National Assessment Program – ICT Literacy 2014

Year 6 and Year 10

Technical Report



acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

NAP NATIONAL ASSESSMENT PROGRAM

ACER Staff

Julian Fraillon and Wolfram Schulz were co-directors of the project that resulted in this report.
This technical report was written by Julian Fraillon, Wolfram Schulz, Eveline Gebhardt, Renee Kwong, Kate O'Malley, Greg Macaskill, Martin Murphy and John Ainley.

Contents

APPENDICES 74

LIST OF TABLES

LIST OF FIGURES

Chapter 1: Introduction

Wolfram Schulz and John Ainley

The *Adelaide Declaration of Australia's National Goals for Schooling in the Twenty-First Century* (MCEETYA, 1999) adopted by the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) in 1999 included an agreement to report on progress toward the achievement of the National Goals on a nationally-comparable basis, via the implementation of three-yearly sample survey assessments in primary science, civics and citizenship and information and communications technology (ICT). In 2008, the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008) 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 National Assessment Program – ICT Literacy (NAP – ICTL) was established in 2005 to address the need for monitoring student skills related to ICT and has been conducted every three years since its inception.

This report reviews procedures, processes and technical aspects of the NAP – ICTL 2014 and should be read in conjunction with the National Assessment Program – ICT Literacy Year 6 and Year 10 Report 2014, which focuses on results and interpretation of results from that assessment (ACARA, 2015). The first cycle of NAP – ICTL was held in 2005 and provided the baseline against which future performance would be compared. The second assessment was conducted in 2008 and was the first survey where trends in performance were examined, while the third assessment implemented in 2011 contained, for the first time, comparisons across more than two adjacent cycles.

National Assessment Program – ICT Literacy

The NAP – ICTL 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 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 – ICTL Assessment Domain (MCEETYA, 2005). It was elaborated first through a set of six key processes and then through three broad strands. Finally, a progress map was developed that articulated the meaning of progress in ICT literacy (MCEETYA, 2007). ICT literacy continues to be regarded as a broad set of cross-disciplinary capabilities that are used to manage and communicate information (Binkley et al., 2012: 52). Capabilities in ICT literacy combine aspects of technological expertise with concepts of information literacy and extend to include ways in which information can be transformed and used to communicate ideas (Markauskaite, 2006; Catts & Lau, 2008). ICT literacy has not focused on programming but on computer use (with computers being seen as an important sub-domain of ICT).

At its inception, the NAP – ICTL Assessment Domain was influenced by work conducted by the Educational Testing Service (ETS) to develop a framework for ICT literacy (ETS, 2002). Since this initial work there has been growing interest in the assessment of ICT literacy related competencies in Australia as well as internationally (Erstad, 2010; European Commission, 2006). Two international projects have emerged in which Australia is participating: the Assessment and Teaching of 21st Century Skills (Griffin, McGaw and Care, 2012) and the International Computer and Information Literacy Study (ICILS) commissioned by the International Association for the Evaluation of Educational Achievement (IEA), which was conducted for the first time in 2013 (Fraillon, Ainley, Schulz, Friedman & Gebhardt, 2014).

Continuing advances in hardware and software technologies have meant that the contexts in which ICT literacy can be demonstrated are changing. Despite this, the core capabilities that are the basis of the NAP – ICTL assessments have remained consistently relevant in the field and congruent with curriculum developments in Australia, including the introduction of ICT capability in the Australian Curriculum (ACARA, 2012b).

Assessment procedures and trend measurement in NAP – ICTL 2014

The assessment for NAP – ICTL 2014 was computer-based and included a combination of simulated and authentic software applications with multiple-choice and text response items, grouped into nine modules, each with its own unifying theme that provided an authentic rationale for completing the tasks beyond their inclusion in a test. Each student completed four out of nine modules which were assigned randomly on a rotational basis.

The assessment was structured to be congruent with the 2005, 2008 and 2011 assessments so as to provide a basis for comparison with them. It was also designed to assess ICT literacy in new contexts and using new developments. For this reason the assessment included previously used or *trend* modules and newly developed modules. The basic format of the ICT literacy assessment in 2014 was the same as in previous cycles to ensure a consistent on-screen environment for students.

Three of the nine modules were trend modules as used in either or both of 2008 and 2011: *Art show* (included in 2011), *Friend's PC* (included in 2008 and 2011) and *Sports Picnic* (included in 2008 and 2011). Each student completed two of the three trend modules.

Six new modules were developed for use in 2014: *Computer Game, Battle of the Bands, Techno-teaching, Slide Show, Technology on the Go* and *Animation Video*. Each student completed two of these new modules. These modules reflect more recent developments in software contexts in which students use ICT and included content such as web page editing, using animation software and working in collaborative workspaces and with tablet interfaces.

Each module followed a linear narrative sequence designed to reflect students' typical *real world* use of ICT. The modules included a range of school-based and out-of-school-based themes. The modules were as follows:

- The *Art Show* module (trend) required students to play the role of content manager for web-based resources and related to students' decision making around the selection and inclusion of appropriate content as well as the technical processes of adding content to web-based resources using software that reflected standard design interface conventions.
- In the *Sports Picnic* module (trend), students used a blog website and a comparative search engine to identify a venue for a sports picnic and to select sports equipment. They used tailored graphics software to produce invitations that included a map generated by using embedded mapping software.
- In the *Friend's PC* module (trend), students searched for and installed photo management software, changed settings for antivirus software, organised a photo collection and edited a photo.
- In the *Computer Game* module (new, Year 10 only), students were asked to work on a project concerned with creating an online game for a class, which used some software to design a survey, ask the teacher to help administer the survey, interpret the survey results and use some software to add two new levels to an online mathematics game.
- In the *Battle of the Bands* module (new, Year 10 only), students had to work with a scenario of three students forming a music band that has won a talent contest and been invited to enter an interstate competition. Tasks included to help the band by completing the online registration for the competition, promote the band's next gig through social media and set up a crowd-funding web page to raise money.
- The *Techno-teaching* module (new, Year 10 only) required students to write a report in collaboration with another student on whether computers can replace teachers in the classroom, which included searching websites to find appropriate material and to format a report that has been drafted by their colleague.
- The *Slide Show* module (new) asked students to complete a class project about the Tasmanian Devil Program on Maria Island involving opening and saving files, searching websites for information on the topic, creating a short slide show

about the Tasmanian Devil Program on Maria Island and scripting notes to go with the slide show.

- In the *Technology on the Go* module (new), a student has borrowed a tablet computer to take on a two-week school trip to Central Australia and is asked to set up the tablet to access the internet, install a number of applications on the tablet computer, set up one of the applications to collect weather data and use software to manage the data.
- The *Animation Video* module (new) consisted of a scenario where a student is part of a design team creating an animated video about water safety around lakes and dams, which is aimed at upper primary school students, and for which the student is required to upload a file to a video website, adjust settings on a video website and use specific software to make a video.

Student questionnaire

A questionnaire for students was incorporated into the (computer-delivered) survey instrument. The questionnaire included some identical questions to those used in previous cycles of NAP – ICTL, similar questions to those used in previous cycles, and some were new questions, including questions about the students' view of the importance of using computers and which types of ICT tasks they had learned at school. The questions in the questionnaire covered the following areas: student experience of using ICT; access to computer resources; frequency of computer use; frequency of use of various computer applications; interest in and enjoyment of using ICT and student ICT self-efficacy.

Delivering the assessments

The principal delivery method for NAP – ICTL 2014 was 'online' via the internet, which constitutes a change from previous assessments. However, in cases where schools did not have sufficient resources for 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, ACER-supplied 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. Such problems could have impacted on the comparability of results obtained solely from an online delivery.

In the preparation phase prior to the assessment, schools were contacted to assess their preparedness to use the new online delivery mode, including a technical readiness test (TRT) on all computers designated for testing. Most schools (95%) used the online delivery mode while in a relatively small number of schools (31) it was necessary to use USB devices on school computers. Even fewer schools (8) required the provision of suitable portable computers for the assessment.

The assessments in schools were conducted by trained test administrators, typically in two groups of ten students at a time. The total time for administration of the four test modules and the student questionnaire was approximately two hours, including 10 minutes for students to be introduced to the testing system with a guided set of practice questions. The assessments were conducted between 13 October and 14 November 2014.

Student background

Data regarding individual student background characteristics were collected from school records, either from the compilations held by education authorities in jurisdictions or directly from schools. While in 2014 the proportions of missing data were relatively low, there was considerable variation in percentages of missing information across jurisdictions. The much higher percentages of missing student background data in 2011 also limited the possibility of presenting comparisons of relations between ICT literacy and student background in 2014 with those from previous assessment cycles.

Sample

The NAP – ICTL 2014 was based on a nationally representative sample of 649 schools with 10,562 participating students, of which 5,622 were from Year 6 and 4,940 were from Year 10. The student data represent 87 per cent of the sampled Year 6 students and 77 per cent of the sampled Year 10 students, so there is only limited potential bias arising from differential participation.

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 Year 6 and 10 Report 2014 (ACARA, 2015).

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 recording of the results for NAP – ICTL 2014 on the scale that had been established in 2005. Consequently, the results from

NAP – ICTL 2014 are directly comparable with those from NAP – ICTL 2011, 2008 and 2005. In practice, 25 items performed in a sufficiently uniform manner across the 2014 and 2011 cycles to be used for equating the results of NAP – ICTL 2014 to the ICT literacy scale established in 2005.

It was also possible to describe students' ICT literacy in terms of proficiency levels. Six proficiency levels were defined in NAP – ICTL 2005 and descriptions, based on the content of the tasks corresponding to the difficulty range in each level, were developed to characterise typical student performance at each level. The newly developed assessment modules for NAP – ICTL 2014 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 proficiency scale, Proficient Standards were established in 2005 for Year 6 and Year 10. The Proficient Standards represent points on the proficiency 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 2014, 55 per cent of Year 6 students reached or exceeded the Year 6 Proficient Standard, whereas 52 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 – ICTL 2014 sample assessment.

Chapter 1 provides important background information and an overview of the main activities involved in test development and implementation and reporting of data.

Chapter 2 summarises the development of the assessment domain 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 data 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 (2014 to 2011, 2008 and 2005) equating and the procedures for estimating equating errors.

Chapter 7 outlines the proficiency levels and the Proficient 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 – ICTL 2014.

Chapter 2: Assessment framework and instrument development

Julian Fraillon and Wolfram Schulz

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 underwent a review which took the Australian Curriculum for students' development of ICT capability (ACARA, 2012b) into account, and it was renamed the NAP ICT – *Literacy Assessment Framework* (ACARA, 2014).

The assessment framework was the central reference point for the construction of the assessment instrument. The described achievement scale generated using the 2005 data (and supplemented with item data from 2008 and 2011) 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

For the purpose of this assessment, ICT literacy was defined 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" (ACARA, 2014). The definition is the same as that used in previous cycles of NAP – ICT Literacy and draws heavily on the framework for ICT literacy developed by the International ICT Literacy Panel in 2002 for the OECD PISA ICT literacy Feasibility Study (International ICT Literacy Panel, 2002). While ICT can be broadly defined to include a broader range of tools and systems, this assessment focuses primarily on the use of computers rather than other forms of ICT.

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

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

The assessment framework includes an ICT literacy progress map that describes skills and understandings that become progressively more demanding across higher proficiency levels. Student achievement of the different ICT literacy processes can only be demonstrated by taking into account the communicative context, purpose and consequences of the medium. The ICT literacy progress map was based on three organising *strands*:

- Strand A – working with information
- Strand B – creating and sharing information
- Strand C – using ICT responsibly.

In Strand A (*working with information*), students progress from using key words to retrieve information from a specified source, through identifying search question terms and suitable sources, to applying a range of specialised sourcing tools and seeking confirmation of the credibility of information from external sources.

In Strand B (*creating and sharing information*), students progress from using functions within software to edit, format, adapt and generate work for a specific purpose, through integrating and interpreting information from multiple sources with the selection and combination of software and tools, to the application of specialised tools to control, expand and author information, producing representations of complex phenomena.

In Strand C (*using ICT responsibly*), students progress from understanding and using basic terminology as well as applications of ICT in everyday life, through recognising responsible application of ICT in particular contexts, to understanding the impact and influence of ICT over time and the social, economic and ethical issues associated with its use.

Mapping the NAP – ICT Literacy Assessment Framework to the Statements of Learning for ICT and ICT Capability in the Australian Curriculum

Since the development of the original NAP – ICT Literacy Assessment Domain in preparation for the 2005 assessment, two key documents have been released that support an Australian national perspective on ICT literacy: the *Statements of Learning for Information and Communication Technologies*, referred to as the Statements of Learning in this report, developed through the Australian Education Systems Official Committee (AESOC) on behalf of MCEETYA (AESOC, 2006); and the document describing *Information and Communication Technology (ICT) capability* (ACARA, 2012). Although each of the two documents serves a slightly different purpose in supporting the implementation of ICT literacy in Australian schools, the documents are clearly interrelated, particularly in terms of their overarching conceptualisation of the components and breadth of ICT literacy.

The Statements of Learning describe the knowledge, skills, understandings and capacities in the field of ICT that all students in Australia should have the opportunity to learn in terms of five overlapping elements.

In the Australian Curriculum, ICT capability is identified as one of the general cross-curricular capabilities that will assist students to live and work successfully in the twenty-first century (ACARA, 2012).

The ICT Capability learning continuum (specified for the end of Year 2, end of Year 4, end of Year 6, end of Year 8 and end of Year 10) is organised into five interrelated elements (ACARA, 2012):

1 Applying social and ethical protocols and practices when using ICT

2 Investigating with ICT

3 Creating with ICT

4 Communicating with ICT

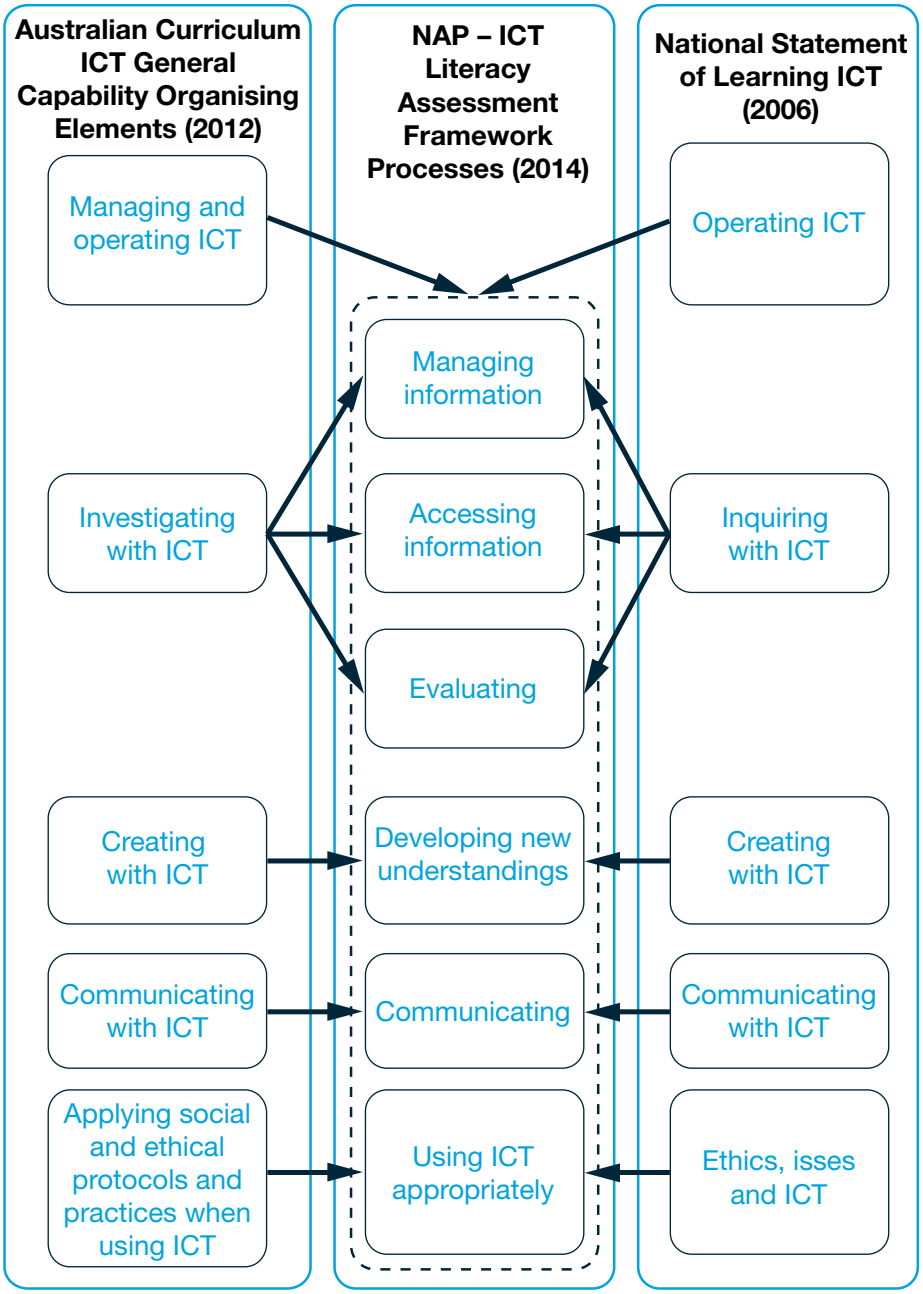
5 Managing and operating ICT.

Figure 2.1 shows a mapping of the elements of the NAP – ICT Literacy Assessment Framework with those included in the Statements of Learning and the Australian Curriculum document describing ICT Capability. The mapping illustrates the strongest connections between the elements but is not intended to suggest that these are necessarily the only connections. The primary purpose of this mapping is to demonstrate the congruence between the NAP – ICT Literacy Assessment Framework and the documents containing the Statements of Learning and the ICT Capability as described in the Australian Curriculum document.

Figure 2.1 emphasises the clear connections between the NAP – ICT Literacy Assessment Framework contents and those of the subsequent frameworks. Three of the NAP – ICT Literacy elements – *developing new understandings; communicating; and using ICT appropriately* – correspond directly to three elements in each of the Statements of Learning and the ICT Capability document.

The two main structural differences between the assessment framework and the other framing documents relate to the treatment of *ICT inquiry/investigative processes and ICT operation* (skills and processes). In the NAP – ICT Literacy Assessment Framework the process of inquiry is represented across the three processes of accessing, managing and evaluating information whereas in the Statements of Learning and in the ICT Capability document these integrated processes have been subsumed under the general concept of inquiring/investigating. This difference reflects the different purposes of the documents. The Statements of Learning and the ICT Capability document have a focus on curriculum implementation that supports an integration of the processes of accessing, evaluating and managing information. However, the assessment framework needs to guide the development of assessment tasks that target each of these components and represent them as discrete elements. Furthermore, it serves to provide an underpinning for the processes of assessment design and reporting that are central to the National Assessment Program.

