AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

National Assessment Program – ICT Literacy Technical Report

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National Assessment Program – ICT Literacy 2011 Year 6 and Year 10

TECHNICAL REPORT

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CHAPTER 1: INTRODUCTION

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In 1999, the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) adopted the *Adelaide Declaration of Australia's National Goals for Schooling in the Twenty First Century* (MCEETYA, 1999). Subsequently, MCEETYA agreed to report on progress toward the achievement of the National Goals on a nationally-comparable basis, via the National Assessment Program (NAP). As part of NAP, a three-yearly cycle of sample assessments in primary science, civics and citizenship and information and communications technology (ICT) was established.

In 2008, the MCEETYA adopted a revised set of goals which was intended to set the direction for Australian schooling for the next decade: the Melbourne Declaration on Educational Goals for Young Australians (MCEETYA, 2008). The Melbourne Declaration continued a theme from the Adelaide declaration 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' (MCEETYA). A companion document to the Melbourne Declaration outlined strategies intended to support the implementation of its educational goals over a four-year period from 2009 through 2012 (MCEETYA, 2009). This included a commitment to evaluation through a national assessment program, comprising national tests in literacy and numeracy across the school population in specified year levels, sample assessments in science literacy, civics and citizenship, and ICT literacy' and participation in relevant international testing programs (MCEETYA, 2009).

This report is concerned with procedures, processes and technical aspects of the National Assessment Program – ICT Literacy 2011 Literacy (NAP – ICTL 2011) and should be read in conjunction with the Public Report from Literacy NAP – ICTL 2011 which focuses on results and interpretation of results from that assessment (ACARA 2012a). The first cycle of the NAP – ICTL was held in 2005 and provided the baseline against which future performance would be compared. The second cycle of the program was conducted in 2008 and was the first cycle where trends in performance were able to be examined.

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, integrate and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society* (MCEETYA, 2005).

This definition formed the basis of the NAP – 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 and internationally (Erstad, 2010). 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).

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, the most recent of which is the introduction of ICT capability in the Australian Curriculum (ACARA, 2012b).

Assessment procedures in NAP – ICTL 2011

The assessment for NAP – ICTL 2011 was computer-based and included a combination of simulated and authentic software applications, multiple choice and text response items, grouped into seven 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 modules assigned on a rotational basis.

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. Six of the seven modules included large tasks to be completed using purpose-built software applications. The modules were as follows:

- In the *Sports Picnic* module, 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, students searched for and installed photo management software, changed settings for antivirus software, organised a photo collection and edited a photo.
- In the *Saving Electricity* module, students researched the topic from given web resources and used their research as the basis for creating an information video by editing supplied video clips and adding text and effects.
- In the *Wiki Builder* module, students updated the wiki page of a local sports club. They received content by email to be included. They edited and formatted existing information, and added new information and functions to the wiki.

- In the *Language Preservation* module, Year 10 students participated in a project to help preserve Indigenous Australian languages. They were assigned several tasks in a collaborative workspace to collect and edit information and used collaboration software to schedule a meeting with other students working on the project.
- In the *Art Show* module, Year 10 students were given the role as manager of the part of their school's website that promotes the school's art show. They downloaded and managed images from a camera, managed communication through a webmail account and then edited and added content to the website.
- The *General Skills* module consisted of discrete tasks based on general computing skills. Students completed everyday tasks using commonly used software applications such as word processing and spreadsheet software. The module also included some questions about basic aspects of computer use.

Measuring trends and including new developments in ICT literacy

The assessment was structured to be congruent with the 2005 and 2008 assessments so as to provide a basis for comparison with those assessments. 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 new developed modules. The format of the ICT literacy assessment in 2011 was the same as in 2008 and 2005 so that the on-screen environment experienced by the student remained consistent.

Three of the seven modules were trend modules as used in either or both of 2005 and 2008: *General Skills* (though extended for 2011), *Friend's PC* and *Sports Picnic*. Each student completed two of the three trend modules.

