test-taking information and navigation facilities; a central information section that could house stimulus materials for students to read or (simulated or live) software applications; and a lower section containing the instructional and interrogative text of the assessment items and the response areas for multiple-choice and constructed response items. The assessment items were presented in a linear sequence to students. Students were not permitted to return to previously completed items because, in some cases, later items in a sequence provide clues or even answers to earlier items. These features were maintained for NAP–ICT Literacy 2014 and 2017, although the user interface was updated to reflect modern software interface design. The colours were changed and the buttons were updated. Figure 2.2 shows the test interface used in NAP–ICT Literacy 2005 to 2011 and the updated interface used in 2014 and 2017.

Figure 2.2: NAP–ICT Literacy test interfaces (2005 to 2011 and 2014 and 2017)



2005–2011 interface

2014–2017 interface

The randomised allocation of different test modules to students, maximum time allowance and module sequencing were managed automatically by the test delivery software. Test administrators were responsible for running the student tutorial, supervising student participation and monitoring student progression between each section/module (including the provision of rest breaks between sections). Progress through the test sections/modules was controlled by a sequence of test administrator passwords. The student assessment consisted of the following three sections:

1. Students completed a tutorial to familiarise themselves with the assessment system (10 minutes).
2. Students completed four randomly assigned year-level-appropriate trend test modules (20 minutes each).
3. All students completed the student survey (10 minutes).

Instrument development

Four trend modules – Animation Video (from NAP–ICT Literacy 2014), Slide Show (from NAP–ICT Literacy 2014), Technology on the Go (from NAP–ICT Literacy 2014) and Friend's PC (from NAP–ICT Literacy 2008, 2011 and 2014) – were included in the 2017 instrument to enable direct comparisons between the performance of students in 2017 with those of previous cycles of NAP–ICT Literacy. The modules were chosen on the basis that their content has remained relevant, and were administered to both Years 6 and Year 10.

Further details about the content of each of these four trend modules are given below.

- Animation Video: Students used animation software where they employed the use of backgrounds, characters, props and scene transitions to communicate water-safety tips around lakes and dams. The audience for the animation video was upper primary school students. Students were required to manage the process of uploading the produced animation video file to a video-sharing website, which required technical and communicative practices, such as privacy settings and naming conventions.
- Slide Show: Students completed a class project about the Tasmanian Devil Program on Maria Island. The module involved opening and saving files, searching websites for information on the topic, creating a short slide show about the program, and scripting notes to go with the slide show.
- Technology on the Go: Students used a borrowed tablet to take on a two-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.
- Friend's PC: Students were required to complete a series of technical tasks relating to setting up software on a computer, and ultimately use a piece of image-editing software to make specified changes to an image. This module focused on software skills reliant on knowledge and application of software, and interface design conventions.

Three new modules were developed for use in NAP–ICT Literacy 2017. The tasks and items in these modules were designed to maintain the requisite content coverage specified in the assessment framework. The content and contexts of the new modules were determined in consultation with the NAP–ICT Literacy Working Group. The three new modules were: Acceptable Use Agreement, Poetry and Pictures and School Website.

- 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 that promotes positive ICT use.
- Poetry and Pictures (Year 6 and Year 10): Students were tasked with creating a digital photo book containing poetry and images that focused on a social justice context of raising awareness about homelessness. Students were asked to employ file management and storage practices, prepare images for use in a

digital photo book, and transfer content from an online drive to the digital photobook while using software features to control the design and layout of the content.

- 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. Finally, students had to create a webpage to promote a sports event, including the creation of a web form for registration into the sports event.

Scoring student responses

Students completed tasks on computers using software that included a seamless combination of simulated and live applications. Student responses were either scored automatically by the testing system or saved and scored later by trained scorers using a scoring guide. Following is a summary of the different task/item types and their related scoring procedures.

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 scored automatically as 0 (incorrect attempt made), 1 (correct attempt made) or 9 (no attempt made). When students completed any attempt (correct or incorrect) for a simulation item they were prompted by the system with 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 option and the consequent scoring of the final attempt only were 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 are when students are asked to configure some software settings that can only be managed by navigating through a set of menus in a simulated piece of software. Unlike the single-step simulation items, students needed to indicate 'I've Finished' before the system would recognise that a response had been made. This was to allow students to navigate and explore the software in order to complete their response. These tasks were usually scored as 0 (incorrect attempt made), 1 (correct attempt made) or 9 (no attempt made), although it was possible to score them with a 2 (fully correct attempt made) and 1 (partially correct attempt made). This form of partial credit scoring was used in cases where students were, for example, instructed to change a software setting. In such cases, partial credit may have been used for students who navigated to the correct interface, but then incorrectly applied the specified setting. 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 purpose of test item analysis, the selection made by a student was recorded by the test administration system and later scored as correct or incorrect.

Constructed response items

Some items required students to respond using one or two sentences. These responses were captured by the test administration system and later delivered to scorers using a purpose-built online scoring system. Some of these items had scoring guides that allowed for dichotomous scoring (sufficient/insufficient), 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 scorers using the online scoring system. Typically, these information products (such as a short video clip, 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 two and four score categories (including zero) that reflected different levels of sophistication with reference to the ICT literacy construct and the elements of the task.

Student survey

As was the case for previous cycles of the NAP–ICT Literacy assessment (2005–2014), there was a survey for students incorporated into the instrument. In 2005 and 2008, the survey material included student demographic information and questions about student ICT use. Since NAP–ICT Literacy 2011, all student demographic information has been collected from school records (or higher-level sector and/or jurisdictional bodies) and consequently there was the opportunity to increase the amount of survey content addressing student use and perceptions of using computers and ICT.

The 2017 survey included some identical questions to those used in previous cycles. There were also some questions used that were the same as in previous cycles but with different (albeit compatible) response categories and/or additional items, along

with the inclusion of some new questions and a slight modification where the home context was redefined and broadened as ‘Outside of school’.

The questions in the survey covered the following areas:

- student experience in using ICT
- different types of ICT used, and where they 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 and what ICT-related issues are being taught to students.

A copy of the student survey, along with the relevant coding information, can be found in Appendix 1.

Field trial

The ICT literacy field trial was completed in June 2017 by 1,558 students in 44 schools (24 schools for Year 6 and 20 schools for Year 10). The field trial was conducted in New South Wales (15 schools), Victoria (15 schools), Queensland (13 schools) and Western Australia (1 school).

The major purpose of the field trial was to test methodologies, systems, documentation and items. Data collected from the field trial informed all facets of the implementation of the main sample. The main aspects of the field trial are listed in Table .

The 2017 field trial instrument included two of the modules from NAP–ICT Literacy 2014 (trend modules) with the expectation to include both in the main data collection. This was done to select the most appropriate of these modules for equating data from 2017 to the established reporting scale used in 2014. The two trend modules were Technology on the Go and Slide Show. Based on the field trial test data, it was decided to include both trend test modules in the main assessment instrument.

Overall, the field operations and the analysis of the collected data suggested that the field operations procedures, test instrument, scoring guides and scoring procedures had been successful and would form a solid foundation for the 2017 main study. As a result of findings from the field trial, there were a number of small changes made to different aspects of the instruments, guides and procedures, such as the addition of examples of student performance, some clarifications of wording in the scoring guides, and refinements of the test administration login system to make the data entry of student information by test administrators more efficient.

Table 2.1: Main aspects of NAP–ICT field trial

Component	Aspect	Data considered
School contact	(1) School infrastructure and capacity to manage test delivery (2) General level of school support for the test administration	(1) Accuracy of data received from a pre-trial resources survey and USB compatibility test with on-site experiences (2) Capacity of school to provide on-site support on the day of administration
Administration procedures	(1) USB-based delivery system and data collection (2) Time for test setup and shutdown (3) Success of setup, shutdown and data upload	(1) USB-based test delivery using school computers and externally supplied notebooks (2) Data transfer was monitored (3) Field operations reports were completed by test administrators
Administration documentation	(1) Test administrator training (2) Test administrators' instructions	(1) Completeness of trainer capacity to deal with local situations (including calls to help desk) (2) Completeness of documentation to implement assessments and transfer student response data (in light of field trial performance and feedback from test administrators)
Test items	(1) Measurement properties of test items including their fit to the ICT literacy scale, difficulty, presence or absence of sub-group bias (2) Scoring guides and procedures for constructed response items and large tasks	(1) Item performance data: fit statistics, scaled difficulties, differential item functioning, scale reliability (2) Feedback from scorers and scoring trainers from the field trial scoring

Chapter 3: Sampling and weighting

This chapter describes the NAP–ICT Literacy 2017 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.

SAMPLING

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

A two-stage stratified cluster sample design was used in NAP–ICT Literacy 2017, 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 a sample of schools, stratified according to state, sector, geographic location, the Socio-Economic Indexes for Areas (SEIFA)[1] and school size. The second stage consisted of a sample of 20 random students from the target year level in sampled schools. Samples were drawn separately for each year level.

The sampling frame

Schools were selected from the ACER sampling frame, a comprehensive list of all schools in Australia, updated annually using information collected from multiple sources, including the Australian Bureau of Statistics and the Commonwealth, state and territory education departments.

School exclusions

Schools excluded from the target population included: non-mainstream schools (such as schools for students with intellectual disabilities or hospital schools), schools listed as having fewer than five students in the target year levels, and very remote schools (except in the Northern Territory). These exclusions account for 1.8 per cent of the Year 6 student population and 1.9 per cent of the Year 10 student population.

The decision to include very remote schools in the Northern Territory sample for 2017 was made because very remote schools constituted more than 20 per cent of the Year 6 population and more than 15 per cent of the Year 10 population in the Northern Territory (while this proportion was less than one per cent of the total student population of Australia). The same procedure was used for the 2011 study.

[1] This is a measure of socio-economic status based on the socio-economic conditions, such as education and employment, of the geographic location of the school.

The inclusion of very remote schools in the Northern Territory in the NAP–ICT Literacy 2017 sample had only a negligible impact on the estimates for Australia and the other states.

The designed sample

For both Year 6 and Year 10 samples, sample sizes were chosen to provide accurate estimates of achievement outcomes for all states and territories. The expected 95 per cent 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. Confidence intervals of this magnitude require an effective sample size[2] of around 100–150 students in the larger states. Smaller sample sizes were deemed as sufficient for the smaller states and territories because of their relatively small student populations. As the proportion of the total population surveyed becomes larger, the precision of the sample increases for a given sample size; this is known as the finite population correction factor.

Table 3.1 shows the population of schools and students and the designed sample.

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

	Year 6			Year 10		
	Enrolment	Schools in population	Schools in sample	Enrolment	Schools in population	Schools in sample
NSW	87,511	2,065	50	87,871	805	50
Vic.	67,662	1,659	50	67,700	564	50
Qld	58,937	1,150	50	60,191	475	50
WA	29,469	742	45	29,307	254	50
SA	18,883	534	45	20,053	197	50
Tas.	5,883	193	40	6,543	85	35
ACT	4,864	95	20	4,959	41	20
NT	3,073	120	20	2,565	47	15
Aust.	276,282	6,558	320	279,189	2,468	320

First sampling stage

Stratification by state, sector and small schools was explicit: separate samples were drawn for each sector within states and territories. Stratification by geographic location, SEIFA and school size was implicit: schools within each state were ordered by size (according to the number of students in the target year level) within sub-groups defined by a combination of geographic location and the SEIFA index.

The selection of schools was carried out 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. In order to minimise variation in weights, the MOS

[2] 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.

for very small schools (between five and 10 students) was set to 10, and the MOS for small schools (between 11 and 20 students) was set to 20.

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.

On the basis of an analysis of small schools (schools with fewer enrolments than the assumed cluster sample size of 20 students) undertaken prior to sampling, the school sample size in some strata were 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 332 and 322, respectively. Both were slightly larger than the designed sample (see **Error! Reference source not found.**). 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 school previous to 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 two replacement schools were generally similar (with respect to geographic location, socio-economic status 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 participation rates. One school was removed from the Year 6 sample and four 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

Within the group of sampled students, individual students were excluded from the assessment on the basis of the criteria listed below.

- Functional disability: Students who have a moderate to severe permanent physical disability such that they cannot perform in the assessment situation.
- Intellectual disability: Students who have a mental or emotional disability and are cognitively delayed such that they cannot perform in the assessment situation.
- Limited assessment language proficiency: Students who are unable to read or speak the language of the assessment and would be unable to overcome the language barrier in the assessment situation. Typically, students who have received less than one year of instruction in the language of the assessment would be excluded.

Table 3.2 and Table 3.3 detail the numbers and percentages of students excluded from the NAP–ICT Literacy 2017 assessment, according to the reason given for their exclusion. The number of student-level exclusions was 154 at Year 6 and 170 at Year 10. This gives weighted exclusion rates of 2.7 per cent of the sampled Year 6 students and 3.0 per cent of sampled Year 10 students.

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

	Functional disability	Intellectual disability	Limited English proficiency	Total	Proportion of sampled students in Year 6
NSW	1	12	2	15	1.6
Vic.	4	27	6	37	4.3
Qld	5	12	6	23	2.4
WA	0	9	5	14	1.7
SA	10	13	9	32	4.2
Tas.	6	5	5	16	2.6
ACT	1	7	1	9	2.5
NT	4	2	2	8	2.9
Aust.	31	87	36	154	2.7

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

	Functional disability	Intellectual disability	Limited English proficiency	Total	Proportion of sampled students in Year 10
NSW	0	8	5	13	1.2
Vic.	3	10	17	30	3.6
Qld	4	13	11	28	4.2
WA	3	14	15	32	3.8
SA	3	17	10	30	3.4
Tas.	1	3	4	8	1.3
ACT	1	14	7	22	5.9
NT	2	3	2	7	2.2
Aust.	17	82	71	170	3.0

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 two 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.

The probability of selection of the school is equal to its measure of size (MOS)[3] divided by the sampling interval (SINT) or one, whichever is lower. (A school with a MOS greater than the SINT is a certain selection and therefore has a probability of

[3] For larger schools, the measure of size is the number of students enrolled in Year 6 or Year 10. For schools with an estimated enrolment of fewer than 10, the measure of size was set to 10. For schools with an estimated enrolment between 11 and 20, the measure of size was set to 20.

selection of one. Some very large schools were also selected with certainty into the sample.)

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.

This 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 class (n_x^{sc}) were:

- a sampled school that no longer existed
- a school that, following sampling, was discovered to have fitted 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 school (n_n^{sc}), neither the originally sampled school nor its replacements participated.

Within each explicit stratum, an adjustment was made to account for school non-response. This non-response adjustment (NRA) for a stratum was equal to:

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

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

$$FW_{sc} = BW_{sc} * NRA_{strt}$$

Second-stage weight

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

- the total 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:

$$NRA_{sc} = \frac{n_p^{st} + n_n^{st}}{n_p^{st}}$$

The final student weight was:

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

Overall sampling weight

The full sampling weight (FWGT) was simply the product of the weights calculated at each of the two sampling stages:

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

After computation of the overall sampling weights, the weights were checked for outliers, because outliers can have a large effect on the computation of the standard errors. A weight was regarded as an outlier if the value was more than four times the median weight within a subpopulation defined by year level, state or territory and sector (i.e. an explicit stratum). There were four outliers in the data, so these weights were trimmed to four times the median weight.

PARTICIPATION RATES

Separate participation rates were computed: (1) with replacement schools included as participants, and (2) with replacement schools regarded as non-respondents. In addition, each of these rates was computed using unweighted and weighted counts. In any of these methods, a school and a student response rate were computed and the overall response rate was the product of these two response rates. The differences in computing the four response rates are described below. These methods are consistent with the methodology used in TIMSS (Olson, Martin & Mullis, 2013).

Unweighted response rates including replacement schools

The unweighted school response rate, where replacement schools were counted as responding 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:

$$RR_1^{st} = \frac{n_r^{st}}{n_r^{st} + n_{nr}^{st}}$$

where n_r^{st} is the total number of responding students in all responding schools and n_{nr}^{st} is the total number of eligible, non-responding, sampled students in all responding 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.

$$RR_2^{st} = \frac{n_r^{st}}{n_r^{st} + n_{nr}^{st}}$$

The overall response rate was again the product of the two 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-response, 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-response.

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, $s + r1 + r2$ all responding schools, j a student, and r_i 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 and applying the same computations as above. More formally, the parts of the response rates are computed as follows:

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

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

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

Reported participation rates

The Australian school participation rate in Year 6 was 99 per cent when including replacement schools and 96 per cent when excluding replacement schools. In Year 10, the respective percentages were 97 per cent and 96 per cent. These are the unweighted response rates and are very similar to the weighted response rates.

Overall unweighted participation weights including replacement schools were 89 per cent for Year 6 and 81 per cent for Year 10.

Table 3.4 and Table 3.5 detail Year 6 and Year 10 participation rates according to the four methods described above.