Figure 2.1 Mapping of NAP – ICT Literacy Assessment Framework, Statements of Learning and ICT Capability as described in the Australian Curriculum



Both the Statements of Learning and the ICT Capability document include operating (and managing) ICT as a discrete element. While there are some differences between the two documents with regard to the elaborations of these elements, their general essence relates to the application of technical knowledge and skills to work with information. This concept is the global unifier across the NAP – ICT Literacy Assessment Framework and this has been represented by the dotted line drawn around all of the elements of the assessment framework shown in Figure 2.1. All the tasks in the NAP – ICT Literacy assessment instrument require students to demonstrate operational skills and understanding. Because the test is an authentic representation of ICT use, the global theme of ICT operation is embedded in each task and is inferred across all aspects of student performance. While in the case of the NAP – ICT Literacy Assessment Framework, the inclusion of an overarching element relating to operational use of ICT would be redundant due to the specific characteristics of the assessment program, in the Statements of Learning and the ICT Capability document it clearly needs to be an essential component of the curriculum.

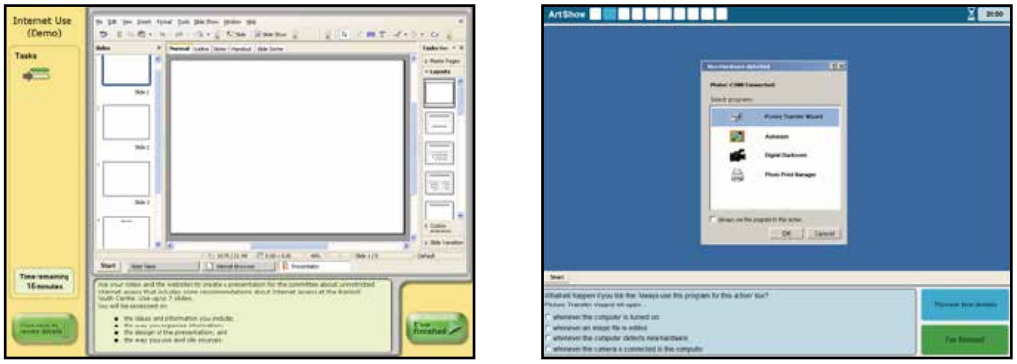
In summary, the elements of ICT learning specified in the Statements of Learning and the ICT Capability document are consistent with the elements for assessment described in the NAP – ICT Literacy Assessment Framework. Differences of structure across the documents reflect their different primary purposes to guide the design of an assessment (in the case of the assessment framework) or to provide a curriculum (in the case of the Statements of Learning for ICT and the ICT Capability document). The newly developed NAP – ICT Literacy assessment modules in 2014 were developed with explicit reference to the NAP – ICT Literacy Assessment Framework and are also congruent with the contents of the ICT Capability document and the Statements of Learning.

Assessment delivery system

The software developed by SoNET systems 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 questionnaire. In 2014 the assessment was primarily delivered to students (typically on school computers) through the internet. In 2011 the assessment was primarily delivered using USB sticks (one per student, typically on school computers). The core (web-based) assessment software system was the same across these two cycles with only the primary delivery mode changing from USB in 2011 to internet-based in 2014.

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 – ICTL 2014, 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.



2005 – 2011 Interface 2014 Interface

Figure 2.2 NAP – ICT Literacy interfaces in the previous cycles (2005 -2011) and the 2014 cycle

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:

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

Instrument development

Six new modules were developed for use in NAP – ICTL 2014. The tasks and items in these modules were designed to maintain the requisite content coverage specified in the assessment framework and to make use of software contexts that reflect changes in software since 2011. The content and contexts of the new modules were determined in consultation with the NAP – ICT Literacy Working Group. The six new modules were: *Computer Game, Battle of the Bands, Techno-teaching, Slide Show, Technology on the Go* and *Animation Video,* which were described in details in chapter one.

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 practice 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, different available paths. Examples of such items are when students are asked to configure some software settings which 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 click on *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 clicked on *I've Finished*, they were given the option to *Try Again*. There was no limit for these items on how often a student could select *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 demonstrate.

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 questionnaire

As was the case for the 2005, 2008 and 2011 NAP – ICT Literacy surveys, there was a questionnaire for students incorporated into the survey instrument. In 2005 and 2008 the questionnaire material included student demographic information and questions about student ICT use. Since NAP – ICTL 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 questionnaire content addressing student use and perceptions of using computers and ICT.

The 2014 questionnaire 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.

The questions in the questionnaire covered the following areas:

- experience of using ICT
- access to computer resources
- frequency of computer use

- frequency of use of various computer applications
- interest in and enjoyment of using ICT
- student ICT self-efficacy
- student use of ICT for school-related purposes
- student experience of ICT learning at school.

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

Field trial

The ICT literacy field trial was completed in March 2014 by 2188 students in 110 schools (55 Year 6 schools and 55 Year 10 schools). The field trial was conducted in New South Wales (48 schools), Victoria (34 schools) and Queensland (28 schools).

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 2.1.

The 2014 field trial instrument included four of the modules from NAP – ICTL 2011 (trend modules) with the expectation to include three of them in the main data collection. This was done to select the most appropriate of these modules for equating data from 2014 to the established reporting scale used in 2011, 2008 and 2005. The four trend modules were *Art Show* (from NAP – ICTL 2011), *Sports Picnic* (from NAP – ICTL 2008 and 2011), *Friend's PC* (from NAP – ICTL 2008 and 2011) and *Wiki Builder* (from NAP – ICTL 2011). Based on the field trial test data it was decided to exclude one trend test module – *Wiki Builder* – from the main survey instrument.

Overall, the field experience with 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 2014 main survey. Early in the field trial a software error was detected that resulted in the responses to some test items not being recorded. This was corrected during the field trial and had therefore no effects on the quality of the main survey data. 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 – ICTL 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 stick with onsite experiences (2) Capacity of school to provide onsite 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) The USB-based test delivery was tested 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 helpdesk) (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

Summary

The national assessment of ICT literacy in 2014 was based on a definition that emphasised accessing, managing and evaluating information as well as developing new understandings, and communicating with others. A key aspect of the assessment of ICT literacy in Australia has always been its design as an authentic performance assessment. The assessment instrument was designed to mirror students' typical 'real world' application of ICT. Students completed tasks on computers using software that included a seamless combination of simulated and live applications. Some tasks were automatically scored and others (those that resulted in information products) were stored and marked by human assessors. The tasks (items) were grouped in thematically linked modules, each of which followed a narrative sequence covering a range of school-based and out-of-school based themes. Test modules typically involved students collecting and appraising information as well as synthesising and reframing the information. The assessment involved a number of modules so as to ensure that the assessment instrument assessed what was common to the ICT literacy construct across a sufficient breadth of contexts.

In NAP – ICTL 2014, the great majority of tests were administered on computers via the internet. Despite this change in the delivery technology from 2008 (where delivery was USB-based), the overall format of the ICT literacy assessment in 2014 was consistent with that of previous cycles. The appearance of material on screen was identical and the method of responding to tasks and saving information products was exactly the same. The screen layout and user features of previous NAP – ICT Literacy cycles were maintained for NAP – ICTL 2014, although the user interface was updated to reflect more modern software interface design. The colours were changed and the appearance of the buttons was updated. The assessment instrument used in the 2014 field trial was linked to that used in 2011, 2008 and 2005 by the inclusion of four trend modules that had been used in 2011 (two of which were also used in 2008). The field trial assessment in 2014 included six new modules designed to maintain the requisite content coverage specified in the assessment framework and to make use of software contexts that reflect changes in software applications since 2011. The content and contexts of these new modules were determined in consultation with the NAP – ICT Literacy Working Group. The student questionnaire was expanded to include more detail of student perceptions of using ICT than had been collected in previous cycles of NAP – ICT Literacy.

Chapter 3: Sampling and weighting

Eveline Gebhardt, Martin Murphy and Greg Macaskill

This chapter describes the NAP – ICTL 2014 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 – ICTL 2014, 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) index of Education, Occupation[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.

1 This is a measure of socio-economic status based on the geographic location of the school.

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 1.4 per cent of the Year 10 student population.

The decision to include very remote schools in the Northern Territory sample for 2014 was made because very remote schools constituted over 20 per cent of the Year 6 population and over 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 survey. The inclusion of very remote schools in the Northern Territory in the NAP – ICTL 2014 sample does only have a negligible impact on the estimates for Australia or the other states.

The designed sample

For both the 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 survey, the burden on individual schools and the overall costs of the survey. 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.

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.

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
ACT	4633	95	20	4843	39	20
New South Wales	86 426	2077	50	86 652	793	50
Northern Territory	3191	123	20	2464	44	15
Queensland	56 615	1162	50	58 447	458	50
South Australia	18 415	534	45	19 968	192	50
Tasmania	6314	201	40	6617	92	35
Victoria	65 211	1664	50	66 237	570	50
Western Australia	28 360	720	45	17 993	238	50
Australia	**269 165**	**6576**	**320**	**263 221**	**2426**	**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* for very small schools (between 5 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 is described 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.

Prior to sample selection an adjustment to the *MOS* was made as a result of procedures applied to minimise overlap with schools that participated in the TIMSS 2013 survey. The aim of minimising overlap between the two surveys was to ensure that the burden of participating in these major surveys was spread across more schools.

The overlap control procedures were the same as those used for controlling overlap between PISA and other surveys, as described in the PISA 2012 Technical Report (OECD, p. 79).

To achieve this, the school selection probability was adjusted as follows:

With *PROBP* as the school selection probability for ICTL prior to adjustment, *PROBT* as the school selection probability for TIMSS, and *PROBI* as the ICTL school selection probability, we applied the following adjustments:

$$PROBI = MAX\left[0, \left(\frac{PROBT + PROBP - 1}{PROBT}\right)\right]$$ for TIMSS schools

$$PROBI = MIN\left[1, \left(\frac{PROBT + PROBT - 1}{PROBT}\right)\right]$$ for schools not selected for TIMSS

$PROBI = PROBP$ for schools not eligible for TIMSS

An adjusted measure of size based on these conditional probabilities (*CMOS*) was then calculated as follows and applied in the systematic sample selection.

$CMOS = PROBI \times$ stratum sampling interval.

Following this adjustment, the standard procedure for selecting schools with PPS, as described above, was applied, but using the adjusted measures of size *(CMOS)* rather than the original *MOS*. A consequence of applying these procedures to the adjusted measure of size is that the number of schools sampled can be slightly lower or higher than the originally assigned sample size (usually no more than one school difference), but this was considered acceptable.

On the basis of an analysis of small schools (schools with lower enrolments than the assumed cluster sample size of 20 students) undertaken prior to sampling, it was decided to increase the school sample size in some strata in order to ensure that the number of students sampled was close to expectations. As a result, the actual number of schools sampled (see Table 3.4 and Table 3.5) was slightly larger than the designed sample (see Table 3.1). 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

location 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 two 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:* Student has a moderate to severe permanent physical disability such that he/she cannot perform in the assessment situation.
- *Intellectual disability:* Student has a mental or emotional disability and is cognitively delayed such that he/she cannot perform in the assessment situation.
- *Limited assessment language proficiency:* The student is unable to read or speak the language of the assessment and would be unable to overcome the language barrier in the assessment situation. Typically, a student who has 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 – ICTL 2014 assessment, according to the reason given for their exclusion. The number of student-level exclusions was 152 at Year 6 and 157 at Year 10. This gives weighted exclusion rates of 1.9 per cent of the sampled Year 6 students and 2.5 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
ACT	1	2	6	9	2.3
New South Wales	4	4	5	13	1.5
Northern Territory	1	1	3	5	1.4
Queensland	11	35	2	48	4.8
South Australia	2	10	5	17	2.1
Tasmania	6	8	4	18	2.3
Victoria	5	15	4	24	2.3
Western Australia	2	11	5	18	2.0
Australia	**32**	**86**	**34**	**152**	**2.5**

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
ACT	1	2	9	12	2.9
New South Wales	1	3	4	8	0.9
Northern Territory	3	6	18	27	8.7
Queensland	3	10	6	19	1.9
South Australia	9	8	13	30	2.7
Tasmania	6	9	8	23	3.6
Victoria	8	4	11	23	2.3
Western Australia	3	7	5	15	2.0
Australia	**34**	**49**	**74**	**157**	**1.9**

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:

- the selection of the school at the first stage
- 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 the lower. (A school with a *MOS* greater than the *SINT* is a certain selection and therefore has a probability of 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 $(BWsc)$, was the inverse of this probability

$$BWsc = \frac{SINT}{MOS}$$

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}).

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 less 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.

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:

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

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:

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

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 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.

$$\mathrm{BW}_{st} = \frac{n_{tot}^{st}}{n_{samp}^{st}}$$

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

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

The final student weight was:

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

Overall sampling weight and trimming

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 was 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 with 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:

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

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 *BW* (numerator) or the school's *FW* (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:

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

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 BW to zero and applying the same computations as above. More formally, the parts of the response rates are computed as follows:

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

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

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

Reported response rates

The Australian unweighted school participation rate in Year 6 was 90 per cent, including replacement schools and 89 per cent excluding replacement schools. In Year 10, the respective percentages were 81 and 80 per cent. These unweighted response rates are very similar to the weighted response rates.

When including replacement schools, the lowest unweighted school participation rates were recorded in the Northern Territory (95% in Year 6 and 93% in Year 10). All other states had a school participation rate of 100 per cent in Year 6. Five states had a school participation rate of 100 per cent in 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
ACT	0.92	1.00	0.92	0.87	0.95	0.92	0.92	1.00	0.92	0.88	0.95	0.92
New South Wales	0.91	1.00	0.91	0.91	1.00	0.91	0.92	1.00	0.92	0.92	1.00	0.92
Northern Territory	0.82	0.95	0.86	0.82	0.95	0.86	0.82	0.91	0.90	0.82	0.91	0.90
Queensland	0.91	1.00	0.91	0.91	1.00	0.91	0.91	1.00	0.91	0.91	1.00	0.91
South Australia	0.89	1.00	0.89	0.87	0.98	0.89	0.89	1.00	0.89	0.86	0.98	0.89
Tasmania	0.91	1.00	0.91	0.91	1.00	0.91	0.92	1.00	0.92	0.92	1.00	0.92
Victoria	0.93	1.00	0.93	0.93	1.00	0.93	0.93	1.00	0.93	0.93	1.00	0.93
Western Australia	0.89	1.00	0.89	0.87	0.98	0.89	0.89	1.00	0.89	0.88	0.98	0.89
Australia	**0.90**	**1.00**	**0.91**	**0.89**	**0.99**	**0.91**	**0.91**	**1.00**	**0.91**	**0.91**	**0.99**	**0.91**

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
ACT	0.78	1.00	0.78	0.78	1.00	0.78	0.78	1.00	0.78	0.78	1.00	0.78
New South Wales	0.81	1.00	0.81	0.81	1.00	0.81	0.78	0.96	0.82	0.78	0.96	0.82
Northern Territory	0.64	0.93	0.69	0.64	0.93	0.69	0.53	0.71	0.74	0.53	0.71	0.74
Queensland	0.83	1.00	0.83	0.83	1.00	0.83	0.83	0.98	0.85	0.83	0.98	0.85
South Australia	0.80	1.00	0.80	0.78	0.98	0.80	0.79	0.96	0.82	0.77	0.94	0.82
Tasmania	0.77	0.97	0.79	0.77	0.97	0.79	0.77	0.94	0.82	0.77	0.94	0.82
Victoria	0.86	1.00	0.86	0.85	0.98	0.86	0.84	0.98	0.86	0.83	0.96	0.87
Western Australia	0.81	0.98	0.83	0.81	0.98	0.83	0.81	1.00	0.81	0.81	1.00	0.81
Australia	**0.81**	**0.99**	**0.81**	**0.80**	**0.99**	**0.81**	**0.81**	**0.97**	**0.83**	**0.81**	**0.97**	**0.83**

Chapter 4:
Data collection procedures

Kate O'Malley

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 so as to ensure the integrity and quality of the data, whilst also minimising the administrative burden on participating schools.

This chapter outlines the procedures used to collect data for NAP – ICTL 2014. 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)
Student List for Year 6 or Year 10 students requested	Upload requested information to the School Administration website
Computer resource information (including Technical Readiness Test [TRT] results) requested	Inform ACER of computer resource availability (including TRT) via the School Administration website and TRT survey
Test delivery method for each school (i.e. online or via USB stick) confirmed	
Test administrators for assessment are selected and trained (includes dissemination of *TA manual*)	
Liaison with school regarding preferred dates for assessment	
Year 6 and Year 10 ICT Literacy assessments are administered	Host assessment with test administrator assistance
Data are cleaned and student tasks are scored	
Interactive online summary reports provided to schools	Access summary reports from ACER OARS system

Contact with schools

The field administration of NAP – ICTL 2014 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.

- 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.
- 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.
- 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.
- 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.
- ACER test administrators then liaised with each school contact so as to confirm the time of assessment, and to discuss any special provisions needed for the assessment day.
- The test administrators then visited the schools on the scheduled day to administer the assessment. If 80 per cent attendance rates were not reached on the initial assessment day, return visits were made to the school to assess the remaining sampled students.
- 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 timeframe was provided for the provision of this information. If the school did not respond within the designated timeframe, follow-up contact was made via email and telephone.

The NAP – ICTL Online School Administration Website

All information provided by schools to ACER was submitted via a secure website. The benefits of the NAP – ICTL 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 using it to provide information to ACER regarding school contact details, assessment date preferences, and student-related information as required.

Collection of student background information

In 2004, Australian Education Ministers agreed to implement standard definitions for student background characteristics detailed in the *2012 Data standards manual* (ACARA, 2012), to collect student background information from parents and to supply the resulting information to national assessment programs. The data were matched to students' test and questionnaire 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 *2012 Data standards manual* (ACARA, 2012). For NAP – ICTL 2014, student background data were collected in one of two ways: either 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, so as to avoid burdening schools with this administrative task. Provision of student background data from education authorities occurred in just under 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 NAP – ICTL Online School Administration Website. Student background coverage by state and territory is included in the *National Assessment Program – ICT Literacy Year 6 and 10 Report 2014* (ACARA, 2015) 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 officer, 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.

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 questionnaire 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 – ICTL 2014 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 – ICTL 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 Technical Readiness Test (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, their role involved conducting the Technical Readiness Test (TRT) on the school's computers that were to be used for the assessment. They were also asked to ensure that all computers were switched on, 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 Technical Readiness Test (TRT) on the computers that were selected for use. The TRT consisted of a number of tests that checked the compatibility of the school's 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 preformed, the ACER Project Team would liaise with any IT Coordinators who had experienced issues with its conduct. The matter was then resolved in one of two ways:

1 The technical issue was resolved through a process of troubleshooting with the ACER Project Team. This sometimes involved referring the matter to the test delivery system developers, or, in the case of access/security protocols, to the relevant central education authority of the applicable school.

2 If the technical issue could not be resolved, the school was flagged as requiring an alternate test delivery method. This meant that the assessment would need to be conducted via USB stick on either the school computers or computers supplied by ACER (referred to as the *mini-lab* solution).

The test administrator

In total, 66 test administrators (TAs) were employed nationally to administer the tests in all standard delivery schools. Each TA was required to complete a TA training of three compulsory elements. These elements were:

1 *Reading and understanding the TA 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.

2 *Online training videos.* ACER developed a number of online training videos for TAs to view before the assessment period. These videos were accessible via

the TA website. TAs were encouraged to view these videos several times to familiarise themselves with all test administration procedures.