Four of the modules were newly developed for use in 2011: *Saving Electricity*, *Wiki Builder*, *Language Preservation* and *Art Show*. Each student completed two of these new modules. These modules included content, such as video and web page editing and collaborative workspaces that reflect more recent developments in the software contexts in which students use ICT.

Student questionnaire

A questionnaire for students was incorporated into the survey instrument. The questionnaire included some identical questions to those used in previous cycles of NAP – ICTL, some questions were the same as in previous cycles but with different, but compatible, response categories (for example, in 2011 there was finer-grained detail regarding the amount of time students spent using computers than in previous cycles) and some were new. 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

NAP – ICTL 2011 was delivered to students using USB sticks (one per student) although in 12 per cent of schools it was necessary to provide sets of laptop computers for the test administration. The testing software itself was entirely web-based and could be delivered using the internet. The USB delivery method was used to account for variations in school-based internet connectivity and computing resources. Web-based delivery of the instruments would not have guaranteed an equivalent test-taking experience for each participating student. This approach also allowed for multimedia videos to be included in the test instrument (by eliminating concerns over connection speeds) and minimised the setup requirements for administration at schools (e.g. through network security and installation of uniform browser types).

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 over a period from late September to November with most of the assessments being held in October.

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. The student background data in the 2005 and 2008 assessments had been collected as part of the student questionnaire. The introduction of a different source of student background data restricts comparisons of relations between ICT literacy and student background in 2011 data with those from previous assessment cycles.

Sample

NAP – ICTL 2011 was based on a nationally representative sample of 11,023 students of which 5,710 were from Year 6 and 5,313 were from Year 10. These students were from 649 schools (333 for Year 6 and 316 for Year 10). These numbers represent 92 per cent of the sampled Year 6 students and 87 per cent sampled Year 10 students so there is little 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 Years 6 and 10 Report 2011 (ACARA, 2012a).

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 (items from the trend modules) equating procedures based on Rasch theory enabled recording the results for NAP – ICTL 2011 on the scale that had been established in 2005. Consequently, the results from NAP – ICTL 2011 could be compared directly with those from NAP – ICTL 2008 and 2005. In practice, 30 items performed sufficiently uniformly across the 2011 and 2008 cycles to be used to link the results of NAP – ICTL 2011 to the ICT literacy scale.

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 2011 enabled some additional examples of ICT literacy achievement to be added to the progress map but did not require changes to the descriptors themselves.

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 years 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 2011, 62 per cent of Year 6 students reached or exceeded the Year 6 Proficient Standard, whereas 65 per cent of Year 10 students reached or exceeded the Year 10 Proficient Standard.

Structure of the Technical Report

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

Chapter 2 summarises the development of the assessment 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 calculation of participation rates.

Chapter 4 summarises the field administration of the assessment.

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

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

Chapter 7 outlines the proficiency levels and standards.

Chapter 8 discusses the reporting of student results, including the procedures used to estimate sampling and measurement variance and the reporting of statistics for, and comparisons among, jurisdictions and designated groups of students over time.

CHAPTER 2:
ASSESSMENT FRAMEWORK AND INSTRUMENT DEVELOPMENT

Julian Fraillon

The NAP – ICTL Assessment Domain developed for use in the 2005 cycle was used, without modification for NAP – ICTL 2008 and 2011. The assessment domain was used as 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) was used as an indicator of item and task difficulty to inform instrument development, but the assessment domain and progress map were used as the substantive bases for instrument construction and the items in the instrument were referenced to the strands in the progress map.

Summary of the assessment domain

For the purpose of this assessment, ICT literacy was defined as "the ability of individuals to use ICT appropriately to access, manage, integrate and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society". The definition 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 range of tools and systems this assessment focuses primarily on the use of computers rather than other forms of ICT.