Table 3.4: Overall school and student participation 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	0.91	1.00	0.91	0.89	0.98	0.91	0.90	1.00	0.90	0.88	0.98	0.90
Vic.	0.88	0.98	0.89	0.86	0.96	0.90	0.85	0.98	0.86	0.83	0.96	0.86
Qld	0.89	0.98	0.91	0.89	0.98	0.91	0.87	0.98	0.88	0.87	0.98	0.88
WA	0.88	0.98	0.90	0.83	0.91	0.91	0.87	0.98	0.89	0.81	0.91	0.90
SA	0.90	1.00	0.90	0.87	0.96	0.91	0.86	1.00	0.86	0.83	0.95	0.87
Tas.	0.90	1.00	0.90	0.88	0.98	0.90	0.88	1.00	0.88	0.86	0.97	0.88
ACT	0.90	1.00	0.90	0.86	0.95	0.91	0.88	1.00	0.88	0.84	0.95	0.88
NT	0.83	0.95	0.87	0.83	0.95	0.87	0.73	0.90	0.81	0.73	0.90	0.81
Aust.	0.89	0.99	0.90	0.87	0.96	0.90	0.87	0.99	0.88	0.85	0.96	0.88

Table 3.5: Overall school and student participation 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	0.85	1.00	0.85	0.85	1.00	0.85	0.81	0.98	0.83	0.81	0.98	0.83
Vic.	0.81	0.98	0.83	0.79	0.96	0.83	0.79	1.00	0.79	0.77	0.98	0.79
Qld	0.82	0.96	0.85	0.80	0.94	0.85	0.78	0.96	0.81	0.76	0.94	0.81
WA	0.85	0.98	0.86	0.85	0.98	0.86	0.81	0.98	0.82	0.81	0.98	0.82
SA	0.78	0.96	0.81	0.77	0.94	0.82	0.77	0.98	0.78	0.75	0.96	0.78
Tas.	0.81	0.97	0.83	0.81	0.97	0.83	0.79	0.97	0.81	0.79	0.97	0.81
ACT	0.82	1.00	0.82	0.82	1.00	0.82	0.75	1.00	0.75	0.75	1.00	0.75
NT	0.61	0.80	0.76	0.61	0.80	0.76	0.57	0.82	0.70	0.57	0.82	0.70
Aust.	0.81	0.97	0.84	0.80	0.96	0.84	0.79	0.98	0.81	0.78	0.97	0.81

Chapter 4: Data collection procedures

It is imperative that the collection of school, student and test data is supported by a framework of high-quality and well-organised data collection procedures. Such procedures have been developed and refined by ACER over time to ensure the integrity and quality of the data, while also minimising the administrative burden on participating schools.

This chapter outlines the procedures used to collect data for NAP–ICT Literacy 2017. An overview of the collection activities undertaken by the ACER Project Team and participating schools is provided in Table 4.1.

Table 4.1: Procedures for data collection

ACER activity	School activity
Contact is made with sampled schools; registration details are requested via online form.	Complete registration details (principal name, school contact person and IT coordinator nomination etc.).
Request made to schools to provide: • student list for Year 6 or Year 10 students • preferred assessment dates.	Upload requested information to the School Administration website.
Computer resource information (including Technical Readiness Test [TRT] results) requested.	Undertake the TRT and inform ACER of computer resource availability and any technical issues via the School Administration website and TRT survey.
Test administrators (TAs) for assessment are selected and trained (includes distribution of TA manual and test instructions handbook), and TAs are allocated their list of schools.	
Year 6 and Year 10 ICT Literacy assessments are administered.	Host assessment with test administrator assistance.
Data are cleaned and student responses are scored.	
Interactive online summary reports provided to schools.	Access summary reports from ACER OARS system.

CONTACT WITH SCHOOLS

The field administration of NAP–ICT Literacy 2017 required several stages of contact with the sampled schools to request or provide information.

In order 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.

The steps involved in contacting schools are described in the following list.

1. Initially, the principals of the sampled schools were contacted by their education authority to inform them of their selection. If the sampled school was unable to take part (as confirmed by an education authority liaison officer), the designated replacement school was contacted.
2. After each school's participation was confirmed by the relevant education authority, ACER contacted school principals to request the nomination of a school contact person and IT coordinator. These individuals would coordinate the assessment in the school and ensure the technical readiness of their schools' computer systems.
3. Following their nomination, school contacts were sent the *School Contact Manual*, and were asked to provide three possible assessment dates that were convenient for the school, and to list all of the Year 6 or Year 10 students in the school using the cohort listing form on the School Administration website. At this time, they were asked to indicate the gender and exclusion status (if applicable) of each student listed.
4. IT coordinators were then provided with a set of instructions and asked to run a Technical Readiness Test (TRT) to ensure that the school's computer system was capable of running the assessment using the online test delivery program. ACER Project Team staff liaised with IT coordinators over this time to circumvent and troubleshoot any technical issues experienced.
5. ACER test administrators then liaised with each school contact to confirm the time of assessment, and to discuss any special provisions needed for the assessment day.
6. The test administrators then visited the schools on the scheduled day to administer the assessment. If an 80 per cent attendance rate was not reached on the initial assessment day, return visits were made to the school where possible to assess the remaining sampled students.
7. The final contact with schools was to send them the results for the participating students and to thank them for their participation.

At each of the stages requiring information to be sent from the schools, a time frame was provided for the provision of this information. If the school did not respond within the designated time frame, follow-up contact was made via email and telephone.

THE NAP–ICT LITERACY ONLINE SCHOOL ADMINISTRATION WEBSITE

All information provided by schools to ACER was submitted via a secure website. The benefits of the NAP–ICT Literacy Online School Administration website were two-fold: 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 school contact details, assessment date preferences, and student-related information as required.

COLLECTION OF STUDENT BACKGROUND INFORMATION

Schools and education systems were required to provide background data for each of the participating students. The structure of these student background variables follows NAP protocols as set out in the *Data Standards Manual* (ACARA, 2017).[4] The data were matched to students' test and survey results for analysis and reporting purposes. The information collected included:

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

All schools are now expected to collect this information for their students and to store these data in line with the standards outlined in the *Data Standards Manual*. For NAP–ICT Literacy 2017, student background data were collected in one of two ways: from the education authorities in each jurisdiction or from the schools themselves. Where possible, education authorities from each jurisdiction undertook to supply these data directly to ACER to avoid burdening schools with this administrative task. Provision of student background data from education authorities occurred in 50 per cent of jurisdictions.

Where data collection from educational authorities was not possible, ACER created a spreadsheet template into which schools could enter the relevant background details for each sampled student. This template was then uploaded by each school onto the secure NAP–ICT Literacy Online School Administration website. Student background coverage by state and territory is included in the 2017 public report *National Assessment Program – ICT Literacy Years 6 and 10* (ACARA, 2018) as Appendix 4.

INFORMATION MANAGEMENT

In order to track schools and students throughout the data collection phase and administration of the assessment, one central, secure database was constructed. This database identified the sampled schools and their matching replacement schools. It also identified the participation status of each school. For each participating school, information about the school contact person, school address, school computer resources and a history of contact with the school was stored. These data were then linked to student sample and identification information.

[4] It is noted that in the 2017 update to the *Data Standards Manual*, country of birth data is no longer required. As this change was being finalised concurrently with the conduct of the NAP–ICT Literacy study, county of birth data is still included for this cycle, but its inclusion may be revised for future cycles.

After the assessment was administered at each participating school, information from this database was cross-referenced with the following to confirm the quality and completeness of student and school data:

- student background information
- responses to test items
- achievement scale scores
- responses to student survey items
- attitude scale scores
- final student weights
- replicate weights.

Further information about these databases and the information that they contained is provided in chapter 5.

WITHIN-SCHOOL PROCEDURES

As the NAP–ICT Literacy 2017 assessment took place within schools, the participation of both ACER and school staff in the organisation and administration of the assessment was an essential part of the field administration. This section outlines the key roles and phases of the NAP–ICT Literacy test administration period.

The school contact

Participating schools were asked to appoint a school contact person to coordinate the assessment within the school. Each school contact was provided with the *School Contact Manual*, which described in detail what was required at each stage of the data collection process. Their duties included:

- providing ACER with information about their school's preferred assessment dates, student cohort list and, if applicable, student background data for the selected students
- scheduling the assessment and booking a room containing an appropriate number of computers with power supply for the assessment sessions
- ensuring the nominated IT coordinator completed the TRT on the computers being used for the assessment
- notifying teachers, students and parents about the assessment, according to their school's policies
- assisting the test administrator with final arrangements on the assessment day (this did not involve assessment administration).

The IT coordinator

An IT coordinator was also nominated by the school principal at each participating school. This coordinator was responsible for ensuring that the school's computer system was 'test ready' by the scheduled assessment date. Primarily, the role

involved conducting the TRT on a sample of the computers that were to be used for the assessment. They were also asked to ensure that all computers were switched on, fully charged (if connection to a power source was not possible), logged in and ready for use on the test day.

The Technical Readiness Test (TRT)

To ensure the smooth running of the assessment, it was necessary to perform a TRT on the computers that were selected for use. The TRT consisted of a number of tests that checked the compatibility of the schools' computers with the NAP–ICTL test delivery program. The TRT instructions that were sent to each IT coordinator are provided in Appendix 2.

After a TRT was performed, the ACER Project Team would liaise with the IT coordinators who had reported issues with its conduct. 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.

The test administrator

In total, 95 test administrators (TAs) were employed nationally to administer the tests in all standard delivery schools. Each TA was required to complete TA training, which comprised of the following:

- *Reading and understanding the test administrator manual, test instructions handbook and all associated documentation*. The importance of procedural compliance was emphasised throughout these documents. TAs were also issued with a series of TA newsletters that provided them with information about technical issues or developments, changes to procedure, or details about test administration.
- *Attending a TA training webinar*. Each TA was required to take part in a webinar with the ACER Project Team. These small-group webinars were highly interactive and TAs were asked a number of questions about test administration procedures in order to assess their knowledge of administrative processes. TAs were also taken through the more technically advanced assessment items in order to familiarise them with expected item behaviour and to give them a feel for the test interface. Throughout the webinar, TAs were encouraged to ask questions about any element of the project with which they were unfamiliar to gain a common understanding of the expected procedure. Elements of the non-secure aspects of the webinar were recorded and made available to TAs via the TA Portal in order to cement their understanding of procedural matters covered in the session.
- *Using TA practice logins*. TAs were given their own practice login so that they could log in to the test program and navigate the test interface in advance of their initial visit to a school. These practice logins gave TAs access to the tutorial and

survey components of the assessment and they were expected to practise their TA instructions or 'script' while clicking through these screens. Access to all secure test content using a practice login was disabled.

Test administrators were also supported via a 1800 number and dedicated email before and during the assessment period.

The primary responsibility of the test administrator was to administer NAP–ICT Literacy 2017 to the sampled students, according to the standardised administration procedures provided in the test administrator manual and test instructions handbook. A test administrator's responsibilities included:

- liaising with the school contact officer at each of their assigned schools before the assessment day to confirm the assessment date and time, the list of selected students, and the assessment delivery method
- administering the test and the survey according to the instructions in the manual
- ensuring that students received a uniform testing experience by conveying the exact contents and meaning of the administrator scripts to the students
- recording student participation and any school-specific assessment issues via the test administrator web portal.

The test administrator web portal

A web portal was created for use by the NAP–ICT Literacy test administrators. This website was designed to assist test administrators with administering the assessment to their allocated schools throughout NAP–ICT Literacy 2017.

This portal had two main purposes:

1. It provided an easy-to-use repository for all school-related information needed by each test administrator. It listed each test administrator's allocated schools and contained important information about each school for review. This information included:
    i. the assessment date for each school
    ii. the name and contact details of the school contact officer, IT coordinator and principal at each school
    iii. the address of the school
    iv. the names and login details of all students selected to participate in the assessment
    v. any other important information about the school's participation (e.g. whether the TA was required to run the assessment in two smaller sessions due to bandwidth limitations).
2. It allowed test administrators to relate important information about student participation in the assessment in a secure, fast and reliable manner after the assessment had taken place. The portal provided test administrators with a

means of informing ACER about which students did not take part in the assessment, and for what reason. It also enabled them to enter comments or concerns about the school's participation in the assessment more generally.

Assessment administration

Schools were allowed to schedule the assessment on a day that suited them within the official assessment period. In 2017, the assessment period was as follows:

Monday 16 October–Friday 3 November

The NAP–ICT Literacy assessment consisted of an introductory tutorial (10 minutes), four assessment modules (20 minutes each) and a student survey (20 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 two 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 4.2 shows the suggested timing of the assessment session.

Table 4.2: 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	20 minutes

Flexible administration

To include eight schools in extremely remote locations, modifications to the standard method of administration were made.

- The school contact person (i.e. school teacher) administered the assessment instead of an external test administrator.
- The number of modules to be completed by each student was reduced from four to two, and the timer function was removed from the application.

- Administering the assessment, to either groups of students or individuals, took place over a series of weeks where it was possible and appropriate to do so (as opposed to one scheduled assessment).
- Teachers were able to read out the instructions and questions to the students (similar to the provision in the regular delivery for test administrators to read instructions and questions to students requiring support).

These provisions aimed to improve the quality and representativeness of very remote school data, and to therefore provide a more representative picture of the national achievements in NAP–ICT Literacy.

Data capture

In 2017, all participating schools were able to undertake the assessment via the online delivery method and using school- or student-supplied computers. There were no instances of schools having to use the 'backup' delivery methods used previously, such as the USB delivery or mini-server solutions.

Return visits to schools

Test administrators were required to revisit 39 standard administration schools. Return visits were required when fewer than 80 per cent of the sampled students were present on the day of the scheduled assessment due to illness or other unexpected absenteeism.

Quality monitor visits

In line with quality assurance processes, ACER sent 12 trained quality monitors to five per cent 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. The quality monitor report template is provided in Appendix 3.

ONLINE MARKING PROCEDURES AND MARKER TRAINING

The marking of this assessment took place at the ACER marking centre in Sydney. As all the student survey and achievement data were collected electronically, this assessment program did not require data entry.

ACER employed 16 markers and four group leaders to score the NAP–ICT Literacy student responses over a two-and-a-half week period in November 2017. The same markers from the field trial and previous cycles of the assessment were used for the main study. This assisted in maintaining the consistency of the applied marking rubric for the trend items, as well as making the training process more efficient and reliable.

Markers were trained on one item from one module at a time and then scored all student responses for this one item. This meant that markers were focused only on one item at a time, making it easier to remember scoring criteria and enabling markers to rapidly score a large set of data.

Either one or two control scripts were set for each of the marked items. These control scripts were pre-selected and given a score by the marking supervisor. As the markers moved through the items, the marking software then provided a summary of the scores given by the marker compared to the score given by the supervisor. In the event that a marker gave a score that was inconsistent with the score given by the supervisor, the scoring criteria were clarified.

In addition to the use of control scripts, spot checking was instituted as a quality-control measure throughout the marking operation. For each marked item, approximately 10 per cent of responses were spot checked (i.e. marked again) by the designated lead markers. The spot-checking process provided an opportunity to identify when particular items were being marked inconsistently, either by the whole group or an individual marker. If inconsistent marking was identified, the markers were retrained on the specific item and the responses were re-marked. This in turn improved the quality of the data used in school and public reports.

SCHOOL REPORTS

After all test data were collected, cleaned, marked and analysed, ACER provided access to interactive, online summary reports for all participating NAP–ICT Literacy schools.

For the first three 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.

Since NAP–ICT Literacy 2014, ACER has 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 as 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).

Scaled scores were not provided in school reports as there was not sufficient time to complete the equating and scaling analysis between the end of the marking process and the end of the school year.

Schools were advised to read their report in conjunction with the NAP–ICT Literacy *School Report Instructions* provided in Appendix 4. For all items that had a maximum score of two or above, the descriptor sheet (Appendix 5) outlined the skills needed to obtain additional marks for this item.

Chapter 5: Data management

The integrity and accuracy of the information contained in the central database was fundamental to maintaining the quality of the resulting data. This chapter provides details of the information contained in the database, how the information was derived, and what steps were taken to ensure the quality of the data.

A system of identification (ID) codes was used to track information in the database. The sampling frame ID was a unique ID for each school that linked schools in the sample to the original sampling frame. The school ID was a six-digit concatenation of codes relating to cohort, state and sector as well as a unique school number. The student ID included the school ID and also a two-digit student number (01–20) that was unique to each student within the school.

SAMPLING DATA

The sampling data were produced by the sampling team, and comprised a list of all sampled schools together with their replacements. Information provided about each school included address details, school-level variables of interest (sector, geo-location, and the Socio-Economic Indexes for Areas [SEIFA]), sampling information such as measure of size (MOS), and the school's participation status.

The participation status of each school was updated as needed by the administration team. Post-assessment, this information was required for computing the school sample weights needed to provide accurate population estimates (see chapter 3).