3 *TA assessment via teleconference.* Each TA was required to take part in a one-hour teleconference with the ACER Project Team. During the teleconference they were asked a number of questions about test administration procedures and associated administrative processes. TAs were also encouraged to ask questions about any element of the project with which they were unfamiliar to gain a common understanding of the expected procedure.

Test administrators were also supported via email and telephone (toll-free help line) before and during the assessment period.

The primary responsibility of the test administrator was to administer NAP – ICTL 2014 to the sampled students, according to the standardised administration procedures provided in the *Test administrator manual* and *Test instructions handbook*. The test administrators' 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 questionnaire 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 – ICTL test administrators. 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:

   - » the assessment date for each school
   - » the name and contact details of the school contact officer, IT Coordinator and principal at each school
   - » the address of the school
   - » the names of all students selected to participate in the assessment
   - » any other important information about the school's participation (e.g. whether the school required the test administrator to bring in laptops for the students to use).

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.

This website was designed to assist test administrators in administering the assessment to their allocated schools throughout the administration of NAP – ICTL 2014.

Assessment administration

Schools were allowed to schedule the assessment on a day that suited them within the official assessment period. In 2014, the assessment period for each jurisdiction was as follows:

- NSW, NT, Qld, Vic: 13 October – 7 November 2014
- ACT, SA, Tas, WA: 20 October – 14 November 2014

The NAP – ICTL assessment consisted of an introductory tutorial (10 minutes), four assessment modules (20 minutes each) and a student questionnaire (10 minutes). All components were to be administered on the same day with a short break between the modules. Whilst the actual assessment time was 80 minutes, schools were asked to allow approximately two hours for the entire assessment process to allow 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 Questionnaire	10 minutes

Flexible delivery

To include eight extremely remote Northern Territory schools in the sampling frame for this assessment, modifications to the standard method of administration were made. These modifications included:

- the school contact officer (i.e. school teacher) administering the assessment instead of an external test administrator. ACER funded two teacher relief days for the teachers at each flexible delivery school as additional assistance over the assessment period
- administering the assessment, to either groups of students or individuals, over a series of weeks where it was possible and appropriate to do so (as opposed to one scheduled assessment)
- being able to read out the instructions and questions to the students.

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 – ICTL.

Data capture

As outlined before, the NAP – ICTL assessment was administered in all standard delivery schools by ACER-trained test administrators. In the eight flexible delivery schools, the assessment was administered by a member of school staff who was supplied with the same ACER TA instructions. Below are the three delivery methods used to administer the 2014 assessment at all standard and flexible delivery schools:

1 *Using school computers (desktops or laptops) connected to the internet – the online solution.* This was the primary delivery method used by the majority of participating schools for this cycle.

2 *Using USB sticks on school computers (desktops or laptops) – the USB solution.* This method was the first-level, back-up test delivery method. It was used if the school's internet connection did not meet minimum requirements or if the school did not have the required internet browser installed on their computers. This method was used in approximately 5 per cent of participating schools.

3 *Using ACER-supplied laptops with USB sticks – the minilab solution.* This was the second-level back up test delivery method. It was used in schools that did not have the necessary minimum of 10 co-located computers meeting the minimum requirements for this testing. ACER would supply 10 laptops to the test administrator to bring to the school. The test program was deployed via USB. The test session was conducted in two sessions: a morning session and an afternoon session. Each session could be up to 10 students. This method was used in only a handful of participating schools.

The choice of delivery method for each school was dependent on the TRT assessment of the school's technical resources and possible further liaison between the ACER Project Team and the school's IT Coordinator. Table 4.3 provides the counts of participating schools by test delivery method.

Table 4.3: Test delivery method summary

	Standard delivery schools	Flexible delivery schools
Method of delivery	Number of schools	
Online	608	6
USB	29	2
Minilab	8	
Total	645	8

Return visits to schools

Test administrators were required to re-visit 43 standard delivery schools. It was because of fewer than 80 per cent of the sampled students being available or present on the assessment day due to illness or other unexpected absenteeism.

Quality monitor visits

In line with quality assurance processes, ACER sent eight 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 questionnaire and achievement data were collected electronically, this assessment program did not require data entry.

ACER employed 18 markers and two group leaders to score the ICTL student responses over a two-and-a-half week period in November 2014. 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.

Between five and 20 student responses were pre-selected for each training item to cover the complete range of student responses for that item. These pre-selected responses were 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 total, 414,653 student responses were marked, with 10 per cent of responses being double marked by the designated lead markers. The double-marking 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 – ICTL schools.

For previous cycles of this assessment, these reports were in a static, electronic PDF format. It 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 survey) receiving different levels of credit for each item.

For the NAP – ICTL 2014, ACER developed interactive online versions of the reports. They were created and disseminated within the ACER Online Assessment and Reporting System (OARS). These interactive reports were based on the same data as used in previous cycles. But it also allowed users to switch between whole school and individual student reports, and 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 for both the field trial and main study, however, in each case this was done for different reasons. At the field trial, the final item set had not been finalised to measure student achievement. During the main survey, 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 – ICTL *School and Student 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.

The school student report (Appendix 6) provided each school with a breakdown of their own students' individual performance on each item, by item set. Because students were assigned a different rotation of item sets, each item set contained results for a subset of students from each school.

Chapter 5: Data management

Kate O'Malley, Renee Kwong and Eveline Gebhardt

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 6-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 2-digit student number (01–20) which was unique to each student within the school.

Sample data

The sample 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, geolocation*, and the *Socioeconomic 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 survey 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 officer and principal, as well as information obtained from the school via the NAP – ICTL 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 questionnaire 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 three sources below. In addition to these variables, student weights and replicate weights were computed and added to the database.

1 the cognitive assessment data and student questionnaire data

2 the student background data and student participation data obtained from the student tracking database

3 school-level variables transferred from the sample database.

Data capture

Student cognitive and questionnaire data were predominantly captured via the online test program using school computers connected to the internet. In a small number of schools where internet delivery was not possible, USB sticks pre-loaded with the test program were used to capture these data.

As all the student questionnaire 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, questionnaire and background data.

- Students with invalid usernames were removed from the database.
- Students with no valid responses to the cognitive test were removed.
- Patterns of missing values were explored and, where appropriate, recoded into not reached.
- After computing the age of students in years, all ages outside a range of six years for each year level (from 10 to 13 years in Year 6 and from 13 to 19 years in Year 10) were set to missing.
- Missing sex of the student was imputed where gender could be inferred from the school (i.e. where single-sex) or name of the student.
- 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	M = male F = female
Date of Birth	Date of birth of student	Free response dd/mm/yyyy
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 Edition)
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 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

Table 5.1: Variable definitions for student background data

Category	Description	Codes
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 (ASCI) Coding Index 2nd Edition)

Variables were also derived for the purposes of reporting achievement outcomes. The transformations undertaken followed the guidelines in the *2012 Data Standards Manual* (ACARA, 2012). 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 MCEETYA Geographical Location Classification
Gender	*GENDER*	Classified by response; missing data 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* (0) according to the SACC codes.
LBOTE	*LBOTE*	Each of the three *LOTE* questions (Student, Mother or Father) were recoded to *LOTE* (1) or *Not LOTE* (2) according to ASCL codes. The reporting variable (*LBOTE*) was coded as *LBOTE* (1) if response was *LOTE* 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 – ICTL proficiency scale. Chapter 6 details the scaling procedures used. The final student database contained original responses to the cognitive items and the scaled student proficiency scores. In total, 133 items were used for scaling, of which 92 were used for both year levels and 41 for only Year 10 students.

Four codes were applied for missing responses to cognitive items. Code **8** was used if a response was invalid (e.g. two responses to a multiple-choice item), code **9** 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), and code **n** for *not administered* (when the item was not in a booklet).

Student questionnaire data

The student questionnaire was included to assess students' experience in using computers and affective processes as described in the assessment framework. The content of the constructs are described in Table 5.3 and the questionnaire is provided in Appendix 1. Nineteen indices were derived from responses to the questionnaire items. Simple indices were constructed by recoding the data of single items or by computing a new variable from between three to ten original items. The index *years of experience* was derived by recoding Q02 into units of years. Number of computers at home was the sum of the number of desktop computers, portable computers and tablets, with the highest category being three or more computers. The dichotomous indices for *computer systems* indicated the use of *Windows, Macintosh* or *other* systems either at home, at school or in other places. *Frequency of using computers at home* in general and *frequency of using computers at school* were simple recodes of the original questions by reversing the order of the categories, starting with the value zero for *never*.

Other student responses to the questionnaire were scaled to derive frequency of activity or affective indices. The methodology for scaling questionnaire 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 **8** for *invalid* responses, **9** for *missing* responses and **7** for *not administered*. Missing scale scores were coded as **999**.

Table 5.3 Definition of the indices and data collected via the student questionnaire

Index name	Index	Questions	Number of questions	Original categories	Recode	Method
NUMCOMP	Number of computers	Q01 a to c	3	0–12	0,1,2,3+	Recode
EXPERNC	Years of experience	Q02	1	1,2,3,4	1,2,4,6	Recode
SYSWIN	Windows computer system	Q03*1	3	1,2,3 / 4	0,1	Recode
SYSMAC	Macintosh computer system	Q03*2	3	1,2,3 / 4	0,1	Recode
SYSOTH	Other computer system	Q03*3	3	1,2,3 / 4	0,1	Recode
INTJOY	Interest and enjoyment	Q05b to e, Q06e	5	1,2,3,4	3,2,1,0	Scale
IMPICT	Importance of ICT	Q05a, Q6a to d	5	1,2,3,4	3,2,1,0	Scale
UTILH	Frequency utilities – Home	Q07*1	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
UTILS	Frequency utilities – School	Q07*2	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
ENTERTH	Frequency entertainment – Home	Q08*1	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
ENTERTS	Frequency entertainment – School	Q08*2	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
COMMH	Frequency communication – Home	Q09*1	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
COMMS	Frequency communication – School	Q09*2	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
TECHH	Frequency technological tasks – Home	Q10*1	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
TECHS	Frequency technological tasks – School	Q10*2	6	1,2,3,4,5,6	5,4,3,2,1,0	Scale
EFFICACY	Self-efficacy	Q11	9	1,2,3,4	3,2,1,0	Scale
ICTLRN	ICT learning at school	Q12	10	1,2	1,0	Scale
ICTCOMS	ICT use for common learning	Q13a to c, e, h	5	1,2,3,4	0,1,2,3	Scale
ICTSPECS	ICT use for special study purposes	Q13d, f, g, i, j	5	1,2,3,4	0,1,2,3	Scale

Student sample weights

In addition to students' responses, scaled scores, questionnaire 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, 165 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

Eveline Gebhardt, Wolfram Schulz and Renee Kwong

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

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

where $P_{xi}(\theta_n)$ denotes the probability of person n to score 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 4.0 software: see Adams, Wu & Wilson, 2014).

Scaling cognitive items

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

Assessment of item fit

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 143 items in the test, seven were removed from the scale due to poor fit statistics at both year levels (ASH01, ASH03, ASH09, ASH15, FPC11, FPC12, and NI13M5Q02) and three were removed at Year 10 (NI13M1Q09, NI13M3Q05B and NI13M3Q05C). Consequently, these items were not used to estimate student performance.

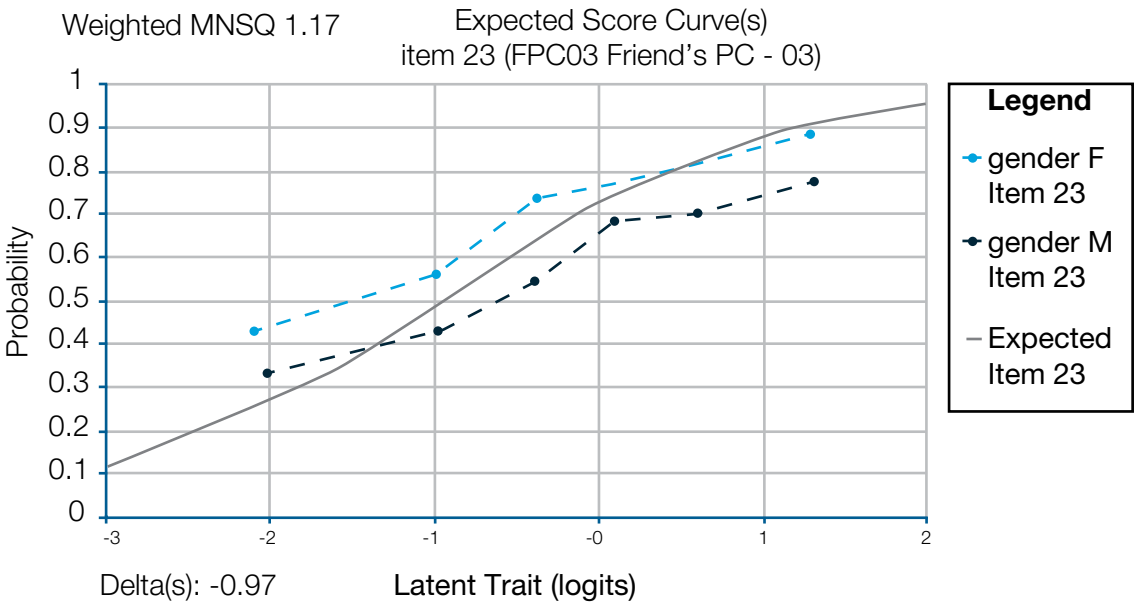
Final decisions on retaining test items were based on a range of different criteria. Generally, items were flagged for review if first item calibrations showed a considerably higher infit statistic (e.g. infit>1.2) as well as low item-rest correlation (0.2 or lower). The project team considered both 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 and consequently no items were removed only on the basis of DIF.

Figure 6.1 Example of item that advantages boys



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 92 common items between Year 6 and Year 10, 75 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 that were likely to be due to problems with test length (*Not reached items*)[4] were treated as missing for 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).

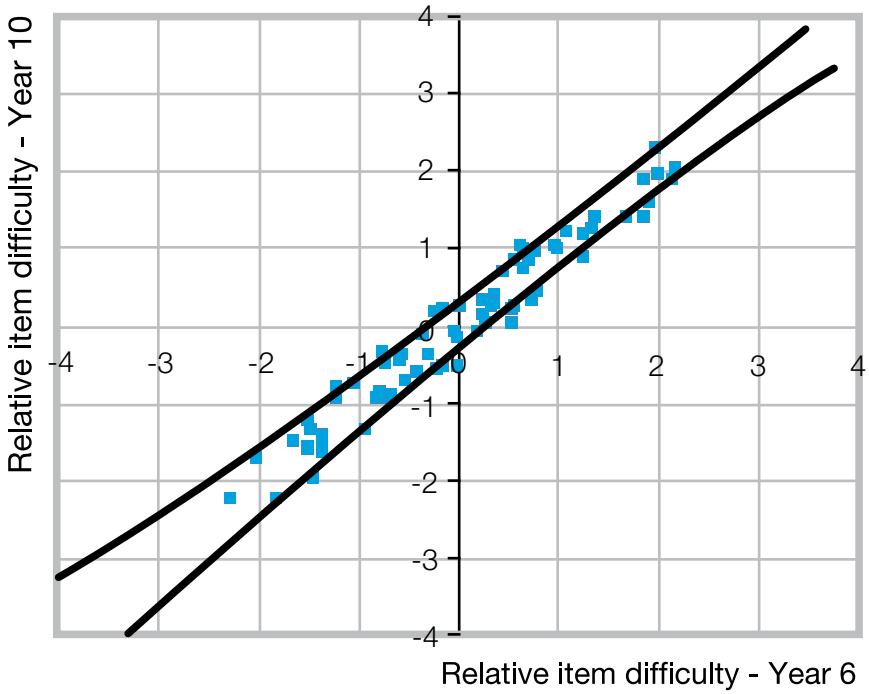
Item parameters were calibrated using all sampled student data, except for (the few) students from very remote schools where we had used flexible delivery and specific administration modes for the assessment. The student weights were rescaled to ensure that each state or territory was equally represented 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, 133 items were used for scaling. Forty-one of these items were administered in Year 10 only; the other 92 items were used for both year levels. Of the 92 common items 75 were used as link items and 17 were regarded as different items in the two year levels.

The difficulties of these 75 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

4 *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 responded to.

75 items their respective difficulties were centred to having a mean of zero for this graph. The solid lines represent the boundaries of the confidence intervals around differences from zero (the identity line indicating that there are no differences in item difficulty).

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



Only a few of the 75 items fall just outside the confidence intervals and showed statistically significant year level DIF. Given that these few items had satisfactory scaling characteristics and constituted only a very small proportion of the 75 link items, it was decided to retain all link items for scaling.

Figure 6.3 presents so-called *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 to respond 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, the data of the two year levels were merged and scaled together. Year level was included in the calibration as a regressor variable to indicate that students came from two different populations. It is necessary to make a distinction between the year levels in the model in order to distinguish between items that were used to assess different numbers of students in each year level. For example, an item with 80 per cent correct for only Year 10 students should not receive the same difficulty estimate as an item with 80 per cent correct for the combined year levels. Adding year level as a regressor results in conditional, as opposed to marginal, parameter estimation.

The overall reliability of the test, as obtained from the scaling model, was 0.95 (ACER ConQuest estimate). Appendix 7 shows the item difficulties on the NAP – ICTL scale with a response probability of 0.62[5] 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.

Horizontal equating

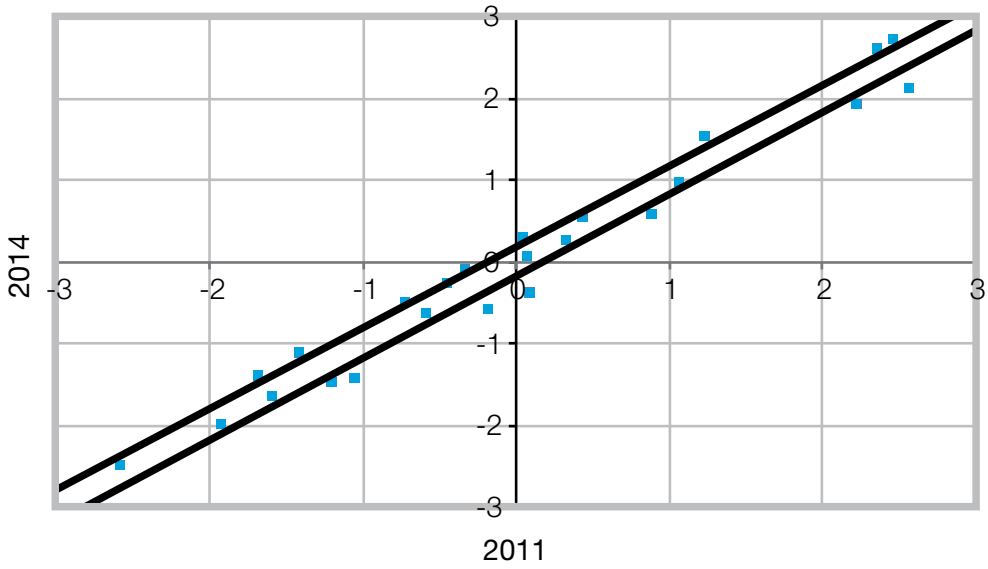
Test items at both year levels consisted of new and old items. The old items were developed for and used in previous cycles. As they had been kept confidential, they could be used as horizontal link items to equate the results of the 2014 assessment

5 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.

with the established NAP – ICTL scale. To ensure that the link items had the same measurement properties across cycles, the relative difficulties in 2014 and 2011 were compared. One out of 25 common items showed large DIF between 2014 and 2011 and was not used for equating. For both assessments, this set of link items showed similar average discrimination (item-rest correlation was 0.45 in 2011 and 0.44 in 2014) and the average DIF with respect to gender in both cycles was close to zero (–0.01 logits in 2011 and 0.02 logits in 2014).