The assessment domain 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 domain includes an ICT literacy progress map that describes skills and understandings that are progressively more demanding across levels. The progress map is a generalised developmental sequence that enables information on the full range of student performance to be collected and reported. 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 the *working with information* strand, students progress from using key words to retrieve information from a specified source, through identifying search question terms and suitable sources, to using a range of specialised sourcing tools and seeking confirmation of the credibility of information from external sources.

In the *creating and sharing information* strand, 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 using specialised tools to control, expand and author information, producing representations of complex phenomena.

In the *using ICT responsibly* strand, students progress from understanding and using basic terminology and uses of ICT in everyday life, through recognising responsible use 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 – ICTL Assessment Domain to the Statements of Learning and the Statement of ICT General Capability

Since the development of the NAP – ICTL Assessment Domain in preparation for the 2005 assessment, two key documents have been released that support an Australian national perspective on ICT literacy. These are 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 Statement of ICT Capability for the Australian Curriculum, referred to as the Statement of ICT General Capability (ACARA, 2012b).

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 Statement of ICT General Capability, competence is identified as one of the seven general capabilities that will assist students to live and work successfully in the twenty-first century (ACARA). The ICT capability learning continuum (specified for end of Year 2, end of Year 6 and end of Year 10) is organised into five interrelated elements.

Although each of the three 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. Figure 2.1 shows a mapping of the elements of the NAP – ICTL Assessment Domain with those of the Statements of Learning and the Statement of ICT General 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 illustrate the congruence between the NAP – ICTL Assessment Domain and each of the Statements of Learning and the Statement of ICT General Capability.

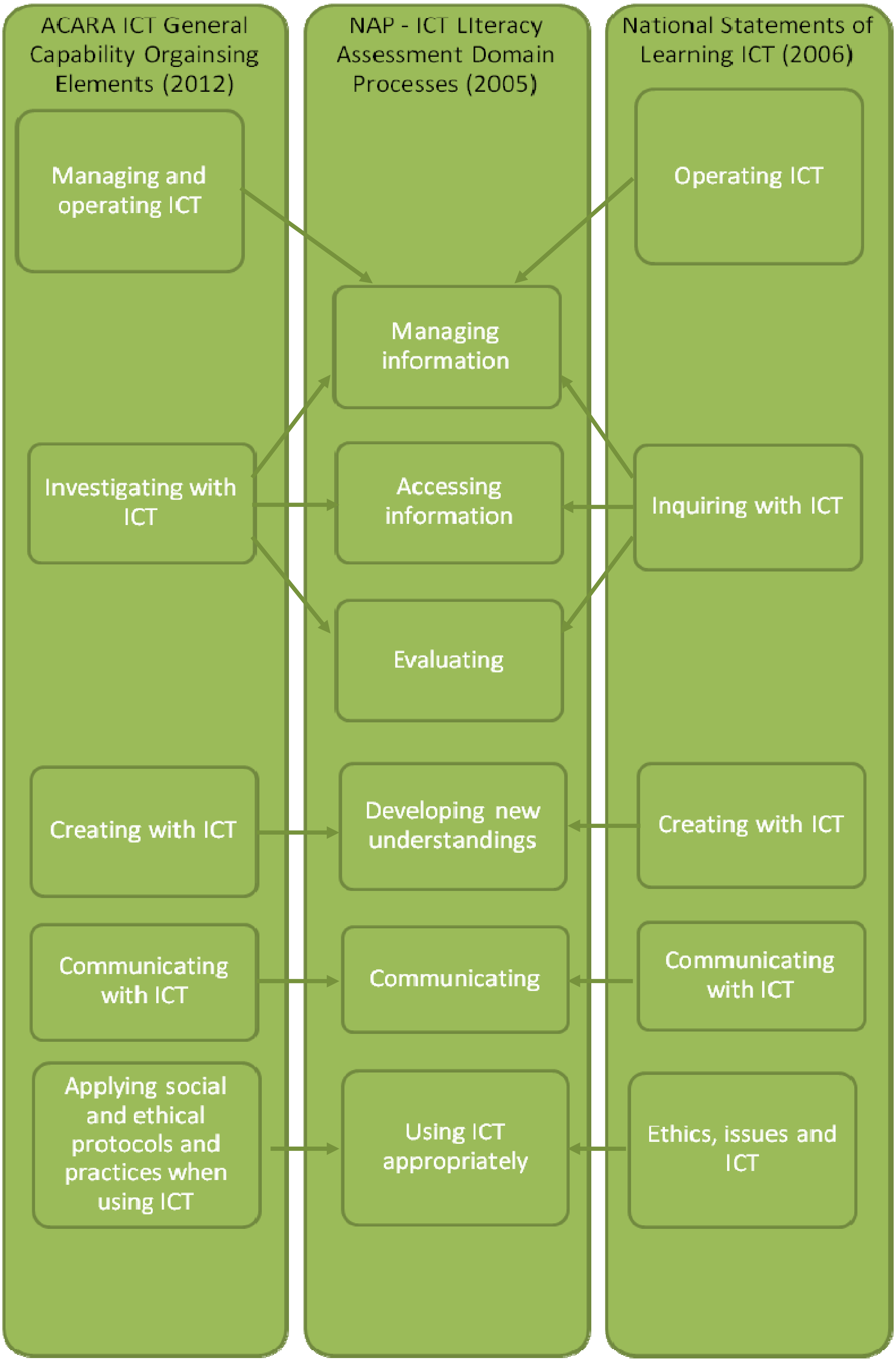
The mapping in Figure 2.1 shows the clear connections between the NAP – ICTL Assessment Domain contents and those of the subsequent frameworks. Three of the NAP – ICTL elements–*developing new understandings*; *communicating*; and *using ICT appropriately*–correspond directly to three elements in each of the Statements of Learning and the Statement of ICT General Capability.