SCHOOL AND STUDENT DATA

The school-level data were derived from both the sample data and the details provided directly to ACER by each of the participating schools. These data included contact details for the school contact person and principal, as well as information obtained from the school via the NAP–ICT Literacy Online School Administration website. This information included data about the school's computer resources, preferred assessment dates and the list of sampled students from each school.

After the assessment had been administered, student participation information supplied from test administrators on the test administrator web portal was cross-referenced with the cognitive and survey data sourced from each sampled student so that any instances of missing data could be flagged. In the event of any inconsistencies being detected between data records, each instance was investigated and subsequently remedied, as outlined in the data-cleaning section below.

FINAL STUDENT DATA

The final student data came from the four sources:

1. the cognitive assessment data and student survey data
2. the student background data provided by the education authorities in each jurisdiction (directly, where possible) or the schools themselves
3. student participation data obtained from the student-tracking database
4. school-level variables transferred from the sample database.

In addition to these variables, student weights and replicate weights were computed and added to the database.

Data capture

Student cognitive and survey data were captured via the online test program using school or student computers connected to the internet.

As all the student survey and achievement data were collected electronically, scanning and/or manual data entry of assessment data was not required.

Data cleaning

The following steps were undertaken to clean the cognitive, survey and background data.

1. Students with invalid usernames were removed from the database.
2. Students with no valid responses to the cognitive test were removed.
3. Patterns of missing values were explored and, where appropriate, recoded to 'not reached'. (Items were assumed not to be reached by a student if a string of items at the end of the test form was missing, except for the first missing response.)
4. After computing the age of students in years, all ages outside a range of six years for each year level (students outside the ranges nine to 14 years in Year 6, and 13 to 18 years in Year 10) were set to missing.
5. Missing sex of the student was attributed where it could be inferred from the school (i.e. where single-sex) or name of the student.
6. All dates of birth were converted to the standard dd/mm/yyyy format, and any auto-formatting executed by the spreadsheet that rendered dates of birth illegible was reversed and corrected.

Student background data

The student list contained the student background variables that were required. Table 5.1 presents the definitions of the variables used for collection.

Table 5.1: Variable definitions for student background data

Category	Description	Codes
Sex	Sex of student	1 = female 2 = male
Date of birth	Date of birth of student	Free response dd/mm/yyyy

Category	Description	Codes
Country of birth	Country student was born in	1101 = Australia (Codes for all other countries as per Standard Australian Classification of Countries [SACC] Coding Index 2nd edn)
Indigenous status	A student is considered to be Indigenous if he or she identifies as being of Aboriginal and/or Torres Strait Islander origin.	1 = Aboriginal but not TSI origin 2 = TSI but not Aboriginal origin 3 = Both Aboriginal and TSI origin 4 = Neither Aboriginal nor TSI origin 9 = Not stated/unknown
Parent school education	The highest year of primary or secondary education each parent/guardian has completed	1 = Year 9 or equivalent or below 2 = Year 10 3 = Year 11 4 = Year 12 0 = Not stated/unknown/Does not have Parent 1 or 2
Parent non-school education	The highest qualification attained by each parent/guardian in any area of study other than school education	5 = Certificate I to IV (including Trade Certificate) 6 = Advanced Diploma/Diploma 7 = Bachelor Degree or above 8 = No non-school qualification 0 = Not stated/unknown/Does not have Parent 1 or 2
Parent occupation group	The occupation group, which includes the main work undertaken by each parent/guardian	1 = Senior management; professionals 2 = Other management; associate professionals 3 = Tradespeople; skilled office, sales and service 4 = Unskilled workers; hospitality 8 = Not in paid work in last 12 months 9 = Not stated/unknown/Does not have Parent 1 or 2
Student/Parent home language	The main language spoken in the home by the respondent	1201 = English (Codes for all other languages as per the Australian Standard Classification of Languages [ASCL] Coding Index 2nd edn)

Variables were also derived for the purposes of reporting achievement outcomes. The transformations undertaken followed the guidelines in the *Data Standards Manual* (ACARA, 2017). Table 5.2 shows the derived variables and the transformation rules used to recode them.

Table 5.2: Transformation rules used to derive student background variables for reporting

Variable	Name	Transformation rule
Geo-location – school	GEOLOC	Derived from geographical location classification (metropolitan, regional, remote).
Gender	GENDER	Classified by response; missing data is treated as missing unless the student was present at a single-sex school or unless deduced from student name.
Age – years	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. Otherwise coded as Non-Indigenous (0).
Student born in Australia	BORNAUS	The reporting variable (COB) was coded as Australia (1) or Not Australia (2) according to the SACC codes.
LBOTE	LBOTE	Each of the three LBOTE questions (student, mother or father) 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 of student, mother or father. If all three responses were Not LOTE then the LBOTE variable was designated as Not 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.
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.

Cognitive achievement data

The cognitive achievement data was collected with a computer-based assessment. Following data cleaning, the cognitive items were used to construct the NAP–ICT Literacy achievement scale. Chapter 6 details the scaling procedures used. The final student database contained original responses to the cognitive items and the scaled student achievement scores. In total, 111 items were used for scaling, of which 94 were used for both year levels, one for Year 6 students only and 16 for Year 10 students only.

Four codes were applied for missing responses to cognitive items. Code ‘9’ was used for embedded missing responses, code ‘r’ for ‘not reached’ items (consecutive missing responses at the end of a booklet with exception of the first one which was coded as embedded missing), code ‘t’ for technical issue and code ‘n’ for ‘not administered’ (when the item was not in a booklet).

Student survey data

The student survey was included to assess students' experience of using computers and affective processes as described in the assessment framework. The content of the constructs are described in Table 5.3 and the survey is provided in Appendix 1. Sixteen indices were derived from student responses to the survey items.

Student responses to the survey were scaled to derive frequency of activity or affective indices. The methodology for scaling survey items is consistent with the one used for cognitive test items and is described in chapter 6.

Missing responses to questions were coded in the database as '9' for missing responses and '7' for not administered. Missing scale scores were coded as '9999'.

Table 5.3: Definition of the indices and data collected via the student survey

Index name	Index	Questions	Number of questions	Original categories	Recode	Method
IMPACT	Students' perceptions of the importance of ICT use	Q5a to f	6	1,2,3,4	3,2,1,0	Scale
UTILSCH	Students' frequency of using study utilities on digital devices – at school	Q6a1 to j1	10	1,2,3,4,5,6	5,4,3,2,1,0	Scale
UTILOUT	Students' frequency of using study utilities on digital devices – outside school	Q6a2 to j2	10	1,2,3,4,5,6	5,4,3,2,1,0	Scale
ENTSCH	Students' frequency of using digital devices for entertainment purposes – at school	Q7a1 to e1	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
ENTOUT	Students' frequency of using digital devices for entertainment purposes – outside school	Q7a2 to e2	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
COMSCH	Students' frequency of using digital devices for communication activities – at school	Q8a1 to e1	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
COMOUT	Students' frequency of using digital devices for communication activities – outside school	Q9f2 to f2	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
TECSCH	Students' frequency of completing technological tasks using digital devices – at school	Q9a1 to g1	7	1,2,3,4,5,6	5,4,3,2,1,0	Scale
TECOUT	Students' frequency of completing technological tasks using digital devices – outside school	Q9a2 to g2	7	1,2,3,4,5,6	5,4,3,2,1,0	Scale
EFFICACY	Students' ICT self-efficacy	Q10a to i	9	1,2,3,4	3,2,1,0	Scale
ICTLEARN	Students' ICT learning at school	Q11a to j	10	1,2	1,0	Scale
PRODAPPS	Use of productivity applications for school-related purposes	Q12a to c, f	4	1,2,3,4	0,1,2,3	Scale
SPECAPPS	Use of specialist applications for school-related purposes	Q12d, e, g to j, l to n	9	1,2,3,4	0,1,2,3	Scale
GENACT	Use of digital devices in general classroom activities	Q13a, b to d, g, h, k, l	8	1,2,3,4	0,1,2,3	Scale
SPEACT	Use of digital devices in specialised classroom activities	Q13e, i, j, m to o	6	1,2,3,4	0,1,2,3	Scale
COMPTHIN	Students' computational thinking–related learning at school	Q14a, c to g	6	1,2,3,4	3,2,1,0	Scale

Student sample weight

In addition to students' responses, scaled scores, survey indices and background data, student sampling weights were added to the database. Computation of student weights is described in chapter 3. In order to compute unbiased standard errors, 169 replication weights were constructed and added to the database. Chapter 8 describes how these replication weights were computed and how they were, and should be, used for computing standard errors.

Chapter 6: 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*, θ_n is the estimated ability of person *n,* and δ_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 θ_n.

For items with more than two (*k*) categories (as for example with Likert-type items) the more general Rasch partial credit model (Masters & 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*, θ_n denotes the person's ability, the item parameter δ_i gives the location of the item on the latent continuum, and τ_{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 4 software: see Adams, Wu & Wilson, 2015).

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 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 119 items in the test, eight were removed from the scale due to poor fit statistics at both year levels (FPC11, FPC12, NI13M4Q13, NI13M5Q02, NI13M5Q06, NI13M5Q07, NI17M2Q16E and NI17M2Q16F). In addition, one item was removed at Year 6 only (NI17M2Q14) and another was removed at Year 10 only (NI17M2Q02). Consequently, these items were not used to estimate student performance.

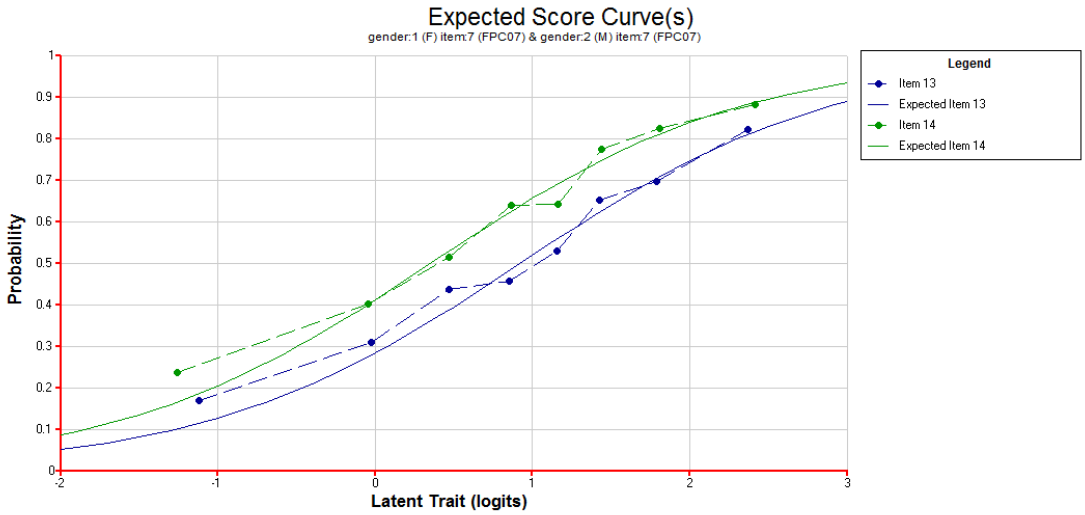
Final decisions on retaining test items were based on a range of different criteria. Generally, items were flagged for review if first item calibrations showed a considerably higher infit statistic (e.g. infit > 1.2) as well as low item–rest correlation (0.2 or lower). The ACER Project Team considered 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 6.1. The 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. Only one item was not used as a horizontal link item on the basis of significant change in gender DIF between 2014 and 2017 (NI13M5Q18).

Figure 6.1: 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 94 common items between Year 6 and Year 10, 77 were used as link items and 17 were treated as different items for the two 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).

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. After removing items with unsatisfactory scaling characteristics, 111 items were used for scaling. One of these items was administered at Year 6 only and 16 at Year 10 only. The other 94 items were used for both year levels. Of the 94 common items, 77 were used as vertical link items and 17 were regarded as different items in the two year levels.

The difficulties of these 77 link items are plotted in Figure 6.2, with Year 6 estimates on the horizontal axis and Year 10 estimates on the vertical axis. For each set of 77 items, their respective difficulties were centred to having a mean of zero for this graph. The thick broken lines represent the boundaries of the confidence intervals around differences from zero (the identity line indicating that there are no differences

[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.

in item difficulty). The difference between the two relative difficulties was less than half a logit for each of the 77 vertical link items.

Figure 6.2: Scatter plot of relative item difficulties for Year 6 and Year 10

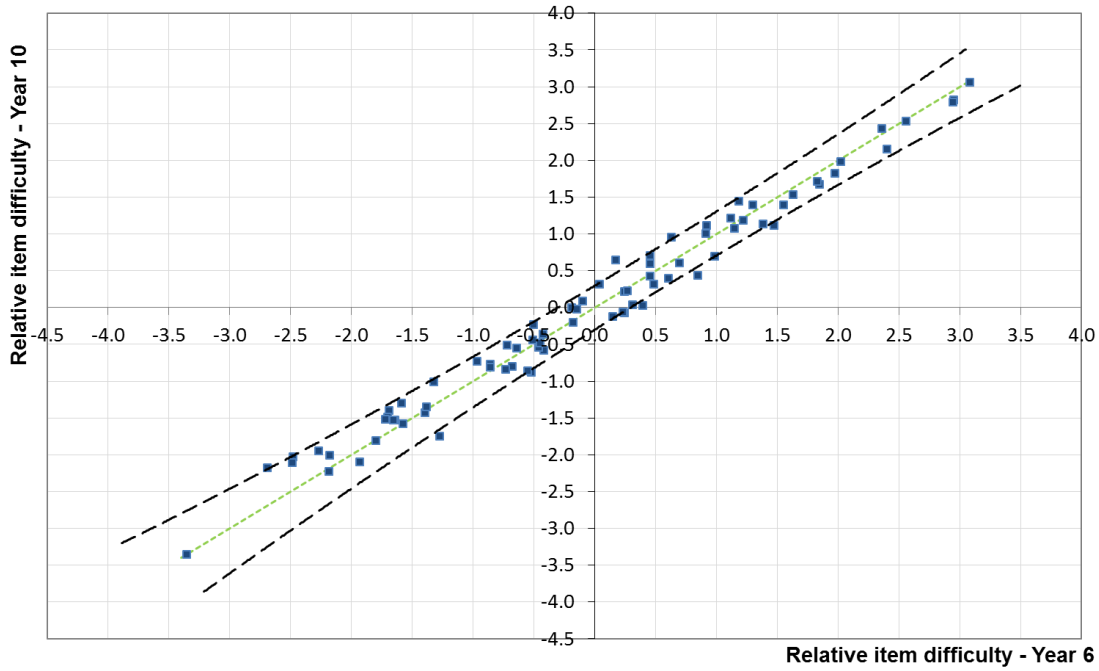
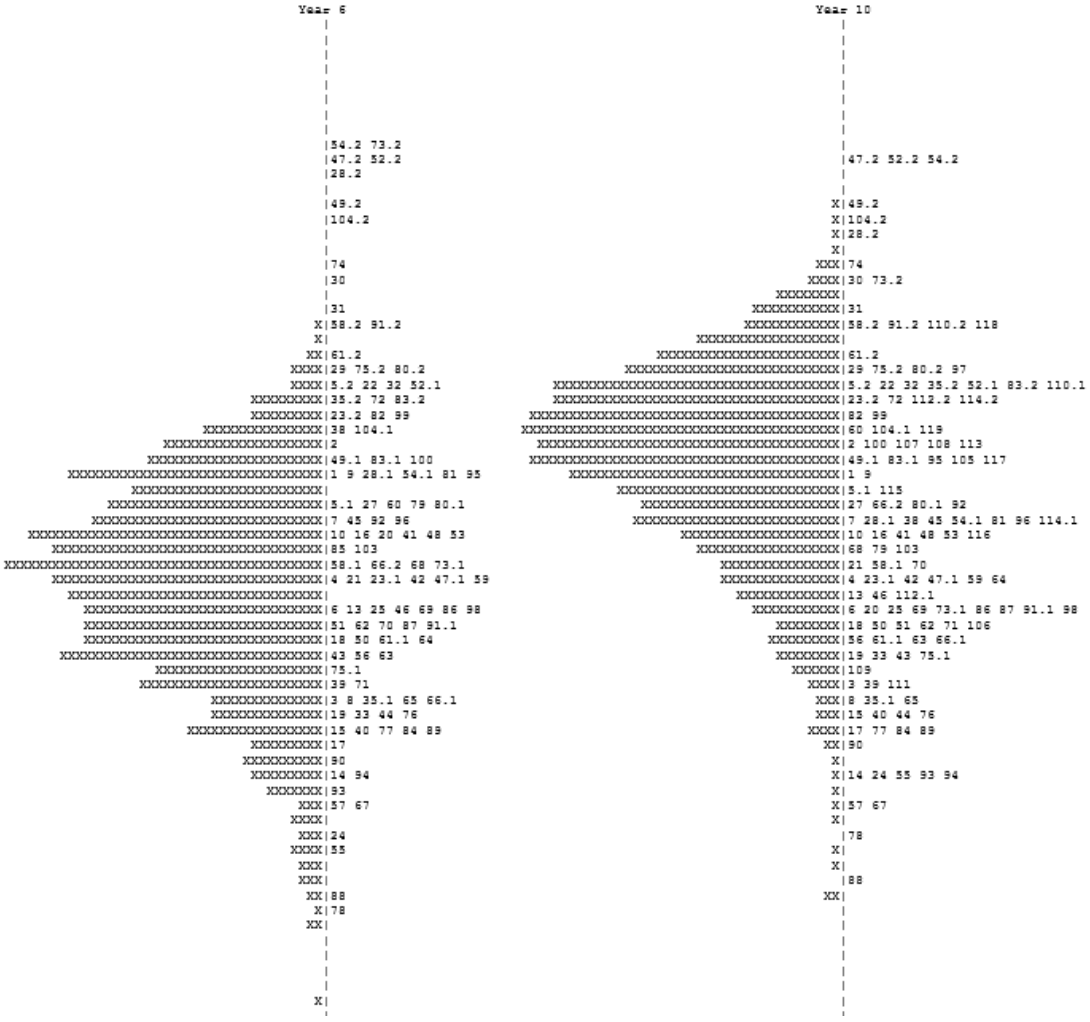


Figure 6.3 presents item maps for the two year levels. The crosses represent students, the numbers represent items, and in the case of a partial credit item the threshold is included. The vertical line represents the measured ICT literacy scale with high-performing students and difficult items at the top and low-performing students and easy items at the bottom. The two 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 per cent chance of responding correctly to that item. The figure shows that the test was well targeted at each year level.