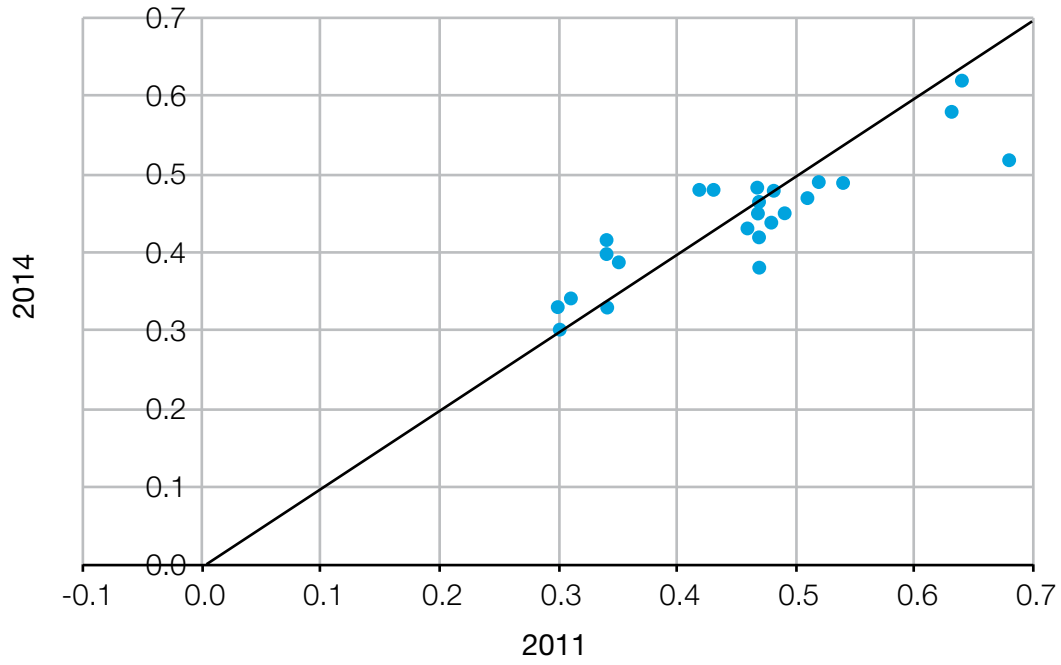
Figure 6.4 shows a scatter plot of item difficulties for horizontal link items in 2011 and 2014. The average difficulty of each set of link items was set to zero and each dot represents one link item. The expected location under the assumption of complete measurement equivalence across both assessments is the identity line (y=x). The solid 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 6, the approximate design effect in 2011. 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 logit. Using this criterion, one item, FPC10, was excluded from equating.

Figure 6.4 Relative item difficulties in logits of horizontal link items between 2011 and 2014



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 2011 and 2014 values of these discrimination indices are plotted in Figure 6.5.

Figure 6.5 Discrimination of link items in 2011 and 2014



After the selection of link items, common item equating was used to shift the 2014 scale onto the historical scale. The value of the shift is the difference in average difficulty of the link items between 2011 and 2014 (–0.039). After applying this shift, the same transformation was applied as in 2011. Original scale scores (logits) were converted as:

$$\theta^{*}_{\mathrm{n}} = \{(\theta_{\mathrm{n}} - 0.039 + 0.210 - 0.032 - \overline{\theta}_{05}) / \sigma_{05}\} \times 100 + 400$$

where θ^{*}_{n} is the transformed knowledge estimate for student n, θ_{n} is the original knowledge estimate for student n in logits, $\overline{\theta}_{05}$ 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 2014 data with the 2011 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 consequence, there is an uncertainty associated with the equating which is due to the choice of link items, similar to the uncertainty associated with the sampling of schools and students.

The uncertainty which results from the selection of a subset of link items is referred to as *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 linking 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:

$$c_{ij} = \hat{\delta}_{ij}^{2014} - \hat{\delta}_{ij}^{2011}$$

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

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

Further let:

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

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

$$Link\text{Error}_{2014,2011} = \sqrt{\frac{\sum_{j=1}^{K} m_j^2 (c_{\bullet j} - \overline{c})^2}{K(K-1)\overline{m}^2}} = \frac{\sum_{j=1}^{K} m_j^2 (c_{\bullet j} - \overline{c})^2}{L^2}\frac{K}{K-1}$$

The link error between 2011 and 2014 is 4.010 scale score points. The equating error between 2008 and 2014 is the sum of the two equating errors between adjacent cycles.

$$error_{2008\text{-}2014} = \sqrt{5.712^2 + 4.010^2} = 6.979$$

The equating error between 2005 and 2014 is the sum of the three equating errors between the three cycles.

$$error_{2005-2014} = \sqrt{4.300^2 + 5.712^2 + 4.010^2} = 8.197$$

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 are 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 questionnaire 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.

Twenty-four 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[6] 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 questionnaire. 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. Details of the coding of variables included directly in the conditioning model or included in the PCA are listed in Appendix 8.

Scaling questionnaire items

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

Exploratory factor analyses revealed a common structure of questions about the frequency of computer activities (questions 7, 8, 9 and 10) at home and at school for Year 6 and Year 10 students. However, two questions needed to be removed from the scales because of inconsistent loadings across settings and year levels. These questions were *Use software to create media and Search the Internet for information that is not for school*. The remaining activities formed four dimensions: study utilities, communication, technological tasks and entertainment.

Factor analyses were also carried out for five items designed to measure *interest* and *enjoyment in using computers* (Q5 and Q6) and eight items reflecting confidence (*self-efficacy*) in using ICT (Q11). The analyses confirmed the expected one-dimensional factor structure of each of these item sets.

Table 6.1 describes the main characteristics of the questionnaire scales including the scale reliabilities (Cronbach's alpha) and their respective correlation with ICT literacy scores.

Student and item parameters were estimated using the ACER ConQuest Version 4.0 software. Items were scaled using the Rasch Partial Credit Model (Masters & Wright, 1997). Items parameters and student scores were jointly estimated using the full sample and 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 common metric for both year levels, where 50 was equivalent to the mean and 10 to the standard deviation of the Year 6 sample.

6 So called weighted likelihood estimates (WLEs) were used as ability estimates in this case (Warm, 1989).

Table 6.1 Description of questionnaire scales

	Name	Question number	Number of items	Cronbach's alpha		Correlation with achievement	
				Year 6	Year 10	Year 6	Year 10
Frequency utilities – Home	UTILH	Q7.1	6	0.79	0.79	-0.06	0.08
Frequency utilities – School	UTILS	Q7.2	6	0.76	0.78	-0.10	-0.04
Frequency entertainment – Home	ENTERTH	Q8.1	5	0.77	0.73	-0.02	0.05
Frequency entertainment – School	ENTERTS	Q8.2	5	0.77	0.78	-0.22	-0.13
Frequency communication – Home	COMMH	Q9.1	6	0.83	0.76	-0.07	0.03
Frequency communication – School	COMMS	Q9.2	6	0.85	0.81	-0.29	-0.17
Frequency technological tasks – Home	TECHH	Q10.1	6	0.81	0.82	-0.20	-0.12
Frequency technological tasks – School	TECHS	Q10.2	6	0.84	0.84	-0.30	-0.18
Importance of ICT	IMPICT	Q5 & Q6	5	0.73	0.78	0.03	0.15
Interest and enjoyment	INTJOY	Q5 & Q6	5	0.82	0.87	0.09	0.15
Self-efficacy	EFFICACY	Q11	9	0.82	0.80	0.21	0.33
ICT learning at school	ICTLRN	Q12	10	0.75	0.82	0.17	0.06
ICT use for common learning practices	ICTCOMS	Q13	5	0.74	0.80	0.21	0.24
ICT use for special study purposes	ICTSPECS	Q13	5	0.69	0.81	-0.12	-0.18

Chapter 7: Proficiency levels and the Proficient Standards

Julian Fraillon and Wolfram Schulz

In addition to analysing and reporting ICT literacy using the NAP – ICTL scale, two other summary measures of student achievement were used. One of these measures referenced a set of six proficiency levels that were ranges on the scale accompanied by descriptions of the ICT capabilities associated with each level. The percentage of students performing at each proficiency level provided a measure of student achievement. Furthermore, the Proficient Standards represent points on the NAP – ICTL scale indicating a 'challenging but reasonable' achievement level that Year 6 and 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.

Proficiency levels

One of the key objectives of NAP – ICTL is to monitor trends in ICT literacy performance over time. The NAP – ICTL scale forms the basis for the empirical comparison of student performance. In addition to the metric established for the scale, a set of six proficiency 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 proficiency levels provides an empirically and substantively convenient way of describing profiles of student achievement.

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

Creating the proficiency levels

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

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

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

- A student whose result places him/her at the lowest possible point of the proficiency 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 proficiency 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 proficiency 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 proficiency levels on the scale. This was done in combination with a standards setting exercise in which a Proficient Standard was established for the NAP – ICTL 2005 assessment cycle at each year level. The Year 6 Proficient Standard was established as the cut-point between Level 2 and Level 3 on the NAP – ICTL scale and the Year 10 Proficient Standard was set as the cut-point between Level 3 and Level 4.

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

Proficiency level cut-points

Six proficiency levels were established for reporting student performances from 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 – ICTL 2014.

Describing proficiency levels

Information about the items in each level was used to develop summary descriptions of the ICT literacy associated with different levels of proficiency. These summary descriptions encapsulate the ICT literacy of students associated with each level. As a set, the descriptions represent growth in ICT literacy. The levels are not discrete discontinuous steps but are a way of illustrating progress. The texts of the proficiency level descriptions, together with descriptions of examples of achievement at each level, are described in Appendix 9.

Table 7.1 Proficiency level cut-points and percentage of Year 6 and Year 10 students in each level in 2014

Proficiency Level	Cut points		Percentage	
	Logits	Scale	Year 6	Year 10
Level 6			0 (±0)	0 (±0.3)
	3.50	769		
Level 5			1 (±0.3)	9 (±1.3)
	2.25	649		
Level 4			13 (±1.3)	43 (±2.0)
	1.00	529		
Level 3			42 (±2.5)	33 (±2.1)
	-0.25	409		
Level 2			31 (±2.4)	11 (±1.4)
	-1.50	289		
Level 1			14 (±1.9)	4 (±1.1)

Setting the Proficient Standards

The process for setting standards in science literacy, information and communications technologies, civics and citizenship and secondary (15-year-old) reading, mathematics, and science was endorsed by the 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 proficiency scale that represent a 'challenging but reasonable' expectation about what typical Year 6 and 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 respective year level. The proficiency of Year 6 students and their expected performance are different to what one would expect as proficiency from Year 10 students. The Year 6 and Year 10 Proficient Standards were established in NAP – ICTL 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 Years 6 and 10 was described in the report on the first NAP – ICTL 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 – ICTL scale. In 2014, 55 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 – ICTL scale. In 2014, 52 per cent of Year 10 students reached or exceeded the Year 10 Proficient Standard.

Chapter 8: Reporting of results

Wolfram Schulz, Eveline Gebhardt and Renee Kwong

The students assessed in NAP – ICTL 2014 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 economic 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, 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 proficiency 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 NAP – ICTL Years 6 and 10 Report 2014.

Computation of sampling and measurement variance

Unbiased standard errors from survey studies should include both sampling variance and measurement variance. One way of estimating sampling variance on population estimates from cluster samples is by utilising the application of *replication techniques* (Wolter, 1985; Gonzalez and Foy, 2000). The sampling variances of population means, differences, percentages and correlation coefficients in NAP – ICTL surveys were estimated using the *jackknife repeated replication* (JRR) technique. 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 ICT literacy. In addition, for comparing achievement test scores with those from previous cycles in 2005, 2008 and 2011, 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[7] . For NAP – ICTL 2014, there were 165 sampling zones in Year 6 and 155 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, 165 replicate weights were computed. In Year 10, which had only 155 sampling zones, the last ten 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:

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

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

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

The computation of JRR variance can be obtained for any statistic. However, many standard statistical software packages like SPSS® do not generally include any procedures for replication techniques. Therefore, specialist software, the *SPSS® replicates add-in*[8] , was used to run tailored SPSS® macros to estimate JRR variance for means and percentages.[9]

7 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.

8 The SPSS® add-in is available from the public website: https://mypisa.acer.edu.au

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

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

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

with M being the number of plausible values.

The sampling variance U is calculated as the average of the sampling variance for each plausible value U_i:

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

Using five plausible values for data analysis allows the estimation of the error associated with the measurement of ICT literacy due to the lack of precision of the test instrument. The measurement variance or imputation variance B_m was computed as:

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

To obtain the final standard error of 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 NAP – ICTL Years 6 and 10 Report 2014, 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 NAP – ICTL Years 6 and 10 Report 2014 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 subgroups
- 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 compared 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 (for example, jurisdictions or year levels).

In the 2014 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 subgroups

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 for mean differences. Standard errors for differences between statistics for subgroups from the same sample (for example, groups classified according to student background characteristics) were derived using the *SPSS® replicates add-in*. Differences between subgroups were considered significant when the test statistic t was outside the critical values ±1.96 (α = 0.05). The value t was calculated by dividing the mean difference by its standard error.

Mean differences between assessment cycles 2005, 2008, 2011 and 2014

The NAP – ICTL Years 6 and 10 Report 2014 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 2014 and the previous assessment in 2011 is 4.01 score points on the NAP – ICTL 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:

$$SE(t_{14} - t_{11}) = \sqrt{SE_{14}^2 + SE_{11}^2 + EqErr_{14\_11}^2}$$

where t can be any statistic in units on the NAP – ICTL scale (mean, percentile, gender difference, but *not* percentages), SE_{14}^2 is the respective standard error of this statistic in 2014, SE_{11}^2 the corresponding standard error in 2011 and $EqErr_{14\_11}^2$ the equating error for comparing 2014 with 2011 results.

When comparing population estimates between 2014 and the second assessment in 2008, two equating errors (between 2014 and 2011 and between 2011 and 2008) 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 2014 and 2008:

$$SE(\mu_{14} - \mu_{08}) = \sqrt{SE_{14}^2 + SE_{08}^2 + EqErr_{14\_08}^2}$$

where $EqErr_{11\_08}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 2014 and 2011 (4.01 score points) as well as between 2011 and 2008 (5.71 score points). This combined equating error was equal to 6.98 score points and was calculated as:

$$EqErr_{14\_08} = \sqrt{EqErr_{14\_11}^2 + EqErr_{11\_08}^2}$$

Similarly, for comparisons between 2014 and the first NAP – ICTL 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:

$$SE(\mu_{14} - \mu_{05}) = \sqrt{SE_{14}^2 + SE_{05}^2 + EqErr_{14\_05}^2}$$

$EqErr^2_{14\_08}$ reflects the uncertainty associated with the equating between the assessment cycles of 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:

$$EqErr_{14\_05} = \sqrt{EqErr^2_{14\_11} + EqErr^2_{11\_08} + EqErr^2_{08\_05}}$$

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

For the cut-point that defines the corresponding Proficient Standard at each year level (409 for Year 6 and 529 for Year 10), a number of n replicate cut-points were generated by adding a random error component with a mean of 0 and a standard deviation equal to the estimated equating error of 4.01 score points for comparisons between 2014 and 2011, 6.98 score points for comparisons between 2014 and 2008, and 8.20 score points for comparisons between 2014 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 2014 and 2011 were calculated as:

$$SE(\rho_{14} - \rho_{11}) = \sqrt{SE(\rho_{14})^2 + SE(\rho_{11})^2 + EqErr(\rho_{14\_11})^2}$$

where ρ_{14} is the percentages at or above the Proficient Standard in 2014 and ρ_{11} in 2011, $SE(\rho_{14})$ and $SE(\rho_{11})$ their respective standard errors, and $EqErr(\rho_{11\_14})$ the equating error for comparisons. For estimating the standard error of the corresponding differences in percentages at or above Proficient Standards between 2014 and 2008 the following formula was used:

$$SE(\rho_{14} - \rho_{08}) = \sqrt{SE(\rho_{14})^2 + SE(\rho_{08})^2 + EqErr(\rho_{14\_08})^2}$$

Likewise, for estimating the standard error of the corresponding differences in percentages at or above Proficient Standards between 2014 and 2005 the following formula was used:

$$SE(\rho_{14} - \rho_{05}) = \sqrt{SE(\rho_{14})^2 + SE(\rho_{05})^2 + EqErr(\rho_{14\_05})^2}$$

For NAP – ICTL 2014, 5000 replicate cut-points were created. Equating errors were estimated for each sample or subsample of interest and Table 8.1 shows the values of these equating errors.

Table 8.1: Equating errors for comparisons between percentages

	Year 6			Year 10		
	2014/ 2011	2014/ 2008	2014/ 2005	2014/ 2011	2014/ 2008	2014/ 2005
Australia	1.3	2.5	2.9	1.5	2.7	3.1
New South Wales	1.4	2.5	3.0	1.8	2.9	3.4
Victoria	1.4	2.4	2.9	1.3	2.4	2.9
Queensland	1.1	2.2	2.6	1.3	2.5	3.0
Western Australia	1.8	3.0	3.4	1.8	2.9	3.4
South Australia	1.5	2.6	3.0	1.6	2.6	3.0
Tasmania	1.2	2.2	2.6	1.7	2.9	3.4
ACT	1.5	2.5	3.0	1.4	2.4	2.7
Northern Territory	1.1	1.9	2.2	1.5	3.3	3.9
Girls	1.3	2.4	2.8	1.2	2.4	2.9
Boys	1.5	2.6	3.0	1.8	2.9	3.4
Metropolitan	1.4	2.5	2.9	1.5	2.7	3.1
Provincial	1.4	2.5	3.0	1.3	2.6	3.1
Remote	1.3	1.7	1.9	3.4	3.9	4.3

Other statistical analyses

While most tables in the NAP – ICTL Years 6 and 10 Report 2014 presented means and mean differences, some also included a number of additional statistical analyses.

Tertile groups

In addition to the usually reported means and differences in mean scores of subgroups mentioned in the previous section, subgroups of students were created based on their scores on questionnaire scales. For NAP – ICTL 2014, three groups of equal size representing students with the lowest scores, middle scores and highest scores (tertile groups) on selected questionnaire scales were formed and compared with regard to their ICT literacy scores. Standard errors of the difference between pairs of tertile groups need to be computed in the same way as standard errors of mean difference between two dependent subsamples (for example, males and females). The SPSS® Replicates Add-in was used to compute the respective standard errors.