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

The Statement of Learning and the Statement of ICT General Capability each also describe a discrete element relating to operating (and managing) ICT. While there are some differences in the elaborations of these between the two documents, 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 – ICTL Assessment Domain and this has been represented using the dotted line around the elements of the assessment domain shown in Figure 2.1. All the tasks in the NAP – ICTL 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. In the case of the NAP – ICTL Assessment Domain, the inclusion of an overarching element relating to operational use would be redundant because of the nature of the assessment program whereas in the Statement of Learning and the Statement of ICT General Capability it is of course an essential component to inform curriculum.

In summary, the elements of ICT learning specified in the Statement of ICT General Capability and the Statements of Learning were consistent with the elements for assessment described in the NAP – ICTL Assessment Domain. Differences of structure across the documents reflect their different primary purposes to inform assessment (in the case of the assessment domain) or curriculum (in the case of the Statements of Learning for ICT and the statement of ICT Capability). The newly developed NAP – ICTL assessment modules in 2011 were developed with explicit reference to the NAP – ICTL Assessment Domain and were informed by the contents of the more recently developed Statement of ICT General Capability and the Statements of Learning.

Figure 2.1: Mapping of NAP - ICT literacy Assessment Domain, Statements of Learning and ICT General Capability



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 a student questionnaire. In 2011 this was delivered to students using USB sticks (one per student). The testing software itself was entirely web-based and could be delivered using the internet. The USB delivery method was employed to account for variations in school-based internet connectivity and computing resources which meant that internet delivery of the instruments could not guarantee that each student would have an equivalent test-taking experience[1]. The lack of dependence on internet delivery also allowed for multimedia video to be included in the test instrument (by removing concerns over connection speeds) and minimised the setup required at schools (e.g. through network security and installation of uniform browser types). Laptop computers were taken to schools with computing facilities that were unsuitable for use in the testing. In these cases, the assessments were delivered using the same USB sticks plugged into the laptop computers (i.e. the delivery system was identical regardless of whether school computers or externally provided laptop computers were used in the testing).

A different back-end delivery software system has been used in each of the three cycles of NAP – ICTL. Despite this, the on-screen environment experienced by the student has remained consistent throughout. 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.