Figure 6.3: Item maps for Year 6 and Year 10



In the second stage of our scaling procedures, Year 6 data was scaled first. Then Year 10 data was scaled anchoring the estimates of the 77 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 0.91 for Year 6 and 0.86 for Year 10 (ACER ConQuest estimate). Appendix 7 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 three indicates if an item was used as a horizontal link (trend) item.

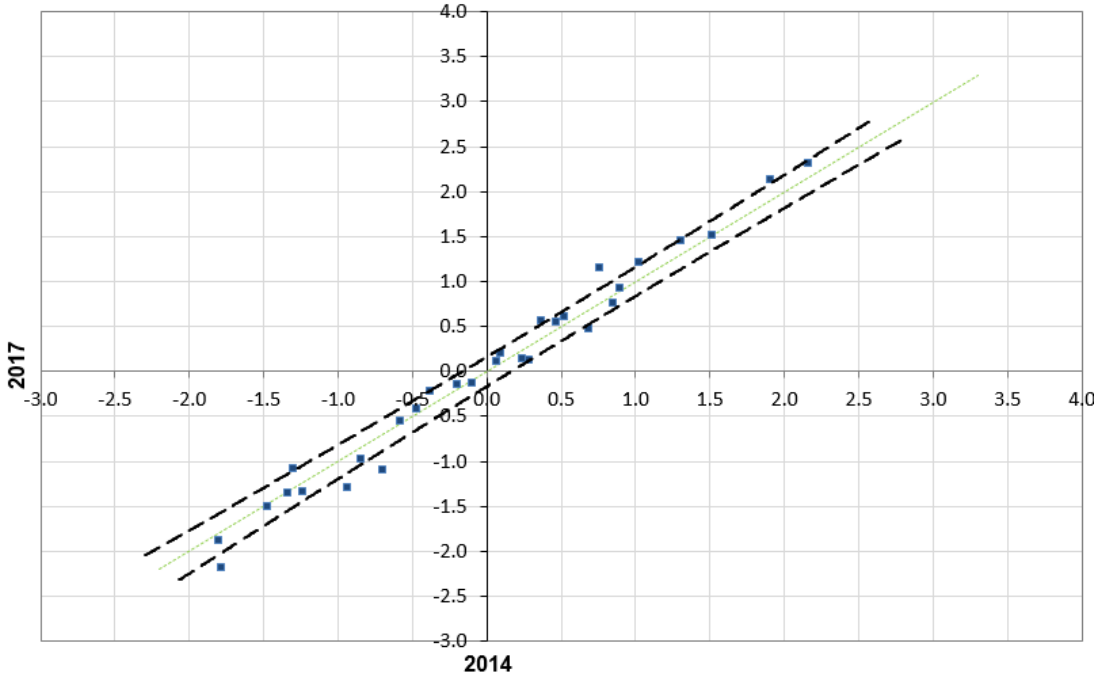
[6] This means that a student with a scale score equal to the item difficulty parameters has 62% probability of giving a correct response to the test question.

HORIZONTAL EQUATING

Test items at both year levels consisted of new and old items. The old items 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 2017 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 2017 and 2014 were compared. Nine out of 39 common items showed large DIF between 2017 and 2014 and were not used for equating. For both assessments, this set of link items showed similar average discrimination (item–rest correlation was 0.43 in 2014 and 0.44 in 2017) and the average DIF with respect to gender in both cycles was close to zero (0.00 logits in 2014 and 0.01 logits in 2017).

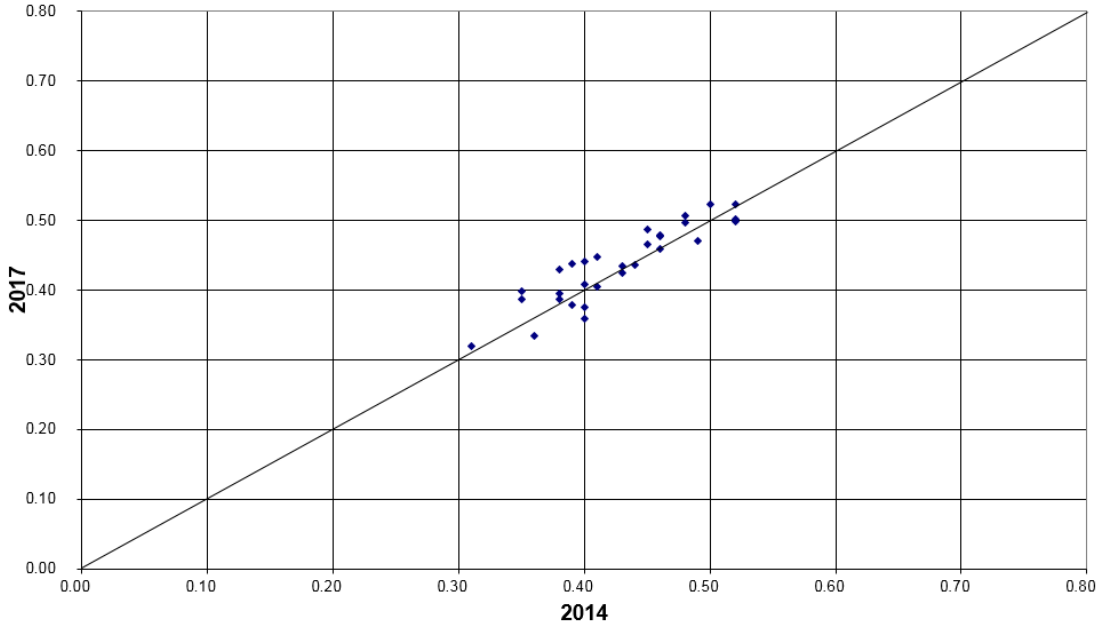
Figure 6.4 shows a scatter plot of item difficulties for horizontal link items in 2014 and 2017. The average difficulty of each set of link items was set to zero and each dot represents one link item. The expected location under the assumption of complete measurement equivalence across both assessments is the identity line ($y = x$). The thick broken lines represent the 95 per cent confidence interval around the expected values and 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 six, the approximate design effect in 2014. 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 about 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, eight items were excluded from equating (and one was excluded because of a large change in gender DIF).

Figure 6.4: Relative item difficulties in logits of horizontal link items between 2014 and 2017



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 2014 and 2017 values of these discrimination indices are plotted in Figure 6.5.

Figure 6.5: Discrimination of link items in 2014 and 2017



After the selection of link items, common item equating was used to shift the 2017 scale onto the historical scale. The value of the shift is the difference in average difficulty of the link items between 2014 and 2017 (–0.167). After applying this shift, the same transformation was applied as in 2014. Original scale scores (logits) were converted as:

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

where θ_n^* is the transformed knowledge estimate for student *n*, θ_n is the original knowledge estimate for student *n* in logits, $\bar{\theta}_{05}$ is the mean ability in logits of the Year 6 students in 2005 (–0.34197), and σ_{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 2017 data with the 2014 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 sub-set 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:

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

Further, let:

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

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

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

The link error between 2014 and 2017 is 5.52 scale score points. The equating error between 2017 and 2014 is the sum of the two equating errors between adjacent cycles.

$$error_{2017-2011} = \sqrt{4.01^2 + 5.52^2} = 6.83$$

The equating error between 2017 and 2008 is the sum of the three equating errors between the three cycles.

$$error_{2017-2008} = \sqrt{5.712^2 + 4.010^2 + 5.52^2} = 8.90$$

$$error_{2017-2005} = \sqrt{4.300^2 + 5.712^2 + 4.010^2 + 5.52^2} = 9.88$$

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 & Sheehan, 1987; von Davier, Gonzalez, & Mislevy, 2009). Here, 'not reached' items were included as incorrect responses, just like other (embedded) missing responses. 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 (see a detailed description in Adams & Wu, 2002). The ACER ConQuest Version 4.0 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 sector, geographic location of the school, SEIFA levels and the student-level variables of gender and Indigenous status. 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 and state or territory. Subsequently, the components that explained 99 per cent 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 8.

SCALING SURVEY ITEMS

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

Exploratory factor analyses were carried out on newly developed or heavily modified questions (questions 12, 13 and 14) to provide evidence of the factor structure (suggesting a two-factor solution to questions 12 and 13, and a one-factor solution to question 14 that fit the conceptual model).Confirmatory factor analyses were carried out for all scales. For example, there are five items designed to measure perceptions of the importance of ICT use (question 5) and nine 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 6.1 describes the main characteristics of the survey scales including the scale reliabilities (Cronbach's alpha) and their respective correlation with ICT literacy scores.

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

Student and item parameters were estimated using the ACER ConQuest Version 4.15 software. Items were scaled using the Rasch partial credit model (Masters & 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.

Table 6.1: 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 to f	6	0.76	0.82	0.11	0.15
Students' frequency of using study utilities on digital devices – at school	*UTILSCH*	Q6a1 to j1	10	0.80	0.81	-0.15	-0.10
Students' frequency of using study utilities on digital devices – outside school	*UTILOUT*	Q6a2 to j2	10	0.83	0.83	-0.11	-0.02
Students' frequency of using digital devices for entertainment purposes – at school	*ENTSCH*	Q7a1 to e1	5	0.75	0.71	-0.23	-0.17
Students' frequency of using digital devices for entertainment purposes – outside school	*ENTOUT*	Q7a2 to e2	5	0.72	0.66	-0.02	0.00
Students' frequency of using digital devices for communication activities – at school	*COMSCH*	Q8a1 to e1	5	0.73	0.73	-0.21	-0.10
Students' frequency of using digital devices for communication activities – outside school	*COMOUT*	Q8a2 to f2	6	0.80	0.66	-0.08	0.04
Students' frequency of completing technological tasks using digital devices – at school	*TECSCH*	Q9a1 to g1	7	0.80	0.85	-0.26	-0.22
Students' frequency of completing technological tasks using digital devices – outside school	*TECOUT*	Q9a2 to g2	7	0.83	0.85	-0.20	-0.14
Students' ICT self-efficacy	*EFFICACY*	Q10a to i	9	0.81	0.79	0.27	0.32
Students' ICT learning at school	*ICTLEARN*	Q11a to j	10	0.76	0.81	0.11	0.00

Name	Index name	Question number	Number of items	Cronbach's alpha		Correlation with achievement	
				Year 6	Year 10	Year 6	Year 10
Use of productivity applications for school-related purposes	*PRODAPPS*	Q12a to c, f	4	0.73	0.72	0.27	0.32
Use of specialist applications for school-related purposes	*SPECAPPS*	Q12d, e, g to j, l to n	9	0.87	0.91	-0.21	-0.19
Use of digital devices in general classroom activities	*GENACT*	Q13a, b to d, g, h, k, l	8	0.85	0.88	0.17	0.26
Use of digital devices in specialised classroom activities	*SPEACT*	Q13e, i, j, m to o	6	0.84	0.87	-0.18	-0.16
Students' computational thinking–related learning at school	*COMPTHIN*	Q14a, c to g	6	0.90	0.94	-0.14	-0.21

Chapter 7: Achievement levels and the proficient standards

In addition to analysing and reporting ICT literacy using the NAP–ICT Literacy scale, two other summary measures of student achievement were used. One of these measures referenced a set of six achievement 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 achievement level provided a measure of student achievement. Furthermore, the proficient standards represent points on the NAP–ICT Literacy scale indicating a 'challenging but reasonable' achievement 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 2012* (ACARA, 2013). This chapter describes the development of these two measures.

ACHIEVEMENT 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 six achievement levels with substantive descriptions was established in 2005. These described levels are syntheses of the item contents within each level. Comparison of student achievement against the achievement levels provides an empirically and substantively convenient way of describing profiles of student achievement.

Students whose results are located within a particular level of achievement are typically able to demonstrate the understandings and skills associated with that level, and also typically possess the understandings and skills defined as applying at lower achievement levels.

Creating the achievement levels

The achievement 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 three 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 two parameters for defining achievement levels were adopted:

- setting the response probability for the analysis of data at $p = 0.62$
- setting the width of the achievement 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 achievement levels:

- A student whose result places him/her at the lowest possible point of the achievement level is likely to get approximately 50 per cent correct on a test made up of items spread uniformly across the level, from the easiest to the most difficult.
- A student whose result places him/her at the lowest possible point of the achievement level is likely to get 62 per cent correct on a test made up of items similar to the easiest items in the level.
- A student at the top of the achievement level is likely to get 82 per cent 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 achievement 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 achievement 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.

Achievement level cut-points

Six achievement levels were established for reporting student performance on the assessment. Table 7.1 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 2017.

Describing achievement levels

Information about the items in each level was used to develop summary descriptions of the ICT literacy associated with different levels of achievement. 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 achievement level descriptions, together with descriptions of examples of achievement at each level, are described in Appendix 9.

Table 7.1: Achievement level cut-points and percentage of Year 6 and Year 10 students in each level in 2017

Achievement Level	Cut-points		Percentage	
	Logits	Scale	Year 6	Year 10
Level 6				0 (±0.1)
	3.50	769		
Level 5			0 (±0.2)	8 (±1.3)
	2.25	649		
Level 4			13 (±1.4)	46 (±2.6)
	1.00	529		
Level 3			41 (±1.9)	33 (±2.5)
	-0.25	409		
Level 2			33 (±2.2)	10 (±1.5)
	-1.50	289		
Level 1			13 (±1.6)	3 (±1.0)

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 MCEETYA's Performance Measurement and Reporting Taskforce (PMRT) 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 judgemental technique, requires stakeholders to examine the test items and the results from the national assessments and agree on a proficient standard for the two year levels.

The proficient standards are points on the achievement scale that represent a 'challenging but reasonable' expectation about what typical Year 6 and Year 10 students should achieve by the end of their respective years of study. The concept of a proficient standard refers to the knowledge, skills and understanding that one would expect to observe in a student who was making adequate learning progress at their own year level. The proficiency of Year 6 students and their expected performance are different to what one would expect as proficient from Year 10 students. The Year 6 and Year 10 proficient standards were established in NAP–ICT Literacy 2005 as a result of consultations (over two days for each year level) with ICT education experts, as well as representatives from all states, territories and school sectors. The standards-setting groups included currently practising teachers with specific ICT expertise, ICT curriculum experts and educational assessment experts. The process of establishing the proficiency cut-points for each of Year 6 and Year 10 was described in the report on the first NAP–ICT Literacy assessment in 2005 (MCEETYA, 2007).

The proficient standard for Year 6 was established as the boundary between levels 2 and 3, equal to a score of 409 on the NAP–ICT Literacy scale. In 2017, 53 per cent of Year 6 students reached or exceeded the Year 6 proficient standard. The proficient standard for Year 10 was established as the boundary between levels 3 and 4, equal to a score of 529 on the NAP–ICT Literacy scale. In 2017, 54 per cent of Year 10 students reached or exceeded the Year 10 proficient standard.

Chapter 8: Reporting of results

The students assessed in NAP–ICT Literacy 2017 were selected using a two-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 on sampling and weighting). Applying cluster sampling techniques is an efficient and economical way of selecting students in educational research. However, as these samples were not obtained through (one-stage) simple random sampling, standard formulae to obtain sampling errors of population estimates are not appropriate. In addition, NAP–ICT Literacy estimates were obtained using plausible value methodology (see chapter 6 on scaling procedures), which allows for estimating and combining the measurement error of achievement scores with their sampling error.