Path modelling

In Chapter 6 of the NAP – ICTL 2014 public report, a multilevel, multivariate path model was reported to test a more complex set of relationships between variables. Unlike simple multiple regression models, path models allow dependent variables to predict other dependent variables. The path model incorporated the two-level structure of the data with students nested within schools to account for the sampling variance. Hence, it was not necessary to apply replication methodology to estimate the sampling errors. Only one plausible value was used, therefore the standard errors were slightly underestimated (however, most of the error variance is due to sampling variance).

The analysis was conducted in Mplus Version 7 (Muthén & Muthén, 2012). In the case of a multilevel analysis, path (or regression) coefficients between student-level variables reflect the average slope of the within-school effects. Relationships with school variables, like geographic location of the school, reflect associations between aggregated data at the school level. School final weights (see Chapter 3) were used at the school level while no weighting was required at the student level because all students in a school had equal within-school student weights.

In order to obtain the explained variance two versions of the model were estimated. First, a so-called *empty* model was applied. An empty model only includes the dependent variables without any predictors. This model estimates the variance *between* school mean scores and between student scores *within* schools. The sum of these two variances is the *total* variance in each of the dependent variables.

In the second version of the model, all predictors were included. The estimated between- and within-school variance of this model is the amount of variance that is *not* explained by the included predictors. Again, the total unexplained variance is the sum of the unexplained between- and within-school variance.

The explained variance is simply the variance estimate from the empty model minus the unexplained variance estimates from the full model. These are calculated for all three types of variance – the between-school variance, the within-school variance and the total variance – and are expressed as a proportion of each variance estimate from the empty model.

References

Australian Curriculum and Reporting Authority (ACARA) (2012). Data Standards Manual: Student Background Characteristics (6th Edition). Sydney: ACARA.

ACARA (2012a). National Assessment Program – ICT Literacy Years 6 and 10 Report 2011. Sydney: ACARA.

ACARA (2012b). The Australian Curriculum: Information and Communication Technology (ICT) capability. Sydney: ACARA. Available: www.australiancurriculum.edu.au/GeneralCapabilities/Information-and-Communication-Technology-capability/

ACARA (2013). Measurement Framework for Schooling in Australia 2012. Sydney: ACARA. Available: www.acara.edu.au/verve/_resources/Measurement_Framework_for_Schooling_in_Australia_2012.pdf

ACARA (2014). National Assessment Program Information and Communication Technology Literacy 2014: Assessment Framework. Sydney: ACARA. Available: www.nap.edu.au/nap-sample-assessments/napsa-assessment-frameworks.html

ACARA (2015). National Assessment Program – ICT Literacy Year 6 and 10 Report 2014. Sydney: ACARA.

Adams, R.J., Wu, M. L. & Wilson, M.R., ACER ConQuest Version 4.0: Generalised item response modelling software [computer program]. 2014, Melbourne: ACER Press.

Adams, R. J., & Wu, M. L. (2002). PISA 2000 Technical Report. Paris: OECD.

Australian Education Systems Officials Committee (AESOC) (2006). Statements of Learning for Information and Communication Technologies (ICT). Carlton: Curriculum Corporation.

Binkley, M., Erstad, E., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). 'Defining 21st century skills.' In P. Griffin, B. McGaw, and E. Care (Eds.), Assessment and Teaching of 21st Century Skills. Dordrecht: Springer.

Catts, R. and J. Lau (2008). Towards Information Literacy Indicators. Paris, UNESCO.

Erstad, O. (2010). Conceptions of technology literacy and fluency. In P. Peterson, E. Baker, and B. McGaw (Eds.) International Encyclopedia of Education (3rd Edition) Oxford Elsevier.

Educational Testing Service (ETS). (2002). Digital transformation: A framework for ICT literacy. Princeton, NJ: Author. Retrieved from www.ets.org/Media/Tests/Information_and_Communication_Technology_Literacy/ictreport.pdf

European Commission. (2006). Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning (Official Journal L 394 of 30.12.2006). Luxembourg Brussels: Author. Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/ PDF/?uri=CELEX:32006H0962&from=EN

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Gebhardt, E. (2014). Preparing

for Life in a Digital Age – The IEA International Computer and Information Literacy Study International Report. Cham/Heidelberg/New York/Dordrecht/London: Springer.

Gonzalez, E. J., & Foy, P. (2000). Estimation of sampling variance. In: M.O. Martin, K.D. Gregory & S.E. Semler (Eds.), TIMSS 1999 Technical Report. Chestnut Hill, MA: Boston College.

Griffin, P., McGaw, B, & Care, E. (2012). Assessment and Teaching of 21st Century Skills. Dordrecht: Springer.

International ICT Literacy Panel (Educational Testing Service; 2002). Digital Transformation: A Framework for ICT Literacy. Princeton, NJ: Educational Testing Service.

Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) (1999). National Goals for Schooling in the Twenty First Century. Curriculum Corporation: Melbourne.

MCEETYA (2005). National Assessment Program Information and Communication Technology Literacy Years 6 and 10: An Assessment Domain for ICT Literacy. Carlton: Curriculum Corporation

MCEETYA (2007). National Assessment Program – ICT Literacy Years 6 & 10 2005 Report. Carlton: Curriculum Corporation.

MCEETYA (2008). Melbourne Declaration on Educational Goals for Young Australians. Carlton: Curriculum Corporation.

Markauskaite, L. (2006). Towards an integrated analytic framework of information and communications technology literacy: From intended to implemented and achieved dimensions. Information Research, 11, 1–20.

Masters, G. N., & Wright, B. D. (1997). The partial credit model. In: W.J Van der Linden & R.K. Hambleton (Eds.), Handbook of Modern Item Response Theory 101–122. New York/Berlin/Heidelberg: Springer.

Mislevy, R. J. (1991). Randomization-based inference about latent variables from complex samples. Psychometrika, 56, 177–196.

Mislevy, R. J., & Sheehan, K. M. (1987). Marginal estimation procedures. In: A.E. Beaton (Ed.), The NAEP 1983–1984 Technical Report, 293–360. Princeton, NJ: Educational Testing Service.

Muthén, L. K. & Muthén, B. O. (2012). Mplus User's Guide. Fifth Edition. Los Angeles, CA: Muthén & Muthén

Organisation for Economic Cooperation and Development (OECD) (2005). PISA 2003 Technical Report. Paris: OECD.

OECD (2009a). PISA 2006 Technical Report. Paris: OECD.

OECD (2009b). PISA Data Analysis Manual SPSS® Second Edition. Paris: OECD.

OECD (2014). PISA 2012 Technical Report. Paris: OECD.

Olson, J. F., Martin, M. O., & Mullis, I. V. S. (Eds.). (2013). Methods and Procedures in TIMSS & PIRLS 2011. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Performance Measurement and Reporting Taskforce (PMRT; 2003). Setting National

Standards. Paper presented at the March 2003 meeting of the Performance Measurement and Reporting Taskforce.

Rasch, G. (1960). Probabilistic Models for Some Intelligence and Attainment Tests. Copenhagen: Nielsen
and Lydiche.

Von Davier, M., Gonzalez, E., & Mislevy, R. (2009). What are plausible values and why are they useful? IERI Monograph Series, (Vol. 2, pp 9–36). Hamburg and Princeton: IERInstitute and ETS.

Warm T. A. (1989). Weighted likelihood estimation of ability in Item Response Theory. Psychometrika, 54, 427–450.

Wolter, K. M. (1985). Introduction to Variance Estimation. New York: Springer-Verlag.

Appendices

Appendix 1: Student questionnaire

Q1 **How many computers and handheld devices are used regularly in your home?**
(Please use the pull-down menu to select a number for each type of device.)

	Number of devices
Desktop computer	
Portable computer (notebook, netbook)	
Tablet device (e.g. iPad, Android)	
Games console with internet connectivity	
Mobile phone with internet connectivity	

0
1
2
3
4
5
6
7
8
9

Q2 **How long have you been using computers?**
(Please click on only one response button.)

- 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. ○

Q3 **What type of computer systems do you use in these places?**
(Please click on "None" or on as many of the other boxes on each row as apply for your use at that place.)

	Windows-based computer (PC)	*Apple Macintosh (OS)-based computer*	*Computers using Android, Linux or other operating systems*	*None*
At home	☐	☐	☐	☐
At school	☐	☐	☐	☐
At other places (e.g. local library, internet cafe, friends place or using a mobile 3G/4G network elsewhere)	☐	☐	☐	☐

Q4 **How often do you use a computer in these places?**
(Please click on only one response button in each row.)

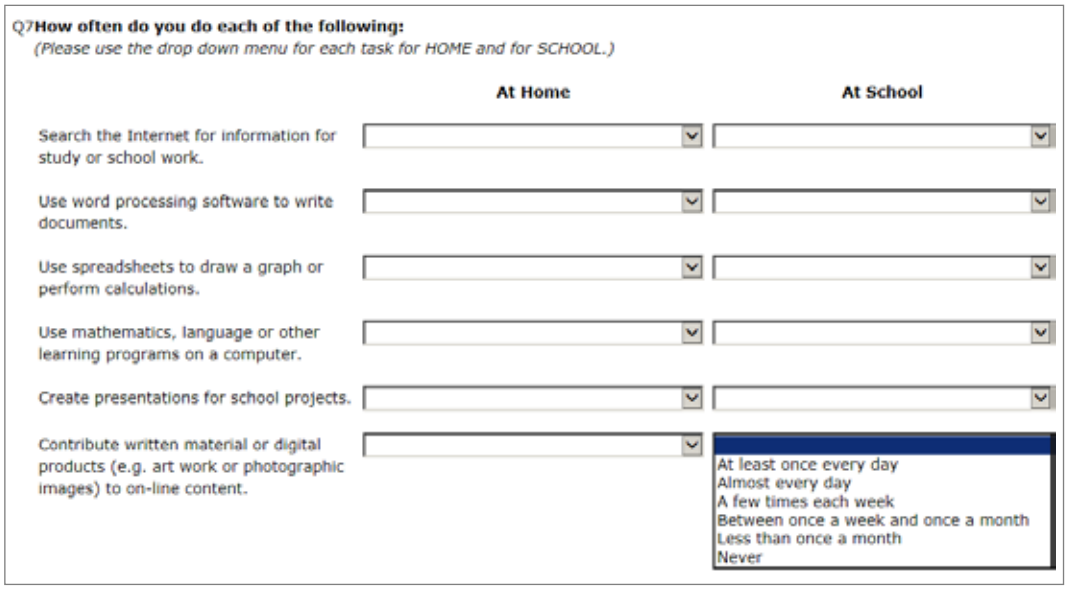
	Several times every day	*Every day*	*Almost every day*	*A few times each week*	*Less than once a week or never*
At home	○	○	○	○	○
At School	○	○	○	○	○

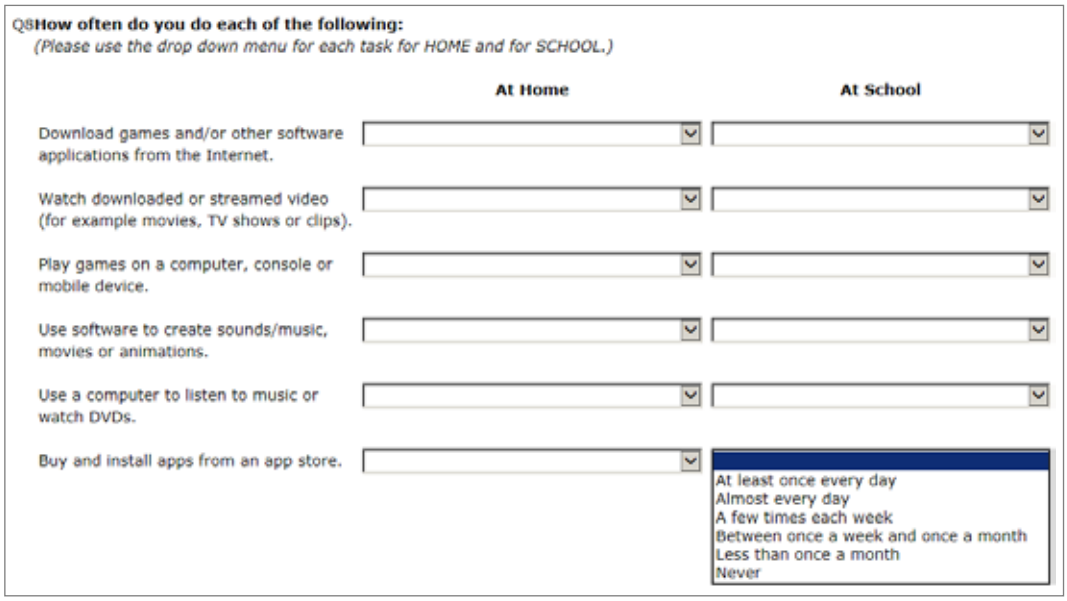
Q5 **To what extent do you agree or disagree with the following statements?**
(Please click on only one response button in each row.)

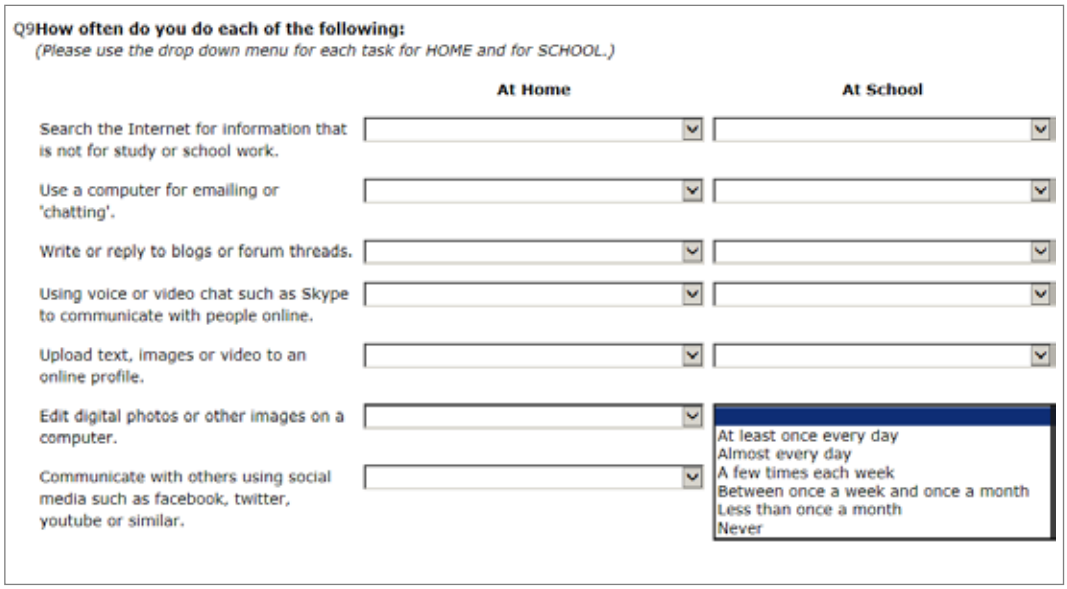
	Strongly agree	*Agree*	*Disagree*	*Strongly disagree*
It is very important to me to work with a computer.	○	○	○	○
I think playing or working with a computer is fun.	○	○	○	○
I use a computer because I am interested in the technology.	○	○	○	○
I like learning how to do new things using a computer.	○	○	○	○
I am always looking for new ways to do things using a computer.	○	○	○	○

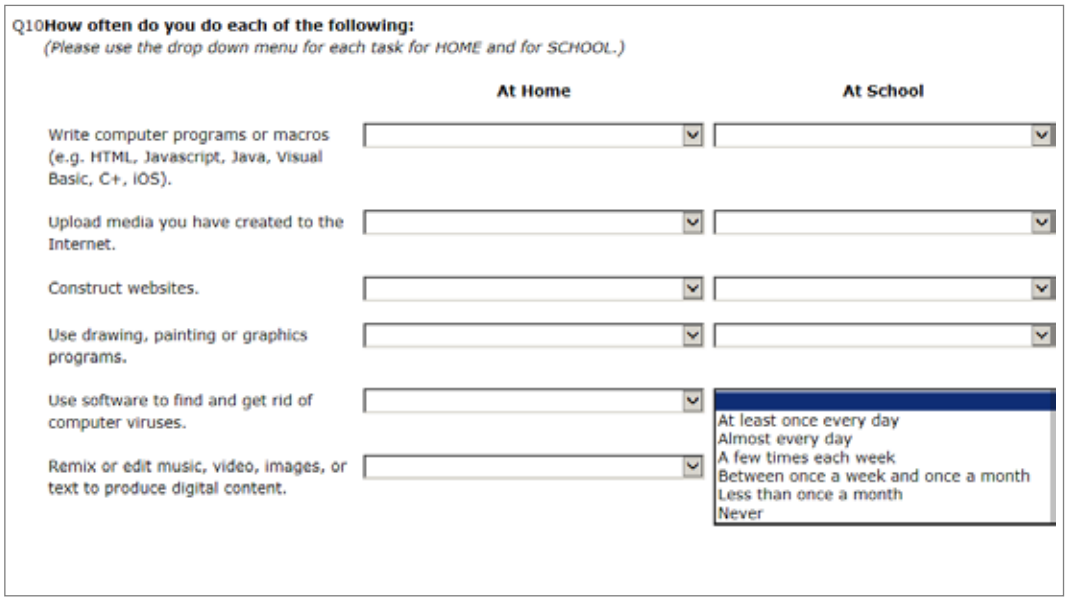
Q6 **To what extent do you agree or disagree with the following statements?**
(Please click on only one response button in each row.)

	Strongly agree	*Agree*	*Disagree*	*Strongly disagree*
I like using computers because they help me improve the quality of my work.	○	○	○	○
I like using computers because they make work easier.	○	○	○	○
I enjoy using computers because they help me to work with others.	○	○	○	○
I enjoy using computers because they help me to communicate with my friends.	○	○	○	○
I like using a computer to find new ways to do things.	○	○	○	○


Q7 How often do you do each of the following:
(Please use the drop down menu for each task for HOME and for SCHOOL.)
At Home
At School
Search the Internet for information for study or school work.
Use word processing software to write documents.
Use spreadsheets to draw a graph or perform calculations.
Use mathematics, language or other learning programs on a computer.
Create presentations for school projects.
Contribute written material or digital products (e.g. art work or photographic images) to on-line content.
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


Q8 How often do you do each of the following:
(Please use the drop down menu for each task for HOME and for SCHOOL.)
At Home
At School
Download games and/or other software applications from the Internet.
Watch downloaded or streamed video (for example movies, TV shows or clips).
Play games on a computer, console or mobile device.
Use software to create sounds/music, movies or animations.
Use a computer to listen to music or watch DVDs.
Buy and install apps from an app store.
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


Q9How often do you do each of the following:
(Please use the drop down menu for each task for HOME and for SCHOOL.)
At Home
At School
Search the Internet for information that is not for study or school work.
Use a computer for emailing or 'chatting'.
Write or reply to blogs or forum threads.
Using voice or video chat such as Skype to communicate with people online.
Upload text, images or video to an online profile.
Edit digital photos or other images on a computer.
Communicate with others using social media such as facebook, twitter, youtube or similar.
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


Q10How often do you do each of the following:
(Please use the drop down menu for each task for HOME and for SCHOOL.)
At Home
At School
Write computer programs or macros (e.g. HTML, Javascript, Java, Visual Basic, C+, iOS).
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.
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

Q11 **How well can you do each of these tasks on a computer?**
(Please click on only one response button in each row.)