Below is a summary of the test sessions completed by students. The randomised module allocation, maximum time allowance and module sequencing was 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.

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

[1] NAP – ICTL data requires students to have the same test-taking experiences (speed, screen display, time allowed etc.) to enable the data to be used for comparing student achievement within and across the assessment cycles.

Instrument development

Four of the modules from NAP – ICTL 2008 (*trend* modules) were included in the 2011 field trial instrument. The intention of this was to select the best modules to include in the 2011 main survey instrument for the purpose of equating the 2011 data to the common scale of 2008 and 2005. One of these modules, the *General Skills*, included only simulation and multiple-choice assessment items in NAP – ICTL 2005 and 2008 and was easier and shorter (15 minutes rather than 20 minutes) than the other modules. As part of test development for NAP – ICTL 2011 a small set of additional items was developed to be placed at the end of the *General Skills* module in order to increase the overall difficulty of the module, and to increase its length to be consistent with the other assessment modules.

The other three trend modules included for use in the field trial were *DVD Day* (2005 & 2008), *Sports Picnic* (2008) and *Friend's PC* (2008). These modules incorporated conventional simulation, multiple-choice and constructed response items with live application software.

Four new modules were developed for use in NAP – ICTL 2011. The tasks and items in these modules were designed to maintain the requisite content coverage specified in the assessment domain and to make use of software contexts that reflect changes in software since 2008. The content and contexts of the new modules were determined in consultation with the NAP – ICTL Review Committee. The four new modules were as follows:

- In the *Saving Electricity* module (Years 6 & 10) students were assigned a school project that required them to raise awareness about saving electricity. They first researched the topic from given web resources and then used their research as the basis for creating an original information video. They created the video by editing given video clips and adding their own text and effects with the purpose of encouraging and educating others about how to save electricity.
- In the *Wiki Builder* module (Years 6 & 10) students were given the task of updating the wiki page of a local sports club. They received content by email to be included in and edit the wiki. They edited and formatted existing information, and added new information and functions to the wiki.
- In the *Language Preservation* module (Year 10 only) students participated in a national project to help preserve Indigenous Australian languages. They were assigned several tasks in a collaborative workspace to collect and edit information on a specific Indigenous Australian language. Students then used collaboration software to schedule a meeting with other students working on the project according to given parameters.
- In the *Art Show* module (designed for use at Years 6 & 10) students were given the role as manager of the part of their school's website that promotes their school's art show. They downloaded and managed images from a camera, managed communication through a webmail account and then edited and added content to the website according to a given set of instructions.

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

Software simulation 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 only of the final attempt 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.

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 (polytomous) 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 and 2008 NAP – ICTL 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. In NAP – ICTL 2011, all student demographic information was to be collected from schools (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 questionnaire included some identical questions to those used in previous cycles of NAP – ICTL, some questions that were the same as those previous cycles but with different (but compatible) response categories (for example, in 2011 there was finer-grained detail regarding the amount of time students spent using computers than in previous cycles) and 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.

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 2008 by 1513 students in 82 schools (41 Year 6 schools and 41 Year 10 schools). The field trial was conducted in New South Wales (20 schools), South Australia (20 schools), Victoria (20 schools), Western Australia (20 schools) and the Northern Territory (2 schools). The initial field trial plan comprised 80 schools with 16 schools sampled from each of New South Wales, South Australia, Victoria, Western Australia and Queensland. Because of the effects of floods in Queensland in Summer 2010/2011 it was decided not to conduct the field trial in Queensland and the number of schools in the other participating states was increased accordingly. Technical trials of the technology were conducted at a later date (June) with classes of students in Queensland schools to ensure that the delivery system operated satisfactorily. Two schools from the Northern Territory were added to the field trial sample because of acknowledged differences in context of ICT literacy teaching and learning in the Northern Territory to the other participating jurisdictions.

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 field trial test instrument included four trend modules with the expectation of reducing this to three for the main survey. Based on the field trial test data it was decided to exclude one trend test module—DVD Day—from the main survey instrument. It was also decided that the *Art Show* module (a new module) was too difficult for the majority of Year 6 students and should only be administered to Year 10 students in the main survey.