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 *National Assessment Program – ICT Literacy Years 6 and 10 Report 2017*.

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 & 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 five plausible values for NAP–ICT Literacy. In addition, for comparing achievement test scores with those from previous cycles (2005, 2008, 2011 and 2014), 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 2017 there were 169 sampling zones in Year 6 and 159 in Year 10.

Within each sampling zone, one school was randomly assigned a value of two, 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, 169 replicate weights were computed. In Year 10, which had only 159 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.

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)* is the statistic *t* estimated for the population using the final sampling weights, and $t(J_h)$ is 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 such as 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 five plausible values, with standard errors reflecting both sampling and measurement

[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 two halves and each half assigned to the two other schools in the final sampling zone to form *pseudo-schools*.

[9] Conceptual background and application of macros with examples are described in the *PISA Data Analysis Manual* SPSS®, 2nd edn (OECD, 2009b).

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 five 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.

The 95 per cent confidence interval, as presented in the *National Assessment Program – ICT Literacy Years 6 and 10 Report 2017*, was computed as 1.96 times the standard error. The actual 95 per cent 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 *National Assessment Program – ICT Literacy Years 6 and 10 Report 2017* included comparisons of achievement test results across states and territories; that is, means of scales and percentages were compared in graphs and tables. Each population estimate was accompanied by its 95 per cent confidence interval. In addition, tests of significance for the difference between estimates were provided, in order to flag results that are significant at the five per cent level ($p < 0.05$), which indicates a 95 per cent probability that these differences are *not* a result of sampling and measurement error.

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

- between states and territories
- between student sub-groups
- between this assessment cycle and previous ones in 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 (α = 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 two means *i* and *j*. This computation of the standard error was only applied for comparisons between two samples that had been drawn independently from each other (e.g. jurisdictions or year levels).

In the 2017 public report, differences were also estimated between percentages attaining the proficient standards in states and territories. The method for estimating the standard error of the difference between percentages is identical to the procedure described for mean differences.

Mean differences between dependent 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, 2009b, for more detailed information). Here, the covariance between the two standard errors for sub-group 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 sub-groups from the same sample (e.g. groups classified according to student background characteristics) were derived using the SPSS® Replicates add-in. Differences between sub-groups were considered significant when the test statistic *t* was outside the critical values ±1.96 (α = 0.05). The value *t* was calculated by dividing the mean difference by its standard error.

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

The *National Assessment Program – ICT Literacy Years 6 and 10 Report 2017* also included 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 2017 and the previous assessment in 2014 is 5.52 score points on the NAP–ICT Literacy scale for both year levels. When testing the difference of a statistic between these two assessment cycles, the standard error of the difference was computed as follows:

$$SE(t_{17} - t_{14}) = \sqrt{SE_{17}^2 + SE_{14}^2 + EqErr_{17\_14}^2}$$

where *t* can be any statistic in units on the NAP–ICT Literacy scale (mean, percentile, gender difference, but *not* percentages), SE_{17}^2 is the respective standard error of this statistic in 2017, SE_{14}^2 is the corresponding standard error in 2014, and $EqErr_{17\_14}^2$ is the equating error for comparing 2017 with 2014 results.

When comparing population estimates between 2017 and the third assessment in 2011, two equating errors (between 2017 and 2014 and between 2014 and 2011) 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 2017 and 2011:

$$SE(\mu_{17} - \mu_{11}) = \sqrt{SE_{17}^2 + SE_{11}^2 + EqErr_{17\_11}^2}$$

where $EqErr_{17\_11}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 2017 and 2014 (5.52 score points), as well as between 2014 and 2011 (4.01 score points). This combined equating error was equal to 6.83 score points and was calculated as:

$$EqErr_{17\_11} = \sqrt{EqErr_{17_{14}}^2 + EqErr_{14_{11}}^2}$$

Similarly, for comparisons between 2017 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:

$$SE(\mu_{17} - \mu_{05}) = \sqrt{SE_{17}^2 + SE_{05}^2 + EqErr_{17\_05}^2}$$

$\mathrm{EqErr}_{14\_05}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 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 (4.30 score points). The combined equating error was equal to 8.20 score points, and was calculated as:

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

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 5.52 score points for comparisons between 2017 and 2014, 6.83 score points for comparisons between 2017 and 2011, 8.90 score points for comparisons between 2017 and 2008, and 9.88 score points for comparisons between 2017 and 2005. Percentages of students at or above each replicate cut-point (ρ_n) were computed and the equating error was estimated as:

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

where ρ_o is the percentage of students at or above the (reported) proficient standard. The standard errors of the differences in percentages at or above proficient standards between 2017 and 2014 were calculated as:

$$SE(\rho_{17} - \rho_{14}) = \sqrt{SE(\rho_{17})^2 + SE(\rho_{14})^2 + EqErr(\rho_{17\_14})^2}$$

where ρ_{17} is the percentages at or above the proficient standard in 2017 and ρ_{14} in 2014, $SE(\rho_{17})$, and $SE(\rho_{14})$ is their respective standard errors, and $EqErr(\rho_{17\_14})$ is the equating error for comparisons. For estimating the standard error of the corresponding differences in percentages at or above proficient standards between 2017 and 2011, the following formula was used:

$$SE(\rho_{17} - \rho_{11}) = \sqrt{SE(\rho_{17})^2 + SE(\rho_{11})^2 + EqErr(\rho_{17\_11})^2}$$

Likewise, for estimating the standard error of the corresponding differences in percentages at or above proficient standards between 2017 and 2008 and between 2017 and 2005, the following formulae were used:

$$SE(\rho_{17} - \rho_{08}) = \sqrt{SE(\rho_{17})^2 + SE(\rho_{08})^2 + EqErr(\rho_{17\_08})^2}$$

$$SE(\rho_{17} - \rho_{05}) = \sqrt{SE(\rho_{17})^2 + SE(\rho_{05})^2 + EqErr\left(\rho_{17\_05}\right)^2}$$

For NAP–ICT Literacy 2017, 5,000 replicate cut-points were created. Equating errors on percentages were estimated for each sample or sub-sample of interest. Table 8.1 and Table 8.2 show the values of these equating errors for Year 6 and Year 10, respectively.

Table 8.1: Year 6 equating errors for comparisons between percentages

Group	2017/2014	2017/2011	2017/2008	2017/2005
NSW	2.45	2.94	3.68	4.01
Vic.	1.76	2.22	2.93	3.25
Qld	2.23	2.72	3.48	3.83
WA	2.10	2.58	3.33	3.69
SA	1.89	2.36	3.14	3.53
Tas.	1.99	2.42	3.07	3.36
ACT	2.13	2.66	3.48	3.83
NT	1.91	2.29	2.92	3.21
Aust.	2.09	2.57	3.30	3.64
Female	3.66	2.55	3.31	3.66
Male	3.63	2.59	3.30	3.63
Non-Indigenous	2.16	2.65	3.40	3.75
Indigenous	1.13	1.39	1.82	2.03
Not LBOTE	2.20	2.70	3.47	3.83
LBOTE	1.92	2.32	2.92	3.20
Not born in Australia	2.31	2.76	3.45	3.77
Born in Australia	2.06	2.54	3.28	3.62
Metropolitan	2.18	2.66	3.40	3.74
Provincial	1.88	2.35	3.07	3.41
Remote	2.22	2.72	3.42	3.70
Senior managers and professionals	2.00	2.45	3.15	3.48
Other managers and associate professionals	1.95	2.41	3.16	3.51
Tradespeople & skilled office, sales and service staff	2.60	3.18	4.05	4.43
Unskilled workers, hospitality	2.28	2.67	3.24	3.51
Not in paid work in last 12 months	1.35	1.66	2.15	2.38
Year 9	2.66	3.08	3.76	4.06
Year 10	1.00	1.23	1.62	1.82
Year 11 or equivalent	2.46	2.85	3.34	3.54
Year 12 or equivalent	2.26	2.71	3.41	3.75
Certificate I to IV (including trade certificate)	2.32	2.87	3.69	4.05
Advanced diploma/Diploma	2.03	2.58	3.42	3.79
Bachelor degree or above	2.07	2.50	3.18	3.51

Table 8.2: Year 10 equating errors for comparisons between percentages

Group	2017/2014	2017/2011	2017/2008	2017/2005
NSW	2.35	2.87	3.68	4.06
Vic.	2.09	2.62	3.45	3.84
Qld	2.39	2.96	3.84	4.25
WA	2.25	2.83	3.77	4.21
SA	1.74	2.28	3.14	3.55
Tas.	2.62	3.26	4.21	4.63
ACT	2.87	3.32	4.02	4.36
NT	2.59	3.35	4.59	5.15
Aust.	2.21	2.76	3.61	4.01
Female	4.28	2.96	3.86	4.28
Male	3.78	2.58	3.40	3.78
Non-Indigenous	2.21	2.75	3.60	3.99
Indigenous	1.92	2.57	3.57	4.02
Not LBOTE	2.33	2.90	3.78	4.20
LBOTE	1.94	2.43	3.20	3.55
Not born in Australia	2.08	2.62	3.48	3.89
Born in Australia	2.26	2.80	3.66	4.06
Metropolitan	2.11	2.62	3.42	3.79
Provincial	2.52	3.16	4.16	4.61
Remote	2.26	2.93	3.99	4.48
Senior managers and professionals	1.81	2.22	2.90	3.23
Other managers and associate professionals	2.53	3.13	4.02	4.42
Tradespeople & skilled office, sales and service staff	2.45	3.18	4.34	4.88
Unskilled workers, hospitality	2.46	2.99	3.84	4.24
Not in paid work in last 12 months	1.58	2.06	2.81	3.15
Year 9	0.89	1.28	1.97	2.31
Year 10	1.26	1.54	2.11	2.42
Year 11 or equivalent	3.28	3.96	5.07	5.59
Year 12 or equivalent	2.82	3.47	4.45	4.90
Certificate I to IV (including trade certificate)	2.75	3.43	4.49	4.97
Advanced diploma/Diploma	2.69	3.28	4.13	4.51
Bachelor degree or above	1.69	2.13	2.85	3.19

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Appendix 1: Student survey

Q1 **How long have you been using the following digital devices?**
(Select one response for each digital device.)

	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
Computers (desktop or portable)	○	○	○	○	○
Tablets	○	○	○	○	○

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

	Computer (desktop or portable)	Tablet with on-screen keyboard	Tablet with external keyboard	Smartphone (to access the internet or use apps)	None
At school	☐	☐	☐	☐	☐
Outside of school	☐	☐	☐	☐	☐

Q3 **Do you have your own portable digital 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
Notebook computer or netbook	○	○	○	○
Tablet	○	○	○	○

Q4 **How often do you use each type of digital device in the following places?**
(Use drop-down menu to select one option for each of **At School** and **Outside of School**.)

	At school	Outside of school
Desktop, laptop, netbook		
Tablet		

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 digital devices because they help me improve the quality of my work.	○	○	○	○
I like using digital devices because they make work easier.	○	○	○	○
I enjoy using digital devices because they help me to work with others.	○	○	○	○
I enjoy using digital devices because they help me to communicate with my friends.	○	○	○	○
I like using digital devices to find new ways to do things.	○	○	○	○
It is very important to me to work with a digital device.	○	○	○	○

Remember to scroll.

Q6 **How often do you use a digital 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 write documents		
Use spreadsheets to draw 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		
Contribute written material or digital products (e.g. art work or photographic images) to online content		
Watch online videos to support your own learning		
Organise your program of work on a topic using a learning management system (e.g. Moodle, Compass)		
Reflect on your learning experiences (e.g. through a blog)		

Q7 **How often do you use a digital 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 downloaded or streamed videos for entertainment		
Play single-player games		
Play multi-player games		
Use software to create sounds/music, movies, animations or artwork		
Listen to downloaded or streamed music or other audio for entertainment		

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

	At school	Outside of school
Emailing		
Chatting		
Write or reply to blogs or forum threads		
Use voice or video chat to communicate with people online (e.g. Skype, FaceTime)		
Upload text, images or video to an online profile		
Communicate with others using social media (e.g. Facebook, Twitter, Snapchat, YouTube or similar)		

Q9 **How often do you use a digital 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
Write code, programs or macros (e.g. HTML, Javascript, Java, C+, Xcode, Swift, SDK)		
Create programs with a visual coding tool (e.g. Scratch, Kodable, GameMaker)		
Upload media you have created to the Internet		
Construct websites		
Use drawing, painting or graphics programs		
Use software to find and get rid of computer viruses		
Remix or edit music, video, images, or text to produce digital content		

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

Remember to scroll.

	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)	○	○	○	○
Enter data in a spreadsheet (e.g. using Microsoft Excel)	○	○	○	○
Use spreadsheet software (e.g. Microsoft Excel) to plot a graph	○	○	○	○
Download music from the Internet	○	○	○	○
Create a multimedia presentation (with sound, pictures, video)	○	○	○	○
Construct a webpage	○	○	○	○
Upload files (images, audio/video and text) to a website	○	○	○	○
Use social media (e.g. Facebook, Twitter, Snapchat, YouTube or similar)	○	○	○	○

Q11 **At school, 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 download music or video	○	○
The problems of using software to copy or download files for free (such as games or videos) that you otherwise would have to pay for	○	○
Checking the credentials of software patches before downloading and accepting them	○	○
Changing your password for internet services (e.g. email) regularly	○	○
Reporting spam to an authority (such as a teacher or parent)	○	○
Reading licence or usage agreements before you click on 'I agree' to install new software	○	○
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 use software to find and get rid of computer viruses	○	○

Q12 **How often do you use the following tools for school-related purposes?**
(Select one response for each purpose.)

Remember to scroll.

	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)	○	○	○	○
Spreadsheet software (e.g. Microsoft Excel)	○	○	○	○
Presentation software (e.g. Microsoft Powerpoint)	○	○	○	○
Software for capturing and editing media	○	○	○	○
Graphic design or drawing software	○	○	○	○
Computer-based information resources (e.g. wiki, websites)	○	○	○	○
Reflecting on your learning experiences (e.g. through a blog)	○	○	○	○
Data logging or monitoring tools	○	○	○	○
Concept mapping software (e.g. Inspiration)	○	○	○	○
Simulations and modelling software	○	○	○	○
Social media (e.g. Facebook, Twitter, Snapchat, YouTube or similar)	○	○	○	○
Robotic devices	○	○	○	○
3D printers	○	○	○	○
Computer-aided drawing (CAD) software	○	○	○	○
Communications software (e.g. Skype)	○	○	○	○

Q13 **How often do the following activities take place in your lessons?**
(Select one response for each activity.)

Remember to scroll.

	Never	Less than once a month	At least once a month but not every week	At least once a week
My teacher uses digital devices to present information to the class.	○	○	○	○
We use digital devices to present information to the class.	○	○	○	○
My teacher uses digital devices to provide us feedback on our work.	○	○	○	○
We use digital devices to collaborate with each other on projects.	○	○	○	○
We use digital devices to collaborate with students from other schools on projects.	○	○	○	○
We use digital devices to complete tests.	○	○	○	○
We use digital devices to work on short assignments (i.e. within one week).	○	○	○	○
We use digital 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 digital devices to collect data for a project.	○	○	○	○
We use digital devices to analyse data.	○	○	○	○
We use digital devices to produce or edit audio.	○	○	○	○
We create or edit visual products (e.g. animations, videos, 3D drawings).	○	○	○	○
We create or program robotic devices.	○	○	○	○

Q14 **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
Developing algorithms (e.g. instructions for a program like Scratch)	○	○	○	○
Using digital devices to present information to the class	○	○	○	○
Writing code, programs or macros	○	○	○	○
Evaluating code, programs or macros	○	○	○	○
Developing applications	○	○	○	○
Refining code to improve efficiency	○	○	○	○
Debugging code	○	○	○	○
Creating visual displays of information or processes (such as graphs, flow charts and decision trees)	○	○	○	○

Appendix 2: Technical Readiness Test (TRT) instructions

NAP NATIONAL ASSESSMENT PROGRAM

NAP ICT Literacy 2017 – Technical Readiness Test

The instructions below outline the steps for conducting the NAP-ICTL Technical Readiness Test 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.

Please note: there is no audio component to the NAP-ICTL assessment.

Instructions

Complete steps 1 to 3 and submit your results on as many devices as possible. After resolving any issues and checking your final device, please complete the TRT feedback questionnaire. The link to the questionnaire can be found in the same email to IT Coordinators that contains the TRT 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://speedof.me/m/ (http://speedof.me/m/)
- https://fast.com/ (https://fast.com/)
- http://www.speedtest.net/ (http://www.speedtest.net/)

Speed test result:

- ○ Less than 500kbps
- ○ 500kbps – 1Mbps
- ○ 1Mbps – 2Mbps
- ○ 2Mbps – 5Mbps
- ○ 5Mbps – 10Mbps
- ○ 10Mbps – 30Mbps
- ○ Greater than 30Mbps
- ○ None of the speed test websites worked for me.