	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*
Use software to find and get rid of computer viruses.	○	○	○	○
Edit digital photographs or other graphic images.	○	○	○	○
Create a database (e.g. using Microsoft Access, FileMaker).	○	○	○	○
Use a spreadsheet to plot a graph.	○	○	○	○
Download music from the Internet.	○	○	○	○
Create a multi-media presentation (with sound, pictures, video).	○	○	○	○
Construct a web page.	○	○	○	○
Upload files (images, audio/video and text) to a website.	○	○	○	○
Use social media (e.g. facebook, twitter).	○	○	○	○

Q12 At school, have you learned about the following issues?
(Please mark one choice in each row.)

	Yes	*No*
The need to provide references to content from web-pages 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 computer 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.	○	○
Keeping anti-virus software up to date.	○	○
How to decide where to look for information about an unfamiliar topic.	○	○
How look for different types of digital information on a topic.	○	○

Q13 **How often do you use computers for the following school-related purposes?**
(Please mark one choice in each row.)

	Never	*Less than once a month*	*At least once a month but not every week*	*At least once a week*
Preparing reports or essays.	○	○	○	○
Preparing presentations.	○	○	○	○
Working with other students from your own school.	○	○	○	○
Working with other students from other schools.	○	○	○	○
Completing worksheets or exercises.	○	○	○	○
Organising your program of work on a topic using a learning management system (e.g. a Moodle).	○	○	○	○
Reflecting on your learning experiences (e.g. through a blog).	○	○	○	○
Completing tests or assessments.	○	○	○	○
Use on-line learning programs such as mathletics.	○	○	○	○
Use data logging tools as part of an investigation.	○	○	○	○

Appendix 2: Technical Readiness Test (TRT) instructions

Technical Readiness Test (TRT) Instructions

It is imperative that you perform this technical test:

- on the computers that students will use on assessment day, and
- using a student login to these computers (i.e. not an 'administrator' login)

Step 1	Navigate to the TRT website address provided in the attached email
Step 2	Complete all required information and practice questions
Step 3	Confirm all images, question text and animations are displaying correctly
Step 4	Click 'Submit Form' at the bottom of the page
Step 5	Perform TRT on any remaining student computers that may be imaged differently

Technical Requirements and Supported Configurations

Hardware	Operating System	Web Browser
• Laptop/PC (iPads not supported) • Mouse	• All operating systems	• Internet Explorer 9+ • Chrome 22+ • Firefox 16+ • Safari 5+ • Opera 12+
Settings		
• 1024 x 768 monitor resolution (screen design optimised for this recommended minimum) • Javascript must be enabled • Bandwidth to internet (for school): 2200 KB bandwidth recommended minimum for up to 20 users		

Helpdesk Information

If you require assistance, please contact the NAP – ICT Literacy Project Team at ACER:

Phone: 1800 762 022

Email: ictl@acer.edu.au

Appendix 3: Quality monitor report template

NAP – ICT Literacy 2014 – QUALITY MONITOR REPORT

Quality Monitor			
School Name			
State/Territory		**Sector**	
Year Level		**Date**	
School Contact			
Test Administrator			
Delivery Method			

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, and whether they were asked to sign a confidentiality form)

Staff Member	Present for all of session (X)	Present for part of session (X)	Confidentiality form signed (Y/N)
School Contact			
IT Coordinator			
Principal			
Other (please specify)			

2. Timing

2.1 Room Set Up and Logging in

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

b) Did the IT Coordinator or other school staff member assist the TA in setting up the computers?

☐ No ☐ Yes

2.2 Instructions and Practice Questions

a) How long did it take the TA to lead students through the Instructions and Practice Questions? _____ (mins)

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

_____

_____

2.3 Test Questions (Part A)

a) How long did it take most of the students to complete the test questions (please add together the time taken for all four modules)? _____ (mins)

b) How long did it take the slowest student to complete the test questions? (please add together the time taken for all four modules)? _____ (mins)

c) How many students were unable in the allocated time to complete the test questions? _____

2.4 Questionnaire (Part B)

a) How long did it take most of the students to complete the questionnaire? _____ (mins)

b) How long did it take the slowest student to complete the questionnaire? _____ (mins)

3. Test Instructions

a) Was the script followed according to the Test Instructions Handbook?

☐ No ☐ Yes

b) If changes were made, were they

☐ Major ☐ Minor

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

_____

_____

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

☐ No ☐ Yes

e) If Yes, please provide further comment.

_____

_____

_____

4. Assistance Given

The Test Administrator may read and reword questions, explain the meaning of words, or explain task requirements to students as long as they do not provide the students with answers to their questions.

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

☐ No ☐ Yes

b) If No, please provide further comment.

_____

_____

_____

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

☐ No ☐ Yes

d) If Yes, please provide further comment.

_____

_____

_____

5. Technical Issues

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

☐ No ☐ Yes

b) If Yes, were they

☐ Major ☐ Minor

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

_____

_____

_____

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

☐ No ☐ Yes

d) 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?	☐	☐	☐

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 (you will be sent a link to this program by the NAP – ICT Literacy Project Team).

You can return the hard copy of this report in the ACER-supplied return satchel, along with your other admin documents, at the end of the assessment period.

Appendix 4: Student and school report instructions

NAP – ICT Literacy Main Study 2014

School and Student Reports
Step-by-Step Instructional Guide

Accessing the reports page

1. Navigate to the school reports webpage for the required year level (i.e. either Year 6 or Year 10):

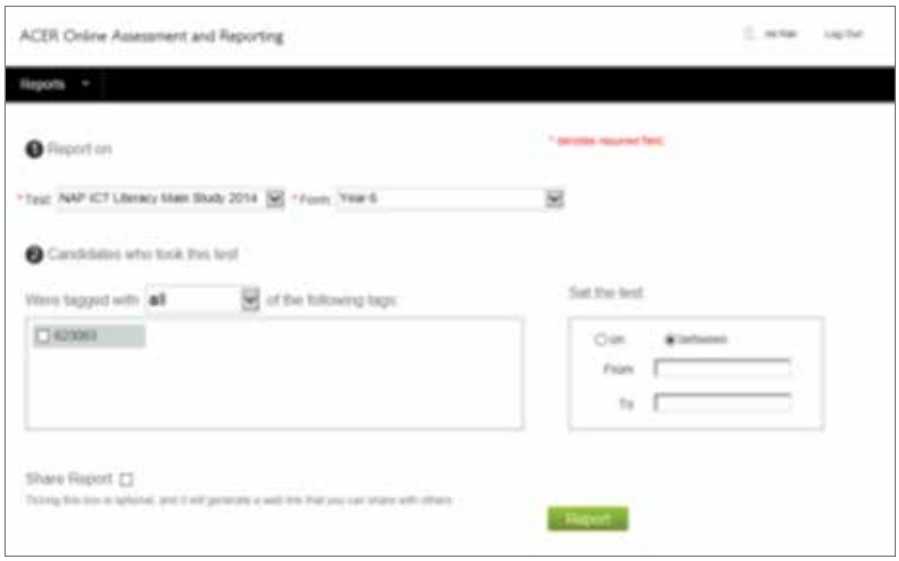
   Year 6 reports: https://schools.acer.edu.au/nap-ict-2014-ms-year-6

   Year 10 reports: https://schools.acer.edu.au/nap-ict-2014-ms-year-10

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

Login page

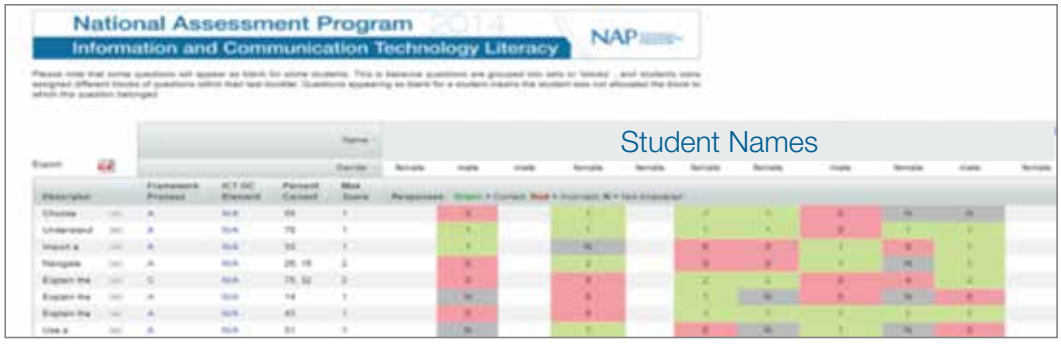
3. Click on the green ‘Report’ button. (You can ignore the other text and check boxes on this page).



Report Confirmation page

Viewing the school (group) report

You will first see an interactive group report that shows the results for all students in your school on all the test items included in the NAP – ICT Literacy Main Study.



Group Report page

Following is a brief description of the contents of the columns shown in this report:

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

b. **Framework Process**: This contains references to the NAP – ICTL Assessment Framework content assessed by each question. Hovering over the blue numbers will display the full description.

c. **ICT GC Element**: This contains references to the NAP – ICTL Assessment Framework cognitive process assessed by each question. Hovering over the blue numbers will display the full description.

d. **Percent Score**: This shows the percentage of all students in the Main Study who answered the question correctly. In some cells you will see more than one number, these refer to the percentages of students who received different scores (e.g. 1 or 2) on questions for which the maximum score is greater than 1.

e. **Max Score**: This shows the maximum score available for each question.

The scores for each question for each student in your school are listed under the names of each student. There are four different possible displays of the score for each question:

i. Blank: The question was not in the test booklet for that student.

ii. Red (0): The student answered the question incorrectly.

iii. Green (1 ... 3): The student correctly (or partially correctly) answered the question. The number refers to the score the student received for their answer to the question. This can be compared to the Max Score for that question.

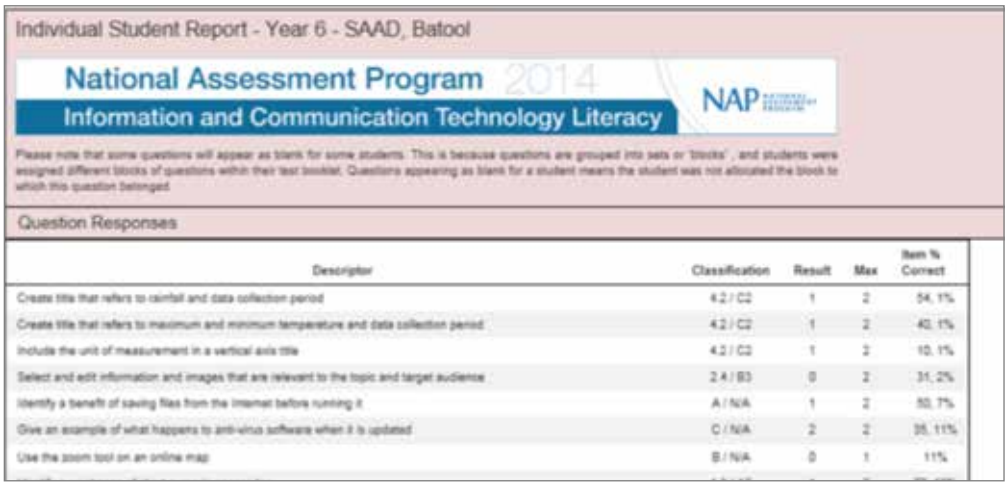
iv. Grey (N): The question was in the test booklet for that student, but the student did not provide a response to the question.

The report has a set of clickable sorting features, so you can, for example, view students grouped by gender, or questions grouped by question type.

Clicking on the pdf icon next to the 'Export' heading will export all individual student reports to a zip file.

Viewing an individual student report

1. Click on the name of a student to see the individual report for that student.



Student Report

2. The individual student report contains the same student and item information shown in the school report (as described in the previous section). However, the student report shows the question and performance information only for those questions in the test booklet presented to that individual student.

Logging out

At any time you can log out of the reporting system by clicking on the 'Log Out' link at the top right of the screen.

Need Help?

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

Appendix 5: Ordered map of NAP – ICT Literacy 2014 task/report descriptors

Scale score	Level	Task descriptor	Strand
899	6	Record six points from a small, contained web environment that are relevant to a specified topic	A
861	6	Identify that an advertisement within a website was automatically generated from the terms and/or metadata found on the website or in the browser	C
782	6	Add two new levels to an online game that show evidence of careful planning regarding the use of colour	B
743	5	Apply the appropriate level of zoom to configure an online map	B
730	5	Choose a website button colour that is consistent with the web page design	B
728	5	Create realistic rules to progress between levels of a game	A
720	5	Place a website button according to interface design principles	B
715	5	Choose an appropriate format for a survey question	B
712	5	Interpret a link chart to create a link from an existing web page to a newly created web page	B
709	5	Include a clear and relevant heading on a newly created level of a game	B
698	5	Explain a weakness of a four-digit numeric passcode	C
680	5	Create a web page with control and planning of layout	B
677	5	Locate and select the graphing tool on a web page	A
673	5	Navigate a website and locate explicit information from within the site	A
666	5	Explain the benefit of using PDF files instead of TXT files	A
661	5	Include notes relevant to slides in a presentation	B
657	5	Describe a potential problem associated with sending an email to a group user list	C
655	5	Recognise automated Internet advertising based on the expression used in the text	A
653	5	Use the Cc email convention appropriately	C
651	5	Give an example of what happens to anti-virus software when it is updated	C
650	5	Add screen elements to a game with evidence of control and planning	B

Scale score	Level	Task descriptor	Strand
650	5	Select and apply objects in a coherent way in a short animated video	B
647	4	Create a short animated video that flows due to continuity in animation technique and content	B
647	4	Select font size and style to suit a slide show presentation	B
646	4	Add levels to a learning game with content appropriate to the difficulty of each level	B
646	4	Use appropriate language to engender interest in a crowd-sourcing campaign	B
644	4	Add two new levels to an online game that show some evidence of planning in the use of colour	B
636	4	Create a presentation with some controlled use of colour	B
634	4	Include the unit of measurement in a vertical axis title of a chart	B
627	4	Create a title for a web page with formatting that makes the role of the title clear	B
617	4	Copy and paste specified text from a document to a web page	B
617	4	Create a presentation with some control of layout of text and images	B
614	4	Connect a mobile device to a specified network	A
609	4	Format the text in the body of a document so that its role is clear in the document	B
608	4	Identify that an advertisement within a website was automatically generated	C
603	4	Align images on a website with clear control	B
600	4	Evaluate search results to choose the most appropriate one for a specified topic	A
593	4	Identify the hyperlink for the web page content manager	A
590	4	Explain why a graphical information display best suits a specified data format	B
581	4	Include the unit of measurement in a vertical axis title	B
578	4	Record four or five points from a small, contained web environment that are relevant to a specified topic	A
578	4	Format headings in a document so that their role is clear	B
578	4	Navigate website menus to locate a specified resource	A
576	4	Include a heading on a newly created level of a game	B
575	4	Demonstrate the importance of text contrast in an information product	B
575	4	Identify the possible impact of registration fees on users of a crowd-sourcing website	C

Scale score	Level	Task descriptor	Strand
567	4	Navigate a simple directory tree and create a new folder in a specified location	A
565	4	Create a web-based invitation that shows evidence of planning regarding the use of colour	B
564	4	Create metadata tags to help web users find the information	A
563	4	Choose a design template to meet given criteria	B
555	4	Use a specified image to create the background for a specified web page	B
554	4	Add four specified images to a web page	B
553	4	Identify a problem of using one's own name as a username	C
551	4	Choose and click on a search result according to given criteria	A
550	4	Create a web page with some control of layout	B
546	4	Explain that software updates are intended to improve the functioning of software	C
545	4	Add screen elements to a game with some evidence of control and planning	B
544	4	Use Save As to save a file to a USB drive	A
542	4	Add two or three specified images to a web page	B
534	4	Recognise the purpose of spyware	C
530	4	Use an image to create the background for a specified web page	B
527	3	Add one of four specified images to a web page	B
526	3	Use an installation wizard to install software to a specified folder	A
523	3	Align images on a web page with some control	B
522	3	Enter the origin and destination in an online map tool	B
521	3	Explain why an online survey might be password-protected	C
519	3	Add a new web page to an existing website	B
518	3	Format some headings in a document so that their role is clear	B
515	3	Format some text in a document so that its role is clear	B
513	3	Use an image to create the background for a web page	B
507	3	Explain why a link to activate an account is sent by email rather than being displayed on screen	C
504	3	Explain the benefit of saving files before opening them	A
504	3	Create a chart title that is appropriate to the contents of the chart	B
503	3	Explain an advantage of storing photos on the Internet	C
498	3	Crop an image to remove background	B
498	3	Set the horizontal graph scale on a chart to 'daily'	B

Scale score	Level	Task descriptor	Strand
495	3	Include all relevant information when uploading a file to a video-sharing site	B
494	3	Align an online map to show both an origin and destination	B
488	3	Select and edit information and images that are relevant to the topic and target audience	A
488	3	Set horizontal graph scale to 'daily'	B
488	3	Configure an app to collect data from a specified date, time and location	B
480	3	Identify an advantage of storing data locally rather than in cloud storage	A
478	3	Use Save As to save a file to a generic location	A
476	3	Create a short animated video with a clearly specified message	B
475	3	Use a software shortcut to open an image for editing	A
466	3	Navigate to a URL presented as plain text	A
463	3	Format font so that it is easy to read as part of a short animated video	B
462	3	Select the search result most likely to provide information on a given topic	A
462	3	Adjust settings to reduce the size of a file to upload to a video-sharing site	A
459	3	Identify a benefit of saving files from the internet before running them	A
459	3	Select the best search term to connect users on a social media site	A
453	3	Recognise sponsored links in a list of search results from a search engine	C
451	3	Find an appropriate link on a page using a synonym	A
445	3	Name and save a file in an online survey builder	A
444	3	Create a chart title that refers to rainfall and data-collection period	B
444	3	Locate and click on the Edit button to edit an image	A
439	3	Identify the value in recording the source of information from websites	C
438	3	Include a relevant and identifiable title in a presentation	B
434	3	Navigate software menus and configure software settings	C
432	3	Record two or three points from a small contained web environment that are relevant to a specified topic	A
432	3	Create a short animated video with some flow in animation technique and content	B
430	3	Move an email into a relevant folder on a webmail account	A
429	3	Adjust online calendar to select date	A