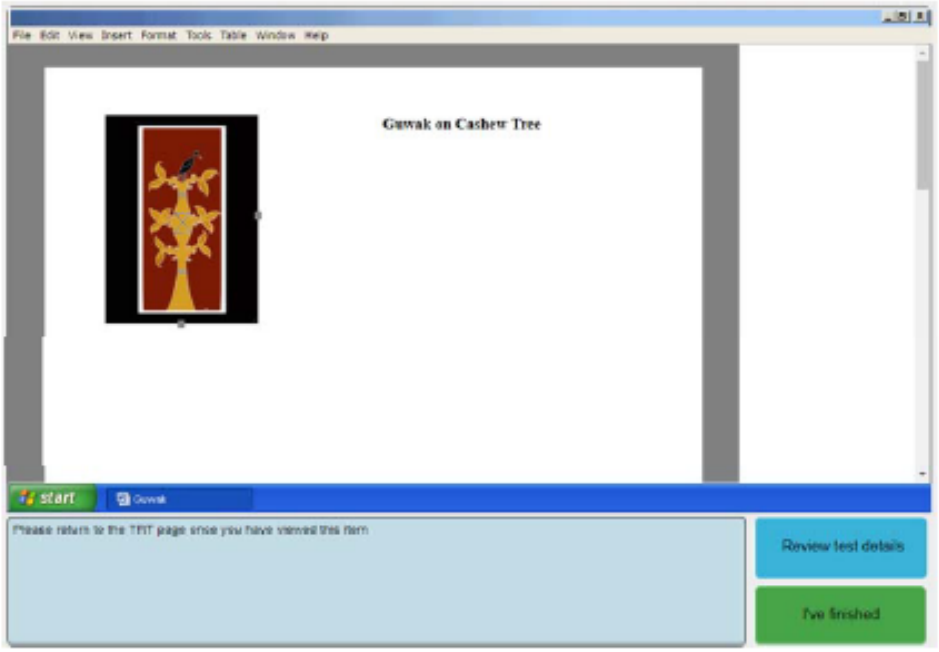
Step 2. Animation Item

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 (/index.php/forms/show/id/7)

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

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 (/index.php/forms/show/id/8)



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

Please submit your results and repeat steps 1 to 3 on as many devices as possible.

Submit Form

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

Appendix 3: Quality monitor report template

NAP-ICT Literacy 2017 – QUALITY MONITOR REPORT

Quality Monitor			
School Name			
State/Territory		**Sector**	
Year Level		**Date**	
Test Administrator			
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)
School Contact		
IT Coordinator		
Principal		
Other (please specify) _____		

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 IT Coordinator 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.

_____

_____

Tutorial

How long did it take the TA to lead students through the Tutorial? _____ (mins)

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

_____

_____

Test Modules

Students are given 20 minutes to complete 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 in the allocated time to complete one or more modules?

_____

Survey

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)

3. Test Instructions

Was the script followed according to the Test Instructions 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

The Test Administrator may read questions to students as long as they do not provide the students with answers to their questions.

In your opinion, did the Test Administrator address students' questions adequately?

☐ 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 Issues**

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 talked to other students during the assessment session?	☐	☐	☐
b)	How many students made noise or moved around, causing disruption to other students during the session?	☐	☐	☐
c)	How many students attempted to access other computer applications or websites on their computer during the session?	☐	☐	☐
d)	How many students attempted to access their mobile phones or other personal electronic devices during the session?	☐	☐	☐
e)	How many students became restless towards the end of the session?	☐	☐	☐
f)	How many students appeared to be engaged in the test material?	☐	☐	☐
g)	How many students appeared to struggle with understanding how to navigate the test interface?	☐	☐	☐

7. **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.

Appendix 4: School report instructions

National Assessment Program 2017

Information and Communication Technology Literacy

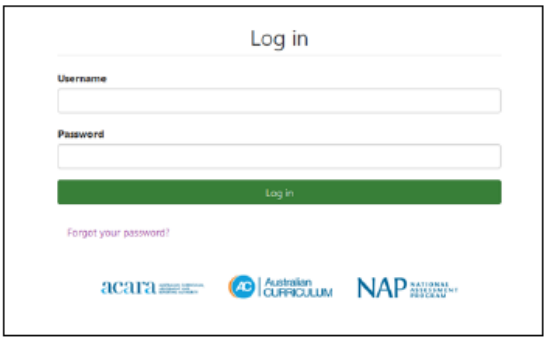
NAP-ICT Literacy School Summary Report:

Instructional Guide

Accessing the report

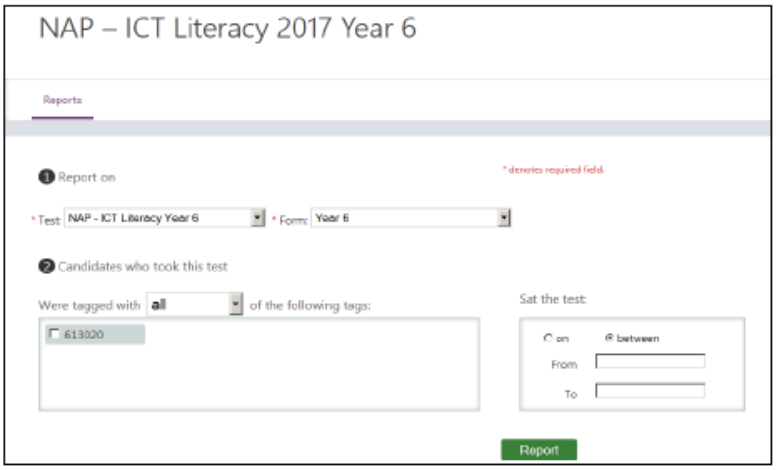
1. Navigate to the school report webpage for the required year level (Year 6 or Year 10):
   - Year 6 reports: https://schools.acer.edu.au/nap-ict-2017-year-6-2
   - Year 10 reports: https://schools.acer.edu.au/nap-ict-2017-year-10

2. Enter your username and password, and then click on the green 'Log in' button. Please note: your designated username and password are provided in the email to which these instructions were attached.



Login page

3. On the next page, click on the green 'Report' button. You can ignore the other text and check boxes on this page.

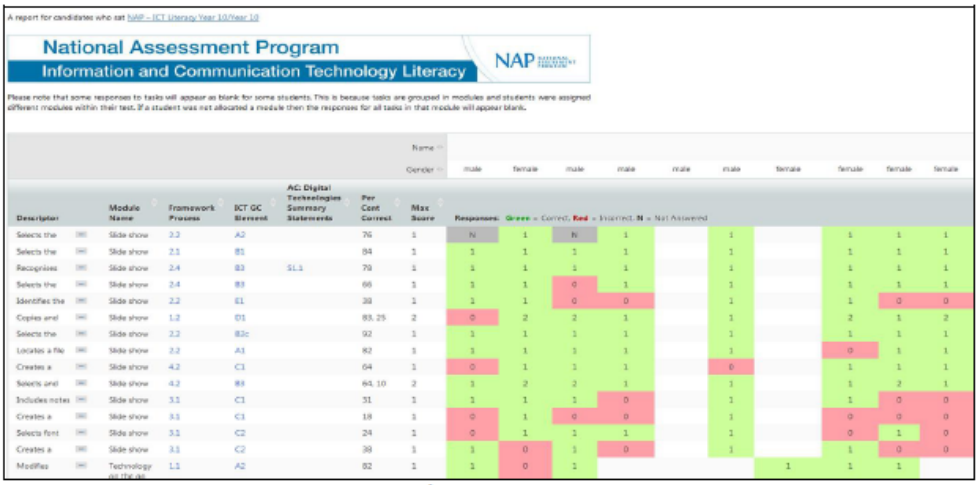


Report confirmation page – Year 6 view used as example

National Assessment Program 2017
Information and Communication Technology Literacy

Viewing the school report

You will see an interactive group report that shows the results for all students in your school on all tasks included in the NAP-ICT Literacy assessment. An example is given in the following screenshot.



Example group report page

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

a) **Descriptor**: This contains a brief description of what students needed to do in order to complete a task. Each row refers to a single task in the assessment. You can click on the blue ellipsis (...) to expand the text for each task descriptor.

b) **Module Name**: Each module has a central theme and a variety of related tasks. Students complete four modules.

c) **Framework Process**: This contains references to the NAP – ICT Literacy Assessment Framework content assessed by each task. Hovering over the blue numbers will display the full description.

d) **ICT GC Element***: This contains references to the Australian Curriculum: ICT General Capabilities organising elements. Hovering over the blue numbers will display the full description.

e) **AC: Digital Technologies summary statements***: This column contains references to the Australian Curriculum: Digital Technologies summary statements presented in the NAP – ICT Literacy Assessment Framework. References are included only for those tasks that overlap with the Australian Curriculum: Digital Technologies. They describe, where relevant, the digital technologies aspect of the task. Hovering over the blue numbers will display the statement. The NAP – ICT Literacy Assessment Framework can be found on the National Assessment Program website (https://www.nap.edu.au/nap-sample-assessments/assessment-frameworks).

f) **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 reflects 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.

g) **Max Score**: This shows the maximum score available for each task.

*Please note, the 2017 NAP-ICTL Assessment Framework is not yet aligned to the Australian Curriculum but mapping exercises have been conducted and items tagged to show the overlap and connections.

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 tasks 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 sorting features, so you can manipulate how you would like to view the data. For example, view students grouped by gender, or tasks grouped by task type.

Logging out

At any time you can log out of the reporting system by clicking on your School Contact's name followed by the Log Out option at the top right of the screen.

Need Help?

If you require any assistance with accessing the reports for your school, or have any questions about the NAP–ICT Literacy assessment in general, please contact the ACER Helpdesk on 1800 599 426 or at ictl@acer.edu.au

National Assessment Program 2017
Information and Communication Technology Literacy

NAP – ICT Literacy School Report Framework References

NAP – ICTL assessment framework processes	
1	**Managing information**
1.1	Organising information
1.2	Storing information for retrieval and reuse
1.3	Reflecting on the processes used to design and construct ICT solutions
2	**Accessing and evaluating information**
2.1	Identifying the information needed
2.2	Knowing how to find information
2.3	Retrieving information
2.4	Making judgements regarding the integrity, relevance and usefulness of information
3	**Developing new understandings**
3.1	Creating information and knowledge by synthesising, adapting, applying, designing, inventing or authoring
4	**Communicating with others**
4.1	Exchanging information by sharing knowledge
4.2	Creating information products to suit the audience, the context and the medium
5	**Using ICT appropriately**
5.1	Using ICT responsibly by considering social, legal and ethical issues

Australian Curriculum: ICT General Capability organising elements	
A	**Managing and operating ICT**
A1	Select and use hardware and software to construct ICT solutions
A2	Understand ICT systems
A3	Manage digital data
B	**Investigating with ICT**
B1	Define and plan information searches
B2a	Locate data and information
B2b	Generate data and information
B2c	Access data and information
B3	Select and evaluate data and information
C	**Creating with ICT**
C1	Generate ideas, plans and processes
C2	Generate solutions to challenges and learning area tasks
D	**Communicating with ICT**
D1	Collaborate, share and exchange
D2	Understand computer mediated communications
E	**Applying social and ethical protocols and practices when using ICT**
E1	Recognise intellectual property
E2	Apply digital information security practices
E3	Apply personal security protocols
E4	Identify the impacts of ICT in society

Australian Curriculum: Digital Technologies summary statements	
S1	**Managing and operating digital systems**
S1.1	Understanding digital systems
S1.2	Managing data in networked digital systems (access and security)
S2	**Accessing, evaluating and analysing data**
S2.1	Acquiring and evaluating data
S2.2	Analysing data and information
S3	**Creating with digital systems**
S3.1	Generating ideas and designing graphical solutions
S3.2	Creating digital solutions
S4	**Collaborating and communicating**
S4.1	Planning and managing projects
S4.2	Exchanging information by sharing knowledge
S5	**Using digital systems appropriately**
S5.1	Applying social, ethical and technical protocols

Appendix 5: Ordered map of NAP–ICT Literacy 2017 item descriptors

Vertical link	Scale score	Level	Task descriptor	Strand
Link	778	6	Uploads a file to a cloud drive	A
Year 6	767	5	Includes the unit of measurement in a vertical axis title	B
Link	765	5	Creates a presentation with some control of layout of text and images	A
Link	764	5	Creates title that refers to maximum and minimum temperature and data collection period	B
Link	727	5	Selects font size and style to suit a slide show presentation	A
Link	712	5	Creates a form with appropriate field types	B
Year 6	711	5	Selects and edits information and images that are relevant to the topic and target audience	A
Link	708	5	Includes the unit of measurement in a vertical axis title	B
Year 10	707	5	Adapts information appropriately for a digital poster	B
Year 10	698	5	Includes the unit of measurement in a vertical axis title	B
Year 6	688	5	Moves multiple files into a specified folder	A
Year 10	685	5	Locates an operating system's search tool	A
Link	675	5	Includes notes relevant to slides in a presentation	A
Link	671	5	Creates a title that refers to rainfall and data collection period	B
Year 10	666	5	Explains a benefit of using a .pdf format instead of a .doc format	A
Year 10	665	5	Selects and edits information and images that are relevant to the topic and target audience	A
Link	659	5	Identifies the hyperlink for the webpage content manager	C
Link	657	5	Creates a presentation with some controlled use of colour	A
Link	638	4	Uses a sorting method to group files	A
Link	631	4	Creates appropriate captions to support images	A
Link	623	4	Formats images appropriately for a page spread in a digital photo book	A
Link	614	4	Transfers text content from a source document to a digital photo book	A
Year 6	611	4	Explains why a link to activate an account is sent by email rather than being displayed on-screen	C
Link	606	4	Creates a balanced design for text elements in a digital photo book	A
Year 10	604	4	Uses persuasive language to support a digital poster	B
Year 10	602	4	Formats font so that it is easy to read as part of a short animated video	A

Vertical link	Scale score	Level	Task descriptor	Strand
Link	599	4	Gives an example of what happens to anti-virus software when it is updated	C
Year 10	599	4	Evaluates the reliability of information presented in a website	A
Year 10	596	4	Explains how technology can improve reporting processes	A
Link	595	4	Creates a short animated video that flows due to continuity in animation technique and adjacency in content	B
Year 10	595	4	Moves multiple files into a specified folder	A
Link	592	4	Navigates website menus to locate a specified resource	A
Link	589	4	Creates a balanced design with images and text	A
Year 10	588	4	Chooses the most relevant search result for a specified topic	A
Year 10	585	4	Identifies relevant search engine filtering tools for improving search results	A
Year 10	579	4	Uses data to support the overall purpose of a digital poster	A
Year 10	578	4	Selects appropriate images/shapes to support information in a digital poster	A
Link	576	4	Locates an upload button on a webpage	A
Year 6	574	4	Chooses relevant images to support text for a digital photo book	A
Link	570	4	Uses data to identify a problem with a website	A
Link	569	4	Chooses and clicks on a search result according to given criteria	A
Link	563	4	Uses an installation wizard to install software to a specified folder	A
Link	548	4	Copies and pastes a URL into an email message	B
Year 10	546	4	Positions images/shapes to support meaning in a digital poster	A
Year 6	546	4	Chooses suitable text colours for page spreads in a digital photo book	A
Year 10	545	4	Explains why file versioning is useful	A
Link	542	4	Selects and uses objects in a coherent way in an short animated video	B
Year 6	541	4	Formats font so that it is easy to read as part of a short animated video	A
Link	540	4	Creates a relevant and identifiable title in a presentation	A
Link	528	3	Analyses a website and explains why a webpage has reduced engagement	A
Link	525	3	Recognises the purpose of spyware	C
Link	525	3	Explains the benefits of file compression for a shared cloud drive	A
Link	525	3	Locates and uploads a file from a nested folder structure	A
Year 10	524	3	Explains why a link to activate an account is sent by email rather than being displayed on-screen	C
Link	519	3	Selects an appropriate graph type to display rainfall data	B