Scale score	Level	Task descriptor	Strand
427	3	Select and apply objects with some coherence in a short animated video	B
425	3	Create an appropriate title for a video file	B
424	3	Select an appropriate graph type to display rainfall data	B
422	3	Locate, evaluate and click on a hyperlink	A
416	3	Locate a file in a specified location in a directory tree	A
413	3	Set rainfall data as the source for a graph in an app	B
412	3	Select the strongest password according to length and range of character types	C
407	2	Use sorting tools to order and locate data	A
407	2	Click on the correct browser tab to access a search engine	A
405	2	Select the correct link and name from a website to reference information	B
402	2	Adjust online clock to select time	A
401	2	Tab between two pages to transfer information	A
397	2	Explain why saving a file with a generic filename may cause a problem	A
396	2	Set temperature data as the source for a graph	B
394	2	Select an appropriate graph type to display temperature data	B
388	2	Add a relevant title to a web-based invitation	B
386	2	Identify a risk of opening an email from an unknown source	C
386	2	Identify the meaning of 'public' on a website privacy setting	C
383	2	Include some relevant information when uploading a file to a video-sharing site	B
380	2	Create a new email folder on a webmail account	A
378	2	Click on an icon that will provide access to stored data	A
377	2	Recognise links as advertisements on a website	A
371	2	Click on a specified hyperlink	A
367	2	Copy and paste a URL into an email message	B
363	2	Locate a data file within a directory tree based on the source of the data	A
362	2	Create a web-based invitation with a balanced layout	B
357	2	Create a web-based invitation with some planning in the use of colour	B
347	2	Modify screen settings on a tablet computer	A
340	2	Find an appropriate link on a page using a word match	A
339	2	Recognise that a four-digit numeric passcode is weak	C
334	2	Use tools (slide control) to brighten an image	B
334	2	Add and edit text within a template on a web page	B

Scale score	Level	Task descriptor	Strand
332	2	Select an appropriate border for an invitation to a picnic	B
331	2	Explain the need to delete private data from public equipment	C
329	2	Select the most appropriate search term for a given topic	A
328	2	Identify the main purpose of a software license agreement	C
324	2	Configure an app to collect data from a specified location	B
323	2	Identify a problem with websites remembering a user's password	C
315	2	Recognise the consequence of selecting 'always use this program for this action'	A
311	2	Erase specified elements of an image	B
281	1	Click on a hyperlink in an email message	A
280	1	Use tools to rotate an image 180 degrees	B
275	1	Locate and click on a hyperlink	A
255	1	Click on the appropriate link to open an email	A
251	1	Click on a hyperlink presented in an email	A
243	1	Enter a specified username into the appropriate field	A
240	1	Click on a hyperlink to a specified website	A
230	1	Click on the appropriate link to open an attachment on an email	A
216	1	Recognise a conventional symbol used in online email displays	A
186	1	Interpret an error message to identify the probable cause of access being denied to a website	C

Appendix 6: Example of school summary report and student report

Individual Student Report - Year 10 - Student 1

National Assessment Program 2014

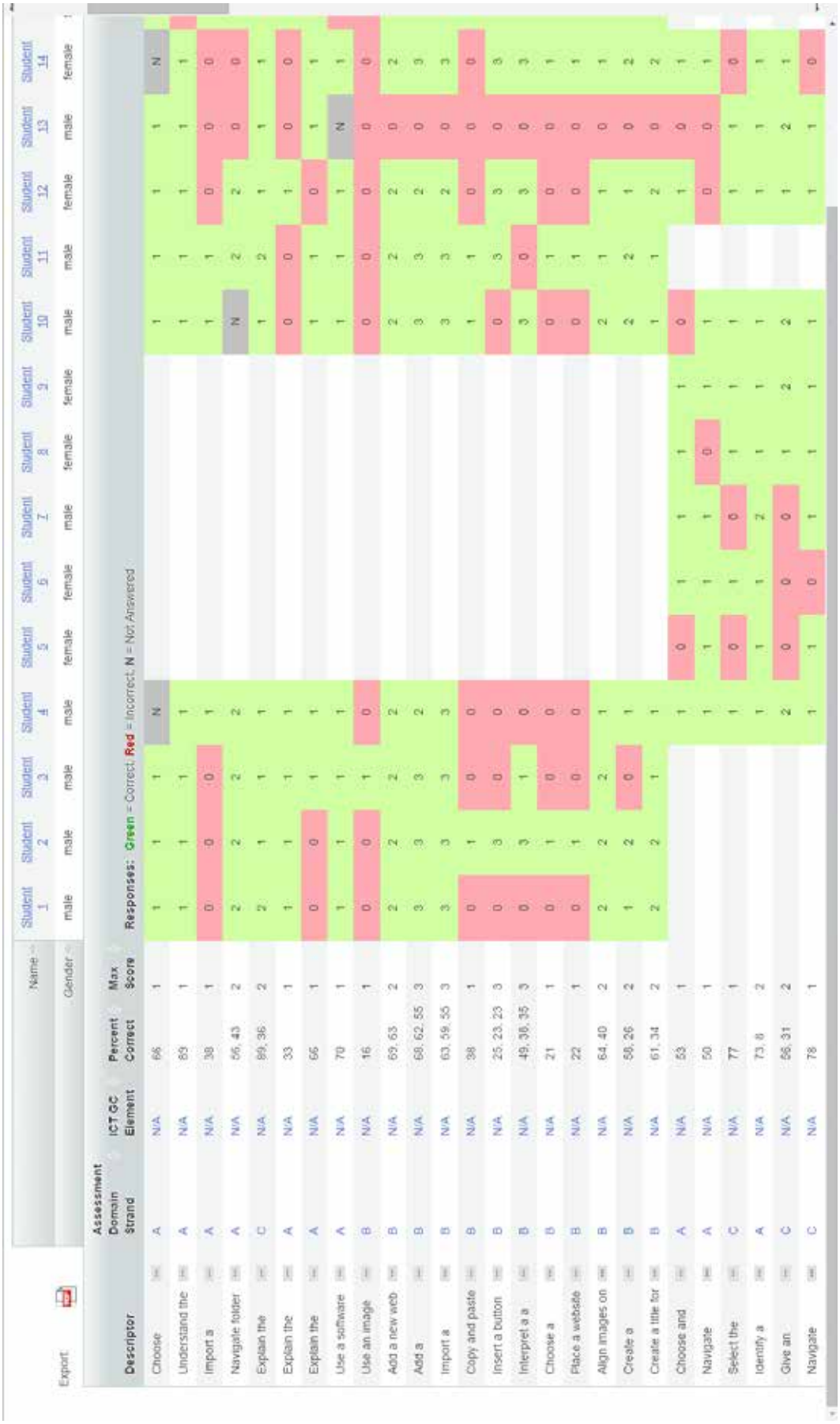
Information and Communication Technology Literacy

NAP

Please note that some questions will appear as blank for some students. This is because questions are grouped into sets or 'blocks' and students were assigned different blocks of questions within their test booklet. Questions appearing as blank for a student means the student was not allocated the block to which this question belonged.

Question Responses

Descriptor	Classification	Result	Max	Item % Correct
Explain the likely origin of an advertisement on a website	C / B3	0	2	41, 4%
Use an image editing program to adjust image attributes for use on a website	B / N/A	0	1	16%
Select and edit information and images that are relevant to the topic and target audience	A / B3	1	2	65, 17%
Use the zoom tool on an online map	B / N/A	0	1	18%
Choose a website button colour that is consistent with the web page design	B / N/A	0	1	21%
Place a website button according to interface design principles	B / N/A	0	1	22%
Insert a button linking an existing web page to a newly created web page	B / N/A	0	3	25, 23, 23%
Create a balanced web page layout	B / N/A	1	2	58, 26%
Navigate a website and locate information	A / N/A	1	1	28%
Explain the benefit of using PDF files instead of TXT files	A / N/A	1	1	33%
Select font size and style to suit a slide show presentation	B / C2	0	1	33%
Create a title for a web page	B / N/A	2	2	61, 34%
Include notes relevant to slides in a presentation	B / C1	1	1	34%
Recognise automated Internet advertising	A / N/A	1	1	34%
Use appropriate language to engender interest in a crowdsourcing campaign	B / D	1	1	34%
Open a hyperlink in a separate tab	A / B2a	0	1	35%
Interpret a a button linking a newly created web page to an existing page	B / N/A	0	3	49, 38, 35%
Explain the need to delete private data from public equipment	C / N/A	2	2	89, 36%
Import a specific set of image files	A / N/A	0	1	36%
Copy and paste specified text from a document to a web page	B / N/A	0	1	38%
Align images on a web page according to interface design principles	B / N/A	2	2	64, 40%



Export							Name →	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7	Student 8	Student 9	Student 10	Student 11	Student 12	Student 13	Student 14
							Gender →	male	male	male	male	female	female	male	female	female	male	male	female	male	female
	Descriptor	Assessment Domain Strand	ICT GC Element	Percent Correct	Max Score	Responses: Green = Correct, Red = Incorrect, N = Not Answered															
⋮	Choose	A	N/A	66	1		1	1	1	N						1	1	1	1	N	
⋮	Understand the	A	N/A	89	1		1	1	1	1						1	1	1	1	1	
⋮	Import a	A	N/A	38	1		0	0	0	1						1	1	0	0	0	
⋮	Navigate folder	A	N/A	66, 43	2		2	2	2	2						N	2	2	0	0	
⋮	Explain the	C	N/A	89, 36	2		2	1	1	1						1	2	1	1	1	
⋮	Explain the	A	N/A	33	1		1	1	1	1						0	0	1	0	0	
⋮	Explain the	A	N/A	66	1		0	0	1	1						1	1	0	1	1	
⋮	Use a software	A	N/A	70	1		1	1	1	1						1	1	1	N	1	
⋮	Use an image	B	N/A	16	1		0	0	1	0						0	0	0	0	0	
⋮	Add a new web	B	N/A	69, 63	2		2	2	2	2						2	2	2	0	2	
⋮	Add a	B	N/A	68, 62, 55	3		3	3	3	2						3	3	2	0	3	
⋮	Import a	B	N/A	63, 59, 55	3		3	3	3	3						3	3	2	0	3	
⋮	Copy and paste	B	N/A	38	1		0	1	0	0						1	1	0	0	0	
⋮	Insert a button	B	N/A	25, 23, 23	3		0	3	0	0						0	3	3	0	3	
⋮	Interpret a a	B	N/A	49, 36, 35	3		0	3	1	0						3	0	3	0	3	
⋮	Choose a	B	N/A	21	1		0	1	0	0						0	1	0	0	1	
⋮	Place a website	B	N/A	22	1		0	1	0	0						0	1	0	0	1	
⋮	Align images on	B	N/A	64, 40	2		2	2	2	1						2	1	1	0	1	
⋮	Create a	B	N/A	58, 26	2		1	2	0	1						2	2	1	0	2	
⋮	Create a title for	B	N/A	61, 34	2		2	2	1	1						1	1	2	0	2	
⋮	Choose and	A	N/A	53	1					1	0	1	1	1	1	0		1	0	1	
⋮	Navigate	A	N/A	50	1					1	1	1	1	0	1	1		0	0	1	
⋮	Select the	C	N/A	77	1					1	0	1	0	1	1	1		1	1	0	
⋮	Identify a	A	N/A	73, 8	2					1	1	1	2	1	1	1		1	1	1	
⋮	Give an	C	N/A	66, 31	2					2	0	0	0	1	2	2		1	2	1	
⋮	Navigate	C	N/A	78	1					1	1	0	1	1	1	1		1	1	0	

Appendix 7: Item difficulties

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
ASH02	0,0,0,1	Link	No	-1.85	-1.37	315							77%	89%	1.05
ASH04	0,1,1	Link	No	0.77	1.26	567							13%	28%	0.99
ASH05	0,1,1	Link	No	-1.69	-1.20	331							73%	89%	1.03
ASH06	0,1	Link	No	1.80	2.29	666							14%	33%	1.07
ASH07	0,1	Link	No	0.11	0.60	504							41%	64%	1.18
ASH08_06	0,1	Year 06	No	0.67	1.16	557							31%		0.98
ASH08_10	0,1	Year 10	Yes	-0.19	0.30	475								70%	0.97
ASH10	0,0,1	Link	No	0.27	0.76	519							17%	32%	0.73
ASH11	0,1,2,3	Link	No	0.42	0.91	533	0.20	513	0.38	530	0.64	555	31%	63%	1.04
ASH12	0,1,2,3	Link	No	0.49	0.98	541	0.35	527	0.51	542	0.63	554	29%	60%	1.04
ASH13_06	0,1	Year 06	No	2.13	2.62	698							11%		0.86
ASH13_10	0,1	Year 10	Yes	1.29	1.78	617								40%	0.86
ASH14_06	0,0,1,1	Year 06	No	3.03	3.52	784							2%		0.90
ASH14_10	0,0,1,1	Year 10	No	2.27	2.76	712								8%	0.82
ASH16_06	0,1	Year 06	No	3.22	3.71	802							4%		0.93
ASH16_10	0,1	Year 10	Yes	2.46	2.95	730								21%	0.86

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
ASH17_06	0,1	Year 06	No	3.01	3.50	783							5%		0.92
ASH17_10	0,1	Year 10	Yes	2.36	2.85	720								22%	0.84
ASH18	0,1,2	Link	No	0.72	1.21	563	0.31	523	1.14	603			26%	54%	0.90
ASH19	0,1,2	Link	No	1.27	1.76	615	0.59	550	1.94	680			16%	44%	0.74
ASH20	0,1,2	Link	No	0.95	1.44	584	0.50	541	1.39	627			21%	49%	0.89
FPC01	0,1	Link	No	0.60	1.09	551							34%	54%	1.17
FPC02	0,1	Link	No	0.88	1.37	578							29%	49%	1.12
FPC03	0,0,1,0	Link	Yes	-0.84	-0.35	412							63%	76%	1.15
FPC04	0,1,1	Link	Yes	-0.36	0.13	459							49%	74%	1.11
FPC05	0,1,2	Link	No	1.10	1.58	599	0.54	546	1.65	651			22%	44%	1.21
FPC06	0,1	Link	Yes	-0.62	-0.13	434							55%	77%	0.96
FPC07	0,0,1,0	Link	No	0.43	0.91	534							39%	56%	1.12
FPC08	0,1,0,0	Link	Yes	-1.72	-1.23	328							73%	91%	0.95
FPC09	0,1	Link	Yes	0.34	0.83	526							34%	64%	0.98
FPC10	0,1	Link	No	0.10	0.59	503							38%	67%	1.10
FPC13	0,1	Link	Yes	-0.52	-0.03	444							54%	73%	1.00
FPC14	0,1	Link	Yes	-2.22	-1.73	280							75%	92%	0.97
FPC15	0,1	Link	Yes	-1.66	-1.17	334							70%	87%	0.99
FPC16	0,1	Link	Yes	0.05	0.54	498							40%	66%	1.04
FPC17	0,1	Link	Yes	-1.89	-1.40	311							71%	91%	0.90

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
SPN01_06	0,1	Year 06	Yes	-2.73	-2.24	231							87%		0.99
SPN01_10	0,1	Year 10	No	-2.27	-1.78	275								92%	1.06
SPN02	0,0,0,1	Link	Yes	1.87	2.36	673							16%	28%	1.07
SPN03	0,1	Link	Yes	1.69	2.18	655							16%	34%	1.06
SPN04	0,1	Link	Yes	-0.74	-0.25	422							59%	76%	0.98
SPN05	0,1	Link	Yes	-0.90	-0.41	407							62%	78%	1.08
SPN06	0,1	Link	Yes	0.72	1.21	563							31%	52%	0.96
SPN07M	0,0,1,1	Link	No	-1.09	-0.60	388							63%	83%	0.83
SPN12	0,0,1	Link	Yes	0.30	0.79	522							20%	29%	0.86
SPN13_06	0,1	Year 06	No	2.17	2.66	702							11%		0.99
SPN13_10	0,1	Year 10	No	2.60	3.09	743								19%	1.04
SPN14	0,0,1	Link	Yes	0.01	0.50	494							22%	33%	0.81
SPN15	0,1	Link	Yes	-1.68	-1.19	332							75%	86%	0.95
SPN16	0,1	Link	Yes	-1.36	-0.87	362							70%	83%	0.99
SPN17	0,1,2	Link	No	-0.33	0.16	461	-1.42	357	0.75	565			53%	67%	1.20
NI13M1Q01	0,0,1,0	Year 10	No	1.11	1.60	600								45%	1.13
NI13M1Q02	0,1,0,0	Year 10	No	-3.20	-2.71	186								96%	1.21

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
NI13M1Q03	0,1	Year 10	No	-0.50	-0.01	445								75%	1.06
NI13M1Q04	0,1	Year 10	No	2.30	2.79	715								22%	1.04
NI13M1Q05	0,0,1	Year 10	No	1.66	2.15	653								16%	0.92
NI13M1Q06	0,1	Year 10	No	0.29	0.78	521								60%	1.17
NI13M1Q07	0,1,1	Year 10	No	1.71	2.20	657								17%	1.02
NI13M1Q08	0,1	Year 10	No	1.91	2.40	677								28%	1.19
NI13M1Q10	0,1	Year 10	No	1.01	1.50	590								47%	1.08
NI13M1Q11A	0,1,2	Year 10	No	1.56	2.04	643	0.87	576	2.25	709				35%	1.14
NI13M1Q11B	0,1,2	Year 10	No	1.09	1.58	598	0.54	545	1.64	650				45%	1.06
NI13M1Q11C	0,1	Year 10	No	0.85	1.34	575								49%	1.12
NI13M1Q11D	0,1,2	Year 10	No	2.28	2.77	713	1.57	644	3.00	782				22%	1.12
NI13M1Q11F	0,1,2	Year 10	No	1.27	1.76	616	0.96	585	1.59	646				39%	1.04
NI13M1Q11G	0,1,1	Year 10	No	2.44	2.93	728								10%	0.89

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
NI13M2Q01	0,0,1	Year 10	No	-1.18	-0.69	380								41%	0.99
NI13M2Q02	0,1	Year 10	No	-0.66	-0.17	430								77%	1.07
NI13M2Q03	0,1	Year 10	No	-2.63	-2.14	240								95%	0.79
NI13M2Q04	0,1	Year 10	No	1.58	2.07	645								35%	1.07
NI13M2Q05B	0,0,1	Year 10	No	-0.96	-0.47	401								40%	0.87
NI13M2Q06	0,1,0,0	Year 10	No	-1.21	-0.72	377								83%	0.99
NI13M2Q07	0,1,2	Year 10	No	2.51	3.00	735	1.20	608	3.82	861				23%	1.17
NI13M2Q08	0,1	Year 10	No	-1.60	-1.11	340								87%	0.97
NI13M2Q09A	0,1	Year 10	No	-0.67	-0.18	429								76%	1.07
NI13M2Q09B	0,1	Year 10	No	-0.95	-0.46	402								80%	1.01
NI13M2Q10	0,1	Year 10	No	0.74	1.23	564								52%	1.06
NI13M2Q11	0,1	Year 10	No	-0.44	0.05	451								72%	0.93
NI13M2Q12	0,1	Year 10	No	-0.36	0.13	459								71%	0.92