Vertical link	Scale score	Level	Task descriptor	Strand
Year 10	515	3	Chooses relevant images to support text for a digital photo book	A
Year 10	512	3	Sizes images/shapes appropriately for a digital poster	A
Link	511	3	Explains an advantage of storing photos on the Internet	C
Link	507	3	Configure an app to collect data from a specified date, time and location	A
Link	505	3	Crops an image to remove the background	A
Link	505	3	Sets horizontal graph scale to daily	B
Year 6	504	3	Recognises sponsored links in search engine results page	A
Link	504	3	Sets horizontal graph scale to daily	B
Link	498	3	Identifies a weakness of four digit passcodes	A
Link	496	3	Creates relevant title	A
Year 6	493	3	Navigates to a specified webpage	A
Year 10	491	3	Chooses suitable text colours for page spreads in a digital photo book	A
Link	485	3	Identifies a sorting method to group files	A
Year 10	478	3	Explains copyright and attribution requirements for content found on the internet	C
Link	472	3	Selects the search result most likely to provide information on a given topic	A
Year 10	471	3	Completes an online registration form to upload a video to a video sharing site	A
Link	467	3	Makes a clear and easy to understand message in a short animated video	B
Link	464	3	Identifies an advantage of storing data locally rather than in cloud storage	A
Link	463	3	Identifies a benefit of saving a file from the Internet before opening it	C
Year 10	458	3	Creates an appropriate title for a video file	A
Link	441	3	Sets rainfall data as the source for a graph	B
Link	440	3	Locates and click on the Edit button to edit an image	A
Link	438	3	Navigates software menus and configures software settings	A
Link	437	3	Selects relevant images to support information on a webpage	A
Link	433	3	Explains how to improve a website menu design for navigability	A
Link	432	3	Locates and opens a specified file	A
Link	431	3	Locates a file in a specified location in a folder tree	A
Year 10	431	3	Recognises sponsored links in search engine results page	A
Link	429	3	Locates a browser's bookmarks menu and selects a specified bookmark	A

Vertical link	Scale score	Level	Task descriptor	Strand
Year 6	425	3	Explains copyright and attribution requirements for content found on the internet	C
Year 10	421	3	Distinguishes between paid search results and non-paid search results	A
Link	420	3	Adjusts settings to reduce the size of a file to upload to a video sharing site	A
Year 6	419	3	Completes an online registration form to upload a video to a video sharing site	A
Link	416	3	Sets temperature data as the source for a graph	B
Link	412	3	Selects the correct browser tab to access a search engine	A
Year 10	412	3	Creates a new specified folder	A
Link	411	3	Selects an appropriate graph type to display temperature data	B
Year 6	404	2	Creates an appropriate title for a video file	A
Link	399	2	Explains why saving a file with a generic filename may cause a problem	A
Link	399	2	Identifies a problem with websites remembering a user's password	C
Link	388	2	Clicks on an icon that will provide access stored data	A
Year 10	387	2	Modifies screen settings on a tablet computer	A
Year 10	383	2	Selects the most appropriate search term for a given topic	A
Year 10	378	2	Explains the right to control personal information	C
Year 6	362	2	Creates a new specified folder	A
Year 10	359	2	Uses the date modified property to identify the relevant file	A
Link	359	2	Selects a specified hyperlink	A
Link	354	2	Selects the strongest password according to length and range of character types	C
Link	348	2	Identifies the main purpose of a software licence agreement	C
Link	347	2	Identifies the meaning of 'public' for a website privacy setting	C
Year 6	331	2	Selects the most appropriate search term for a given topic	A
Year 6	330	2	Modifies screen settings on a tablet computer	A
Link	330	2	Navigates a user interface to find a specified function	A
Link	329	2	Locates a data file within a folder tree based on the source of the data	A
Link	324	2	Uses tools (slide control) to brighten an image	A
Link	322	2	Configures an app to collect data from a specified location	A
Link	319	2	Identifies a file with slowest load time	A
Link	318	2	Decreases the width of an image according to specifications	A

Vertical link	Scale score	Level	Task descriptor	Strand
Link	316	2	Clicks on a hyperlink embedded in a paragraph	A
Link	309	2	Erases specified elements of an image	A
Link	296	2	Identifies a method to improve file transfer speed	A
Year 10	273	1	Selects the correct hyperlink presented in an email	A
Link	272	1	Uses tools to rotate image 180 degrees	A
Link	271	1	Selects the correct edit button on a webpage	A
Year 10	268	1	Enters a specified username into the appropriate field	A
Link	263	1	Locates an edit button on a webpage	A
Link	243	1	Clicks on a hyperlink in an email message	A
Link	243	1	Clicks on a hyperlink in an email	A
Year 6	223	1	Selects the correct hyperlink presented in an email	A
Year 6	208	1	Enters a specified username into the appropriate field	A
Year 10	207	1	Adjusts the brightness of a dark image	A
Link	159	1	Locates a button on a webpage	A
Year 6	139	1	Adjusts the brightness of a dark image	A

Appendix 6: Example of a school summary report

National Assessment Program

Information and Communication Technology Literacy

Please note that some responses to tasks will appear as blank for some students. This is because tasks are grouped in modules and students were assigned different modules within their test. If a student was not allocated a module then the responses for all tasks in that module will appear blank.

							Name						
							Gender	male	female	female	male	male	male	male
Descriptor	Module Name	Framework Process	ICT GC Element	AC: Digital Technologies Summary Statements	Per Cent Correct	Max Score	Responses: Green = Correct, Red = Incorrect, N = Not Answered						
Selects the	Slide show	2.2	A2		76	1		1	1		1	1	
Selects the	Slide show	2.1	B1		84	1		1	1		1	1	
Recognises	Slide show	2.4	B3	S1.1	78	1		1	1		1	1	
Selects the	Slide show	2.4	B3		66	1		N	1		1	1	
Identifies the	Slide show	2.2	E1		38	1		1	1		1	1	
Copies and	Slide show	1.2	D1		83, 25	2		2	1		2	1	
Selects the	Slide show	2.2	B2c		92	1		1	1		1	1	
Locates a file	Slide show	2.2	A1		82	1		1	1		1	1	
Creates a	Slide show	4.2	C1		64	1		1	1		1	1	
Selects and	Slide show	4.2	B3		64, 10	2		2	1		0	0	
Includes notes	Slide show	3.1	C1		31	1		1	1		0	0	
Creates a	Slide show	3.1	C1		18	1		0	1		0	0	
Selects font	Slide show	3.1	C2		24	1		0	1		0	1	

Appendix 7: Item difficulties

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 =0.50	RP =0.62	ICTL scale	RP =0.50	ICTL scale	RP =0.50	ICTL scale				
FPC01	1	Link	Yes	0.96	1.44	569	0.96	569			29%	48%	1.14	1.12
FPC02	1	Link	Yes	1.19	1.68	592	1.19	592			25%	47%	1.04	1.02
FPC03	1	Link	No	-1.28	-0.79	354	-1.28	354			70%	82%	1.07	1.28
FPC04	1	Link	Yes	-0.15	0.34	463	-0.15	463			49%	67%	1.06	1.18
FPC05	2	Link	Yes	1.27	1.75	599	0.69	543	1.84	654	21%	44%	1.19	1.21
FPC06	1	Link	Yes	-0.41	0.08	438	-0.41	438			55%	75%	1.00	1.00
FPC07	1	Link	Yes	0.50	0.99	525	0.50	525			37%	56%	1.09	1.08
FPC08	1	Link	Yes	-1.34	-0.85	348	-1.34	348			71%	85%	0.98	0.88
FPC09	1	Link	Yes	0.89	1.38	563	0.89	563			30%	59%	0.97	0.94
FPC10	1	Link	Yes	0.36	0.84	511	0.36	511			40%	66%	1.17	1.00
FPC13	1	Link	Yes	-0.38	0.11	440	-0.38	440			54%	73%	0.94	1.08
FPC14	1	Link	Yes	-2.14	-1.65	272	-2.14	272			81%	90%	0.87	0.88
FPC15	1	Link	Yes	-1.60	-1.11	324	-1.60	323			74%	87%	0.99	0.98
FPC16	1	Link	Yes	0.29	0.78	505	0.29	505			40%	63%	1.05	1.03
FPC17	1	Link	Yes	-1.76	-1.27	309	-1.76	309			76%	89%	0.86	0.72
NI13M4Q02	1	Link	Yes	-0.68	-0.19	412	-0.68	412			59%	75%	1.00	1.17
NI13M4Q03	1	Year 6	No	-1.52	-1.03	331	-1.52	331			74%		1.01	
NI13M4Q04	1	Year 6	No	0.28	0.77	504	0.28	504			40%		1.02	
NI13M4Q03	1	Year 10	No	-0.98	-0.49	383	-0.98	383				82%		0.90
NI13M4Q04	1	Year 10	No	-0.48	0.01	431	-0.48	431				76%		0.88
NI13M4Q05	1	Link	Yes	-0.05	0.43	472	-0.06	472			47%	65%	1.00	1.03
NI13M4Q07	1	Link	No	1.89	2.38	659	1.89	659			15%	35%	0.99	1.06
NI13M4Q10	2	Link	No	0.74	1.23	548	-0.16	462	1.63	634	32%	54%	1.00	0.85
NI13M4Q11	1	Year 6	No	-2.65	-2.16	223	-2.65	223			88%		0.91	
NI13M4Q11	1	Year 10	No	-2.12	-1.63	273	-2.12	273				92%		0.93
NI13M4Q12	1	Link	Yes	-0.48	0.01	431	-0.48	431			55%	80%	1.07	0.92

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 =0.50	RP =0.62	ICTL scale	RP =0.50	ICTL scale	RP =0.50	ICTL scale				
NI13M4Q14A	1	Link	No	0.65	1.14	540	0.65	540			33%	60%	1.11	0.99
NI13M4Q14B	2	Year 6	No	2.44	2.93	711	0.91	565	3.96	858	15%		0.93	
NI13M4Q14B	2	Year 10	No	1.95	2.44	665	0.50	525	3.40	804		34%		0.94
NI13M4Q14C	1	Link	Yes	2.06	2.55	675	2.06	675			13%	29%	1.07	1.03
NI13M4Q14D	1	Link	No	2.99	3.48	765	2.99	765			6%	16%	1.12	1.14
NI13M4Q14E	1	Link	No	2.60	3.09	727	2.60	727			8%	20%	1.05	1.07
NI13M4Q14F	1	Link	Yes	1.87	2.36	657	1.87	657			15%	34%	1.04	1.12
NI13M5Q01	1	Year 6	No	-1.53	-1.04	330	-1.53	330			75%		1.11	
NI13M5Q01	1	Year 10	No	-0.94	-0.45	387	-0.94	387				82%		1.23
NI13M5Q03	2	Link	Yes	0.21	0.70	498	-1.37	345	1.80	650	44%	53%	1.09	1.07
NI13M5Q08	1	Year 6	No	1.39	1.88	611	1.39	611			22%		1.02	
NI13M5Q08	1	Year 10	No	0.49	0.98	524	0.49	524				60%		1.08
NI13M5Q09	1	Link	Yes	-1.23	-0.74	359	-1.23	359			70%	89%	0.94	0.72
NI13M5Q13	1	Link	Yes	-1.61	-1.12	322	-1.61	322			76%	87%	0.98	1.17
NI13M5Q15	1	Link	Yes	0.31	0.80	507	0.31	507			41%	63%	0.96	0.98
NI13M5Q17	1	Link	Yes	-0.13	0.36	464	-0.13	464			49%	70%	1.05	1.08
NI13M5Q18	1	Link	No	-0.93	-0.44	388	-0.93	388			64%	78%	1.08	1.27
NI13M5Q19	1	Link	Yes	-1.55	-1.06	329	-1.55	329			73%	84%	1.03	1.29
NI13M5Q20A	1	Link	No	0.44	0.92	519	0.44	519			38%	66%	0.86	0.76
NI13M5Q20B	1	Link	No	-0.38	0.11	441	-0.38	441			53%	76%	0.86	0.74
NI13M5Q20C	2	Link	No	2.02	2.51	671	-0.14	464	4.17	878	25%	40%	0.82	0.76
NI13M5Q20D	1	Link	No	0.28	0.77	504	0.28	504			41%	68%	0.87	0.76
NI13M5Q20E	2	Link	No	2.41	2.90	708	1.14	586	3.68	831	13%	27%	0.90	0.86
NI13M5Q20F	1	Link	No	-0.69	-0.20	411	-0.69	411			59%	79%	0.91	0.83
NI13M5Q20G	1	Link	No	-0.63	-0.14	416	-0.63	416			58%	78%	0.89	0.81
NI13M5Q20H	2	Link	No	2.99	3.48	764	1.82	652	4.15	876	8%	21%	0.95	1.03
NI13M5Q20I	1	Link	No	0.29	0.78	505	0.29	505			41%	68%	0.90	0.77
NI13M5Q20J	2	Year 6	No	3.01	3.50	767	1.02	575	5.00	958	14%		0.85	
NI13M6Q01	1	Year 6	No	-2.81	-2.32	208	-2.81	208			89%		1.08	

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 =0.50	RP =0.62	ICTL scale	RP =0.50	ICTL scale	RP =0.50	ICTL scale				
NI13M5Q20J	2	Year 10	No	2.30	2.79	698	0.41	516	4.20	881		33%		0.78
NI13M6Q01	1	Year 10	No	-2.18	-1.69	268	-2.18	268				92%		1.07
NI13M6Q02	1	Link	No	-0.81	-0.33	399	-0.81	399			61%	79%	1.05	1.06
NI13M6Q03	1	Link	Yes	-2.43	-1.94	243	-2.44	243			85%	91%	0.91	1.41
NI13M6Q04A	2	Link	No	1.23	1.72	595	0.02	479	2.44	711	26%	40%	1.01	0.96
NI13M6Q04B	1	Link	Yes	-0.11	0.38	467	-0.11	467			48%	67%	0.96	0.94
NI13M6Q04D	1	Year 6	No	0.67	1.16	541	0.67	541			33%		1.08	
NI13M6Q04D	1	Year 10	No	1.30	1.79	602	1.30	602				43%		1.11
NI13M6Q04E	2	Link	Yes	0.67	1.16	542	-0.79	401	2.14	683	36%	48%	1.05	1.09
NI13M6Q05	1	Link	No	-0.60	-0.11	420	-0.60	420			57%	76%	1.11	1.17
NI13M6Q06	1	Link	Yes	-0.81	-0.33	399	-0.81	399			56%	76%	1.00	1.01
NI13M6Q07	1	Year 6	No	-0.76	-0.27	404	-0.76	404			53%		1.03	
NI13M6Q07	1	Year 10	No	-0.20	0.29	458	-0.20	458				67%		0.98
NI13M6Q08	1	Link	Yes	-1.35	-0.87	347	-1.35	347			61%	80%	0.97	1.01
NI13M6Q09	2	Year 6	No	-0.60	-0.11	419	-1.27	355	0.06	483	49%		1.22	
NI13M6Q09	2	Year 10	No	-0.06	0.42	471	-0.72	408	0.59	534		65%		1.13
NI17M1Q01	1	Link	No	-2.44	-1.95	243	-2.44	243			87%	92%	0.97	1.35
NI17M1Q02	1	Link	No	0.08	0.57	485	0.08	485			46%	62%	1.12	1.17
NI17M1Q03	1	Link	No	-0.47	0.02	432	-0.47	432			57%	75%	1.12	1.16
NI17M1Q04	1	Year 6	No	-0.54	-0.05	425	-0.54	425			58%		1.12	
NI17M1Q05	1	Year 6	No	-1.19	-0.71	362	-1.20	362			70%		1.05	
NI17M1Q04	1	Year 10	No	0.00	0.49	478	0.00	477				68%		1.09
NI17M1Q05	1	Year 10	No	-0.68	-0.19	412	-0.68	411				79%		1.05
NI17M1Q06A	1	Link	No	1.67	2.16	638	1.67	638			18%	38%	1.10	1.03
NI17M1Q06B	2	Year 6	No	2.20	2.69	688	0.00	477	4.39	899	24%		1.00	
NI17M1Q06B	2	Year 10	No	1.22	1.71	595	-0.48	431	2.93	759		46%		1.01
NI17M1Q07	1	Link	No	3.13	3.62	778	3.13	778			6%	14%	1.00	1.01
NI17M1Q08	2	Link	No	0.50	0.99	525	-0.97	384	1.96	666	40%	53%	1.04	1.09
NI17M1Q09	1	Link	No	-1.54	-1.05	330	-1.54	330			75%	88%	1.03	0.97

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 =0.50	RP =0.62	ICTL scale	RP =0.50	ICTL scale	RP =0.50	ICTL scale				
NI17M1Q10A	1	Link	No	-1.66	-1.17	318	-1.66	318			76%	87%	0.97	1.14
NI17M1Q10B	1	Year 6	No	-3.52	-3.03	139	-3.52	139			92%		0.95	
NI17M1Q11A	1	Year 6	No	0.71	1.20	546	0.71	546			33%		0.79	
NI17M1Q10B	1	Year 10	No	-2.81	-2.32	207	-2.81	207				95%		1.00
NI17M1Q11A	1	Year 10	No	0.14	0.63	491	0.14	491				65%		0.75
NI17M1Q11B	2	Link	No	1.34	1.83	606	0.63	538	2.05	674	21%	41%	0.91	0.84
NI17M1Q11C	1	Year 6	No	1.01	1.50	574	1.01	574			28%		0.79	
NI17M1Q11C	1	Year 10	No	0.39	0.88	515	0.39	515				61%		0.79
NI17M1Q11D	1	Link	No	1.51	2.00	623	1.52	623			20%	46%	0.90	1.00
NI17M1Q11E	2	Link	No	1.42	1.91	614	1.08	581	1.77	647	17%	45%	0.85	0.94
NI17M2Q01	1	Link	No	-1.68	-1.19	316	-1.68	316			77%	87%	1.05	1.34
NI17M2Q02	1	Year 6	No	0.17	0.66	493	0.17	493			43%		1.16	
NI17M2Q03	1	Link	No	-0.46	0.03	433	-0.46	433			55%	71%	1.05	1.23
NI17M2Q04	1	Link	No	-0.51	-0.02	429	-0.51	429			56%	80%	0.91	0.87
NI17M2Q05	1	Link	No	-3.31	-2.82	159	-3.31	159			93%	97%	0.89	1.01
NI17M2Q06	1	Link	No	-1.65	-1.16	319	-1.65	319			76%	86%	0.97	1.29
NI17M2Q07	1	Link	No	-1.89	-1.40	296	-1.89	296			79%	92%	0.94	0.84
NI17M2Q08	2	Link	No	0.96	1.45	570	-0.49	430	2.42	710	32%	46%	1.14	1.23
NI17M2Q09	1	Link	No	0.53	1.02	528	0.53	528			36%	61%	0.91	0.89
NI17M2Q10	1	Link	No	-2.23	-1.74	263	-2.23	263			83%	90%	0.91	1.27
NI17M2Q11	1	Link	No	-2.14	-1.65	271	-2.14	271			82%	92%	0.99	0.99
NI17M2Q12	1	Link	No	1.03	1.52	576	1.03	576			27%	54%	1.00	0.94
NI17M2Q13	1	Link	No	0.50	0.99	525	0.50	525			36%	59%	1.12	1.15
NI17M2Q14	1	Year 10	No	1.96	2.45	666	1.96	666				30%		1.09
NI17M2Q16A	1	Link	No	-0.42	0.07	437	-0.42	437			52%	73%	0.92	0.82
NI17M2Q16B	1	Link	No	1.60	2.09	631	1.60	631			18%	39%	0.95	0.95
NI17M2Q16D	1	Link	No	1.16	1.65	589	1.16	589			24%	43%	1.07	1.09
NI17M2Q16G	1	Link	No	0.19	0.68	496	0.19	495			41%	67%	0.89	0.82
NI17M2Q16H	2	Link	No	2.44	2.93	712	1.40	611	3.49	813	11%	26%	0.99	1.12

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 =0.50	RP =0.62	ICTL scale	RP =0.50	ICTL scale	RP =0.50	ICTL scale				
NI17M3Q01	1	Year 10	No	1.12	1.61	585	1.12	585				47%		1.06
NI17M3Q02	1	Year 10	No	-0.58	-0.10	421	-0.59	421				77%		1.08
NI17M3Q03	1	Year 10	No	1.15	1.64	588	1.15	588				46%		1.05
NI17M3Q04	1	Year 10	No	1.26	1.75	599	1.26	599				44%		1.05
NI17M3Q06	1	Year 10	No	-1.03	-0.54	378	-1.03	378				83%		1.07
NI17M3Q07	2	Year 10	No	2.16	2.65	685	1.85	655	2.47	714		22%		1.13
NI17M3Q08	1	Year 10	No	-1.23	-0.74	359	-1.23	359				85%		1.00
NI17M3Q09	2	Year 10	No	0.70	1.19	545	-0.28	451	1.68	639		55%		1.05
NI17M3Q10	1	Year 10	No	1.24	1.73	596	1.24	596				44%		0.94
NI17M3Q13A	2	Year 10	No	1.05	1.54	578	0.47	522	1.64	634		48%		1.17
NI17M3Q13B	1	Year 10	No	0.72	1.21	546	0.72	546				54%		1.03
NI17M3Q13C	1	Year 10	No	0.37	0.86	512	0.37	512				61%		1.01
NI17M3Q13D	1	Year 10	No	1.06	1.55	579	1.06	579				47%		1.00
NI17M3Q13E	1	Year 10	No	2.39	2.88	707	2.39	707				23%		1.04
NI17M3Q13F	1	Year 10	No	1.31	1.80	604	1.31	603				42%		0.99

Appendix 8: Variables for conditioning

Variable	Name	Values	Coding	Regressor
Adjusted school mean achievement	sch_adj_mn	Adjusted school mean	Logits	Direct
Sector	Sector	Public	00	Direct
		Catholic	10	
		Independent	01	
ASGS remoteness code	GeoLoc_ABS	Major Cities of Australia	00000	Direct
		Inner Regional Australia	10000	
		Outer Regional Australia	01000	
		Remote Australia	00100	
		Very Remote Australia	00010	
		Not stated	00001	
SEIFA levels	SEIFA_National	Mode of year level	000000000	Direct
		Other category 1	010000000	
		Other category 2	001000000	
		Other category 3	000100000	
		Other category 4	000010000	
		Other category 5	000000000	
		Other category 6	000001000	
		Other category 7	000000100	
		Other category 8	000000010	
		Other category 9	000000001	
Gender	Gender	Male	1	Direct
		Female	0	
Indigenous status indicator	INDIG	Indigenous	10	Direct
		Non-Indigenous	00	
		Missing	01	
Age	AGE	Value	Copy, 0	PCA
		Missing	Mean, 1	
LOTE spoken at home	LBOTE	Yes	10	PCA
		No	00	
		Missing	01	
Student born in Australia	COB	Australia	00	PCA
		Overseas	10	
		Missing	01	
Parental highest occupation group	POCC	Mode of year level	00000	PCA
		Other category 1	10000	
		Other category 2	01000	
		Other category 3	00100	
		Other category 4	00010	
		Not stated or unknown	00001	PCA
Highest level of parental education	PARED	Mode of year level	0000000	PCA

Variable	Name	Values	Coding	Regressor
		Other category 1 Other category 2 Other category 3 Other category 4 Other category 5 Other category 6 Not stated or unknown	1000000 0100000 0010000 0001000 0000100 0000010 0000001	
Experience with computers Experience with tablets	Q01A Q01B	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 Missing	Five dummies for each variable with the year level mode as the reference category	PCA
Use of computer – at school Use of tablet with no on-screen keyboard – at school Use of tablet with external keyboard – at school Use of smartphone – at school Use of digital devices – none – at school	Q02A1 Q02A2 Q02A3 Q02A4 Q02A5	Yes (Box checked) No (Box not checked)	One dummy for each variable with the year level mode as the reference category	PCA
Use of computer – outside of school Use of tablet with no on-screen keyboard – outside of school Use of tablet with external keyboard – outside of school Use of smartphone – outside of school Use of digital devices – none – outside of school	Q02B1 Q02B2 Q02B3 Q02B4 Q02B5	Yes (Box checked) No (Box not checked)	One dummy for each variable with the year level mode as the reference category	PCA
Own computer used in class Own tablet used in class	Q03A Q03B	No 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 Missing	Four dummies for each variable with the year level mode as the reference category	PCA
Frequency use of desktop, laptop, netbook – at school Frequency use of desktop, laptop, netbook – outside of school Frequency use of tablet – at school Frequency use of tablet – outside of school	QN04A1 QN04A2 QN04B1 QN04B2	Several times every day Once a day Almost every day A few times each week Once a week or less Missing	Five dummies for each variable with the year level mode as the reference category	PCA

Variable	Name	Values	Coding	Regressor
Help me improve the quality of my work	Q05A	Strongly agree Agree Disagree Strongly disagree Missing	Four dummies for each variable with the year level mode as the reference category	PCA
Make work easier	Q05B			
Help me to work with others	Q05C			
Help me communicate with my friends	Q05D			
Find new ways to do things	Q05E			
Important to work with a digital device	Q05F			
Search the Internet – at school	QN06A1	At least once every day Almost every day A few times each week Between once a week and once a month Less than once a month Never Missing	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			
Use word processing software or apps – at school	QN06B1			
Use word processing software or apps – outside of school	QN06B2			
Use spreadsheets – at school	QN06C1			
Use spreadsheets – outside of school	QN06C2			
Use mathematics, language or other learning programs – at school	QN06D1			
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			
Contribute to online content – at school	QN06G1			
Contribute to online content – outside of school	QN06G2			
Watch online videos – at school	QN06H1			
Watch online videos – outside of school	QN06H2			
Use a learning management system – at school	QN06I1			
Use a learning management system – outside of school	QN06I2			
Reflect learning experiences – at school	QN06J1			
Reflect learning experiences – outside of school	QN06J2			
Watch videos for entertainment – at school	QN07A1	At least once every day Almost every day A few times each week Between once a week and once a month Less than once a month	5,4,3,2,1,0; missing replaced by the year level mode;	PCA
Watch videos for entertainment – outside of school	QN07A2			
Play single-player games - at school	QN07B1			

Variable	Name	Values	Coding	Regressor
Play single-player games – outside of school	QN07B2	Never Missing	dummies for missing	
Play multi-player games - at school	QN07C1			
Play multi-player games – outside of school	QN07C2			
Use software to create sounds/music, movies, animations or artwork – at school	QN07D1			
Use software to create sounds/music, movies, animations or artwork – outside of school	QN07D2			
Listen music or audio – at school	QN07E1			
Listen music or audio – outside of school	QN07E2			
Emailing – at school	QN08A1	At least once every day Almost every day A few times each week Between once a week and once a month Less than once a month Never Missing	5,4,3,2,1,0; missing replaced by the year level mode; dummies for missing	PCA
Emailing – outside of school	QN08A2			
Chatting – at school	QN08B1			
Chatting – outside of school	QN08B2			
Write to blogs or forum threads – at school	QN08C1			
Write to blogs or forum threads – outside of school	QN08C2			
Use voice or video chat to communicate – at school	QN08D1			
Use voice or video chat to communicate – outside of school	QN08D2			
Upload to an online profile – at school	QN08E1			
Upload to an online profile – outside of school	QN08E2			
Use social media to communicate – at school	QN08F1			
Use social media to communicate – outside of school	QN08F2			
Write code, programs or macros – at school	QN09A1	At least once every day Almost every day A few times each week Between once a week and once a month Less than once a month Never Missing	5,4,3,2,1,0; missing replaced by the year level mode; dummies for missing	PCA
Write code, programs or macros – outside of school	QN09A2			
Create programs with a visual coding tool – at school	QN09B1			
Create programs with a visual coding tool – outside of school	QN09B2			
Create and upload media to the internet – at school	QN09C1			
Create and upload media to the internet – outside of school	QN09C2			
Construct websites – at school	QN09D1			
Construct websites – outside of school	QN09D2			
Use “art” programs – at school	QN09E1			

Variable	Name	Values	Coding	Regressor
Use “art” programs – outside of school	QN09E2			
Use anti-virus software – at school	QN09F1			
Use anti-virus software – outside of school	QN09F2			
Remix or edit music, video, images or text to produce digital content – at school	QN09G1			
Remix or edit music, video, images or text to produce digital content – outside of school	QN09G2			
Edit digital photographs or other graphic images	QN10A	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 Missing	Four dummies for each variable with the year level mode as the reference category	PCA
Create a database	QN10B			
Enter data in a spreadsheet	QN10C			
Use spreadsheet software	QN10D			
Download music from the Internet	QN10E			
Create a multi-media presentation	QN10F			
Construct a webpage	QN10G			
Upload files	QN10H			
Use social media	QN10I			
Need to provide references to webpage content	QN11A	Yes No Missing	Two dummies for each variable with the year level mode as the reference category	PCA
Need to know about copyright permissions	QN11B			
Problems with using pirated software	QN11C			
Checking software credentials	QN11D			
Password changes for Internet services	QN11E			
Reporting spam to authority	QN11F			
Reading licence/user agreements	QN11G			
How to decide about information sources	QN11H			
How to look for different types of digital information	QN11I			
How to use anti-virus software	QN11J			
Word processing software – school-related purposes	QN12A	Never Less than once a month At least once a month but not every week At least once a week Missing	Four dummies for each variable with the year level mode as the reference category	PCA
Spreadsheet software – school-related purposes	QN12B			
Presentation software – school-related purposes	QN12C			
Software for capturing and editing media – school-related purposes	QN12D			
Graphic design or drawing software – school-related purposes	QN12E			

Variable	Name	Values	Coding	Regressor
Computer-based information resources – school-related purposes	QN12F			
Reflecting on your learning experiences – school-related purposes	QN12G			
Data logging or monitoring tools – school-related purposes	QN12H			
Concept mapping software – school-related purposes	QN12I			
Simulations and modelling software – school-related purposes	QN12J			
Social media – school-related purposes	QN12K			
Robotic devices – school-related purposes	QN12L			
3D printers – school-related purposes	QN12M			
Computer-aided drawing (CAD) software – school-related purposes	QN12N			
Communications software – school-related purposes	QN12O			
Teacher uses digital devices to present	QN13A	Never Less than once a month At least once a month but not every week At least once a week Missing	Four dummies for each variable with the year level mode as the reference category	PCA
Use digital devices to present	QN13B			
Teacher uses digital devices to provide feedback	QN13C			
Use digital devices to collaborate with each other	QN13D			
Use digital devices to collaborate with students from other schools	QN13E			
Use digital devices to complete tests	QN13F			
Use digital devices to work on short assignments	QN13G			
Use digital devices to work on extended projects	QN13H			
Use the Internet to contact students from other schools	QN13I			
Use the Internet to contact experts outside the school	QN13J			
Use digital devices to collect data	QN13K			
Use digital devices to analyse data	QN13L			
Use digital devices to produce or edit audio	QN13M			
Create or edit visual products	QN13N			
Create or program robotic devices	QN13O			
Developing algorithms	QN14A	To a large extent To a moderate extent To a small extent Not at all	Four dummies for each variable with the year	PCA

Variable	Name	Values	Coding	Regressor
		Missing	level mode as the reference category	
Using digital devices to present	QN14B			
Writing code, programs or macros	QN14C			
Evaluating code programs or macros	QN14D			
Developing applications	QN14E			
Refining code to improve efficiency	QN14F			
Debugging code	QN14G			
Creating visual displays of information or processes	QN14H			

Appendix 9: Proficiency level descriptions

Achievement 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 and careful planning and review. They use software features to organise information and to synthesise and represent data as integrated complete information products. 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. • Select appropriate key points and data from available resources and use their own words to include and explicate them in an information product. • 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. • 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.
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. 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. They use available software features to enhance the appearance of their information products. They employ file management practices to support workflow management when creating information products.	• 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. • Use video/animation editing techniques to control the timing of events and transitions to create a sense of continuity. • Select and include information from electronic resources in an information product to suit an explicit communicative purpose. • Use graphics and text software editing features such as font formats, colour and animations consistently within an information product to suit a specified audience. • Create tables and charts that accurately represent data and include them in an information product with text that refers to their contents. • 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. • Explain the advantages and disadvantages of saving documents as PDFs.

Achievement level	Proficiency level description	Examples of student achievement at this level
Level 4	Students working at level 4 generate well-targeted searches for electronic information sources and select relevant information from within sources to meet a specific purpose. They create information products with simple linear structures and use software commands to edit and reformat information products in ways that demonstrate some consideration of audience and communicative purpose. They recognise situations in which ICT misuse may occur and explain how specific protocols can prevent this.	• Create an information product in which the flow of information is clear and the tone is controlled to suit a specified audience. • 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. • Apply graphics and text software editing features, such as font formats, colour and image placement, consistently across a simple information product. • 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.
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 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. 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. • Identify the difference between paid and non-paid search engine generated results when conducting research. • Select clear, simple, relevant information from given information sources and include it in an information product. • Make recommendations to improve the navigability of a website. • Identify a potential problem with a website based on a web traffic report. • Use graphics and text software editing features to manipulate aspects such as colour, image size and placement in simple information products. • 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. • Recognise the potential for ICT misuse, such as plagiarism, computer viruses, and deliberate identity concealment, and suggest measures to protect against them.
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	• Locate explicit relevant information or links to information from within a webpage. • Use metadata, such as date, to help identify and select relevant files. • Make changes to some presentation elements in an information product. • Apply simple software and file management functions, such as copying and pasting information from one column of a spreadsheet to another column, or adding a webpage to a list of favourites (bookmarks) in a web browser, or

Achievement level	Proficiency level description	Examples of student achievement at this level
	and information management. They recognise and identify basic ICT electronic security and health and safety usage issues and practices.	opening an email attachment. • 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 virus protection software up-to-date and the need to maintain good posture when using a computer. • Explain the purpose of specific school ICT use and social media use policies.
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.	• Apply graphics editing software functions, such as adding and moving predefined shapes and adjusting property sliders to control the basic appearance of an image. • Apply basic file and computer management functions, such as opening and dragging-and-dropping files on the desktop. • Apply generic software commands, such as the 'save as' and 'paste' function, 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 'shutdown' command is a safe way to turn off a computer.