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
NI13M2Q13	0,1,0,0	Year 10	No	-2.89	-2.40	216								94%	0.85
NI13M2Q14B	0,1	Year 10	No	1.59	2.08	646								35%	1.04
NI13M2Q14C	0,1	Year 10	No	-1.66	-1.17	334								86%	0.92
NI13M2Q16	0,1	Year 10	No	0.85	1.34	575								49%	1.05
NI13M3Q01	0,1	Year 10	No	-1.12	-0.63	386								82%	1.09
NI13M3Q07	0,1	Year 10	No	-0.92	-0.43	405								80%	0.97
NI13M3Q08A	0,1,2	Year 10	No	0.57	1.06	548	0.25	518	0.88	578				58%	0.94
NI13M3Q08B	0,1,2	Year 10	No	0.72	1.21	562	0.23	515	1.21	609				54%	1.01
NI13M4Q02	0,1	Link	No	-0.90	-0.41	407							63%	76%	1.04
NI13M4Q03	0,0,0,1	Link	No	-1.70	-1.22	329							75%	87%	1.01
NI13M4Q04	0,0,0,1	Link	No	-0.42	0.07	453							49%	78%	0.95
NI13M4Q05	0,1	Link	No	-0.33	0.16	462							52%	67%	1.00
NI13M4Q07	0,1	Link	No	1.04	1.53	593							24%	46%	1.04
NI13M4Q10_06	0,1	Year 06	No	-0.42	0.07	453							52%		0.88
NI13M4Q10_10	0,1	Year 10	No	-1.32	-0.83	367								85%	0.78

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
NI13M4Q11	0,1	Link	No	-2.52	-2.03	252							85%	93%	0.86
NI13M4Q12	0,1	Link	No	-0.80	-0.31	416							59%	77%	1.09
NI13M4Q13	0,1,2	Link	No	0.19	0.68	511	-0.16	478	0.53	544			35%	69%	1.21
NI13M4Q14A	0,1	Link	No	-0.57	-0.08	438							52%	78%	0.99
NI13M4Q14B_06	0,1,1	Year 06	No	0.69	1.18	559							15%		0.91
NI13M4Q14B_10	0,1,1	Year 10	No	-0.05	0.44	488								33%	0.89
NI13M4Q14C	0,1	Link	No	1.74	2.23	661							14%	34%	0.99
NI13M4Q14D	0,1	Link	No	1.29	1.78	617							19%	43%	0.98
NI13M4Q14E	0,1	Link	No	1.60	2.08	647							17%	35%	1.02
NI13M4Q14F	0,1	Link	No	1.48	1.97	636							17%	41%	0.98
NI13M5Q01_06	0,1	Year 06	No	-2.09	-1.61	292							80%		1.06
NI13M5Q01_10	0,1	Year 10	No	-1.52	-1.03	347								87%	1.07
NI13M5Q03	0,1,2	Link	No	0.26	0.75	518	-1.61	339	2.13	698			43%	55%	1.09
NI13M5Q06_06	0,0,1	Year 06	No	0.52	1.01	543							17%		1.14
NI13M5Q06_10	0,0,1	Year 10	No	1.26	1.75	614								22%	1.16
NI13M5Q07_06	0,1	Year 06	No	0.05	0.54	498							43%		1.23

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
NI13M5Q07_10	0,1	Year 10	No	0.62	1.11	553								56%	1.24
NI13M5Q08_06	0,1	Year 06	No	1.05	1.54	594							25%		1.08
NI13M5Q08_10	0,1	Year 10	No	0.15	0.64	507								64%	1.13
NI13M5Q09	0,1	Link	No	-1.27	-0.78	371							66%	87%	0.91
NI13M5Q13	0,1	Link	No	-1.76	-1.27	324							75%	89%	0.98
NI13M5Q15	0,0,0,1	Link	No	-0.06	0.43	488							44%	71%	0.94
NI13M5Q17	0,1	Link	No	-0.14	0.35	480							45%	72%	1.05
NI13M5Q18	0,1	Link	No	-1.20	-0.71	378							67%	81%	1.06
NI13M5Q19	0,1	Link	No	-1.36	-0.87	363							69%	82%	1.02
NI13M5Q20A	0,1	Link	No	-0.72	-0.23	424							55%	79%	0.86
NI13M5Q20B	0,1	Link	No	-0.83	-0.34	413							57%	80%	0.83
NI13M5Q20C	0,1,1	Link	No	-0.51	-0.02	444							25%	39%	0.79
NI13M5Q20D	0,1	Link	No	0.05	0.53	498							41%	67%	0.88
NI13M5Q20E_06	0,1,1	Year 06	No	2.53	3.01	736							4%		1.00
NI13M5Q20E_10	0,1,1	Year 10	No	1.47	1.96	634								19%	0.97
NI13M5Q20F	0,1	Link	No	-1.03	-0.54	394							60%	82%	0.87
NI13M5Q20G	0,1	Link	No	-1.01	-0.52	396							60%	82%	0.87
NI13M5Q20H	0,1,1	Link	No	0.11	0.60	504							19%	35%	0.78

Item	Scores	Vertical link	Horizontal link	Difficulty			Threshold 1		Threshold 2		Threshold 3		Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
				RP =0.50	RP =0.62	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale	RP =0.50	ICTL Scale			
NI13M5Q20I	0,1	Link	No	-0.05	0.44	488							43%	68%	0.89
NI13M5Q20J_06	0,1,1	Year 06	No	2.02	2.51	687							6%		0.94
NI13M5Q20J_10	0,1,1	Year 10	No	0.91	1.40	581								25%	0.86
NI13M6Q01_06	0,1	Year 06	No	-3.37	-2.88	170							92%		1.04
NI13M6Q01_10	0,1	Year 10	No	-2.61	-2.12	243								95%	1.07
NI13M6Q02	0,1	Link	No	-1.77	-1.28	323							75%	90%	1.05
NI13M6Q03	0,1	Link	No	-2.21	-1.72	281							82%	92%	0.92
NI13M6Q04A	0,1,2	Link	No	0.48	0.97	540	-0.63	432	1.60	647			37%	53%	1.08
NI13M6Q04B	0,1	Link	No	-0.18	0.31	476							48%	68%	0.93
NI13M6Q04D	0,1	Link	No	-0.32	0.17	463							52%	68%	0.95
NI13M6Q04E	0,1,2	Link	No	0.47	0.96	539	-0.69	427	1.63	650			38%	53%	1.07
NI13M6Q05	0,1	Link	No	-0.33	0.16	462							50%	74%	1.16
NI13M6Q06	0,1	Link	No	-1.00	-0.51	397							56%	80%	0.97
NI13M6Q07_06	0,1	Year 06	No	-1.12	-0.63	385							56%		1.03
NI13M6Q07_10	0,1	Year 10	No	-0.72	-0.23	425								72%	1.01
NI13M6Q08	0,1	Link	No	-1.12	-0.63	386							53%	77%	1.04
NI13M6Q09	0,1,2	Link	No	-0.56	-0.07	439	-1.15	383	0.02	495			46%	69%	1.17

Appendix 8: Variables for conditioning

Variable	Name	Values	Coding	Regressor
Adjusted school mean achievement	SCH_MN	Adjusted school mean	Logits	Direct
Sector	Sector	Public	00	Direct
		Catholic	10	Direct
		Independent	01	Direct
Geographic Location	Geoloc	Metro 1.1	0000000	Direct
		Metro 1.2	1000000	Direct
		Provincial 2.1.1	0100000	Direct
		Provincial 2.1.2	0010000	Direct
		Provincial 2.2.1	0001000	Direct
		Provincial 2.2.2	0000100	Direct
		Remote 3.1	0000010	Direct
		Remote 3.2	0000001	Direct
SEIFA Levels	SEIFA	Mode of state and year level	000000000	Direct
		Other category 1	010000000	Direct
		Other category 2	001000000	Direct
		Other category 3	000100000	Direct
		Other category 4	000010000	Direct
		Other category 5	000000000	Direct
		Other category 6	000001000	Direct
		Other category 7	000000100	Direct
		Other category 8	000000010	Direct
		Other category 9	000000001	Direct
Sex	SEX	Male	10	Direct
		Female	00	Direct
		Missing	01	Direct
Indigenous Status Indicator	INDIG	Indigenous	10	Direct
		Non-Indigenous	00	Direct
		Missing	01	Direct
Flexible delivery school	FD	Yes	1	PCA
		No	0	PCA
Age	AGE	Value	Copy, 0	PCA
		Missing	Mean, 1	PCA
LOTE spoken at home – Student	LBOTEs	Yes	10	PCA
		No	00	PCA
		Missing	01	PCA

Variable	Name	Values	Coding	Regressor
LOTE spoken at home – Parent 1	LBOTEp1	Yes	10	PCA
		No	00	PCA
		Missing	01	PCA
LOTE spoken at home – Parent 2	LBOTEp2	Yes	10	PCA
		No	00	PCA
		Missing	01	PCA
Student Born in Australia	BORNAUS	Australia	10	PCA
		Overseas	00	PCA
		Missing	01	PCA
Parental Occupation Group – Parent 1	POCC	Mode of state and year level	00000	PCA
		Other category 1	10000	PCA
		Other category 2	01000	PCA
		Other category 3	00100	PCA
		Other category 4	00010	PCA
		Not stated or unknown	00001	PCA
Parental Occupation Group – Parent 2	POCC	Mode of state and year level	00000	PCA
		Other category 1	10000	PCA
		Other category 2	01000	PCA
		Other category 3	00100	PCA
		Other category 4	00010	PCA
		Not stated or unknown	00001	PCA
Parent School Education – Parent 1	PARED	Mode of state and year level	0000	PCA
		Other category 1	1000	PCA
		Other category 2	0100	PCA
		Other category 3	0010	PCA
		Not stated or unknown	0001	PCA
Parent School Education – Parent 2	PARED	Mode of state and year level	0000	PCA
		Other category 1	1000	PCA
		Other category 2	0100	PCA
		Other category 3	0010	PCA
		Not stated or unknown	0001	PCA

Variable	Name	Values	Coding	Regressor
Parent Non-School Education – Parent 1	PARED	Mode of state and year level	0000	PCA
		Other category 1	1000	PCA
		Other category 2	0100	PCA
		Other category 3	0010	PCA
		Not stated or unknown	0001	PCA
Parent Non-School Education – Parent 2	PARED	Mode of state and year level	0000	PCA
		Other category 1	1000	PCA
		Other category 2	0100	PCA
		Other category 3	0010	PCA
		Not stated or unknown	0001	PCA
NUMCOMP – Number of desktop computers	Q01a	Integer	Copy value, replace missing by year level and state median and five dummies for missing values	PCA
NUMCOMP – Number of portable computers	Q01b	Integer		PCA
NUMCOMP – Number of tablets	Q01c	Integer		PCA
NUMCOMP – Number of games consoles	Q01d	Integer		PCA
NUMCOMP – Number of mobile devices	Q01e	Integer		PCA
EXPERNC – Experience with computers	Q02	Never or less than one year	10000	PCA
		At least one year but less than three years	01000	PCA
		At least three years but less than five years	00100	PCA
			00010	PCA
		At least five years but less than seven years	00000	PCA
		Seven years or more	00001	PCA
		Missing		

Variable	Name	Values	Coding	Regressor
SYSWIN - Home computer systems – Windows	Q03a1	Yes No Missing	Two dummies for each variable with the year level and state median as the reference category	PCA
SYSMAC – Home computer systems – Mac	Q03a2			PCA
SYSOTH – Home computer systems – Other	Q03a3			PCA
SYSWIN – School computer systems – Windows	Q03b1			PCA
SYSMAC – School computer systems – Mac	Q03b2			PCA
SYSOTH – School computer systems – Other	Q03b3			PCA
SYSWIN – Other places computer systems – Windows	Q03c1			PCA
SYSMAC – Other places computer systems – Mac	Q03c2			PCA
SYSOTH – Other places computer systems – Other	Q03c3			PCA
Use at home	Q04a	Several times every day Every day Almost every day	4,3,2,1,0; missing replaced by the year level mode; dummies for missing	PCA
Use at school	Q04b	A few times each week Less than once a week or never Missing		PCA
IMPICT – Computer work important	Q05a	Strongly agree Agree Disagree Strongly disagree Missing	Four dummies for each variable with the year level and state mode as the reference category	PCA
INTJOY – Computer is fun	Q05b			PCA
INTJOY – Interested in technology	Q05c			PCA
INTJOY – Like learning new things	Q05d			PCA
INTJOY – Always looking for new ways	Q05e			PCA

Variable	Name	Values	Coding	Regressor
IMPICT – Improve quality of work	Q06a	Strongly agree Agree Disagree Strongly disagree Missing	Four dummies for each variable with the year level and state mode as the reference	PCA
IMPICT – Make work easier	Q06b			PCA
IMPICT – Help work with others	Q06c			PCA
IMPICT – Help communicate with friends	Q06d			PCA
INTJOY – Find new ways to do things	Q06e			PCA
UTILH – Home: Search internet for information	Q07a1	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 and state median; dummies for missing	PCA
UTILH – Home: Use word processing	Q07b1			PCA
UTILH – Home: Use spreadsheets	Q07c1			PCA
UTILH – Home: Use learning programs	Q07d1			PCA
UTILH – Home: Create presentations	Q07e1			PCA
UTILH – Home: Create presentations	Q07e1			PCA
UTILH – Home: Contribute to online content	Q07f1			PCA
UTILS– School: Search internet for information	Q07a2			PCA
UTILS – School: Use word processing	Q07b2			PCA
UTILS – School: Use spreadsheets	Q07c2			PCA
UTILS – School: Use learning programs	Q07d2			PCA
UTILS – School: Create presentations	Q07e2			PCA
UTILS – School: Contribute to online content	Q07f2			PCA

Variable	Name	Values	Coding	Regressor
ENTERTH – Home: Download software	Q08a1	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 and state median; dummies for missing	PCA
ENTERTH – Home: Download/stream media	Q08b1			PCA
ENTERTH – Home: Play games on computer	Q08c1			PCA
Home: Use software to create media	Q08d1			PCA
ENTERTH – Home: Use computer to play media	Q08e1			PCA
ENTERTH – Home: Buy and install apps	Q08f1			PCA
ENTERTS – School: Download software	Q08a2			PCA
ENTERTS – School: Download/stream media	Q08b2			PCA
ENTERTS – School: Play games on computer	Q08c2			PCA
School: Use software to create media	Q08d2			PCA
ENTERTS – School: Use computer to play media	Q08e2			PCA
ENTERTS – School: Buy and install apps	Q08f2			PCA

Variable	Name	Values	Coding	Regressor
Home: Search internet for information that is not for school	Q09a1	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 and state median; dummies for missing	PCA
COMMH – Home: Use computer for e–mail/chat	Q09b1			PCA
COMMH – Home: Write/reply to blogs/ forum threads	Q09c1			PCA
COMMH – Home: Use video/voice chat	Q09d1			PCA
COMMH – Home: Upload media to online profile	Q09e1			PCA
COMMH – Home: Edit images on computer	Q09f1			PCA
COMMH – Home: Communicate with other via social media	Q09g1			PCA
School: Search internet for information that is not for school	Q09a2			PCA
COMMS – School: Use computer for e–mail/chat	Q09b2			PCA
COMMS – School: Write/reply to blogs/ forum threads	Q09c2			PCA
COMMS – School: Use video/voice chat	Q09d2			PCA
COMMS – School: Upload media to online profile	Q09e2			PCA
COMMS – School: Edit images on computer	Q09f2			PCA
COMMS – School: Communicate with other via social media	Q09g2			PCA

Variable	Name	Values	Coding	Regressor
TECHH – Home: Write programs/ macros	Q10a1	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 and state median; dummies for missing	PCA
TECHH – Home: Upload created media on Internet	Q10b1			PCA
TECHH – Home: Construct websites	Q10c1			PCA
TECHH – Home: Use "art" programs	Q10d1			PCA
TECHH – Home: Use antivirus software	Q10e1			PCA
TECHH – Home: Produce digital content	Q10f1			PCA
TECHS – School: Write programs/ macros	Q10a2			PCA
TECHS – School: Upload created media on Internet	Q10b2			PCA
TECHS – School: Construct websites	Q10c2			PCA
TECHS – School: Use "art" programs	Q10d2			PCA
TECHS – School: Use antivirus software	Q10e2			PCA
TECHS – School: Produce digital content	Q10f2			PCA
EFFICACY – Use antivirus software	Q11a	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 and state mode as the reference category	PCA
EFFICACY – Edit images	Q11b			PCA
EFFICACY – Create database	Q11c			PCA
EFFICACY – Use spreadsheet to plot graph	Q11d			PCA
EFFICACY – Download music	Q11e			PCA
EFFICACY – Create multi-media presentation	Q11f			PCA
EFFICACY – Construct web page	Q11g			PCA
EFFICACY – Upload files to a website	Q11h			PCA
EFFICACY – Use social media	Q11i			PCA

Variable	Name	Values	Coding	Regressor
ICTLRN – Need to provide references to web-page content	Q12a1	Yes No Missing	1,0; missing replaced by the year level and state median; dummies for missing	PCA
ICTLRN – Need to know about copyright permissions	Q12b1			PCA
ICTLRN – Problems with using pirated software	Q12c1			PCA
ICTLRN – Checking software credentials	Q12d1			PCA
ICTLRN – Password changes for internet services	Q12e1			PCA
ICTLRN – Reporting spam to authority	Q12f1			PCA
ICTLRN – Reading license/user agreements	Q12g2			PCA
ICTLRN – Keeping anti-virus software updated	Q12h2			PCA
ICTLRN – How to decide about information sources	Q12i2			PCA
ICTLRN – How to look for different types of digital information	Q12j2			PCA
ICTCOMS – Preparing reports and essays	Q13a	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 and state mode as the reference category	PCA
ICTCOMS – Preparing presentations	Q13b			PCA
ICTCOMS – Working with other students at own school	Q13c			PCA
ICTSPECS – Working with other students at other schools	Q13d			PCA
ICTCOMS – Completing worksheets and exercises	Q13e			PCA
ICTSPECS – Organising work program with learning management system	Q13f			PCA
ICTSPECS – Reflecting on learning experiences	Q13g			PCA
ICTCOMS – Completing tests and assessments	Q13h			PCA
ICTSPECS – Using online learning programs	Q13i			PCA
ICTSPECS – Using data logging as part of investigation	Q13j			PCA

Appendix 9: Proficiency level descriptions

Level	Proficiency level description	Examples of student achievement at this 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.
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.	• 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. • 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 sorting data in a spreadsheet according to a specified criterion.

Level	Proficiency level description	Examples of student achievement at this 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 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 infrequently used software and file management functions such as displaying a specified hidden toolbar in a word processor, editing text in an online survey, or using a single pull-down menu function or installation wizard to save files to a specified location. • Identify security risks associated with spyware and providing personal data over the internet and explain the importance of respecting and protecting the intellectual property rights of authors.
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 from given electronic sources to answer specific, concrete questions. They assemble information in a provided simple linear 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. • Select clear, simple, relevant information from given information sources and include it in an information product. • 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	Proficiency level description	Examples of student achievement at this level
2	Students working at Level 2 locate simple, explicit information from within a given electronic source. They add content to and make simple changes to existing information products when instructed. They edit information products to create products that show limited consistency of design and information management. They recognise and identify basic ICT electronic security and health and safety usage issues and practices.	• Locate explicit relevant information or links to information from within a web page. • 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 web page to a list of favourites (bookmarks) in a web browser or 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.
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 manipulation software features such as adding and moving predefined shapes to reproduce the basic attributes of a simple 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 web page, or selecting all the text on a page. • Recognise basic computer use conventions such as identifying the main parts of a computer and that the 'Shut down' command is a safe way to turn off a computer.