Overall the field operations and data collected from the field trial suggested that the test instrument, scoring guides and scoring procedures, the student questionnaire and field operations procedures had been successful and would form a solid foundation for the

2011 main survey. There were a number of small changes made to different aspects of the instruments, guides and procedures as a result of the field trial experience, such as the addition of examples of student performance and some clarification of wording in the scoring guides, and refinements of the test administration login system to make it faster for test administrators to enter student details.

Table 2.1: Main aspects of NAP-ICT field trial

Component	Aspect	Data considered
School Contact	(1) School infrastructure and capacity to manage USB-based 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. 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 reports were obtained from Test Administrators
Administration Documentation	Test Administrator training 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 2011 was based on a definition that emphasised accessing, managing, integrating 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 been that it is designed as an authentic performance assessment. The assessment instrument was designed to mirror students' typical 'real world' use 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. Each module 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 2011 the tests were administered on computers using self-contained software on USB sticks. Despite this change in the delivery technology, the format of the ICT literacy assessment in 2011was the same as in 2008 and 2005 in that the appearance of material was identical and the method of responding to tasks and saving information products was exactly the same. The assessment instrument used in the 2011 field trial was linked to that used in 2008 and 2005 by the inclusion of four trend modules that had been used in 2008 (two of which were also used in 2005). The assessment in 2011 included four new modules designed to maintain the requisite content coverage specified in the assessment domain and to make use of software contexts that reflect changes in software since 2008. The content and contexts of the new modules were determined in consultation with the NAP – ICTL Review Committee. The student questionnaire was expanded to include more detail of student perceptions of using ICT than had been collected in previous cycles of NAP – ICTL.

Overall the field operations and data collected from the field trial suggested that the test instrument, scoring guides and scoring procedures, the student questionnaire and field operations procedures had been successful and would form a solid foundation for the 2011 main survey. As had been planned, analyses of information collected in the field trial informed refinements to the instruments and operations procedures for the main survey.

CHAPTER 3:
SAMPLING AND WEIGHTING

Eveline Gebhardt & Martin Murphy

This chapter describes the NAP – ICTL 2011 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 2011, 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). Te first stage consists of a sample of schools, stratified according to state, sector, geographic location, the Socio-Economic Indexes for Areas (SEIFA) index of Education and Occupation[2] and school size; the second stage consists 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

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

School exclusions

Schools excluded from the target population included: 'non-mainstream schools' (such as schools for students with intellectual disabilities or hospital schools), schools listed as having fewer than five students in the target year levels and very remote schools (except in the Northern Territory). These exclusions account for 1.8 per cent of the Year 6 student population and 1.3 per cent of the Year 10 student population.

The decision to include very remote schools in the Northern Territory sample for 2011 was made on the basis that very remote schools constituted over 20 per cent of the Year 6 population and over 10 per cent of the Year 10 population in the Northern Territory (in contrast to less than one per cent when considering the total population of Australia). The same procedure was used for the 2008 survey. The inclusion of very remote schools in the

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

Northern Territory in the NAP – ICTL 2011 sample does not have any 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 determined that would 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 times the population standard deviation for estimated means for 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[3] 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 relative 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.

In a complex, multi-stage sample such as the one selected for this study, the students selected within schools tend to be more alike than students selected across schools. The effect of the complex sample design (for a given assessment) is known as the design effect. The value of the design effect for the NAP – ICTL 2011 sample was estimated for planning the sample design on the basis of data from NAP – ICTL 2008.

The actual sample sizes required for each state and territory were estimated by multiplying the desired effective sample size by the estimated design effect (Kish, 1965, p. 162). The process of estimating the design effect for NAP – ICTL 2011 and the consequent calculation of the actual sample size required is described below.

Any within-school homogeneity reduces the effective sample size. This homogeneity can be measured with the intra-class correlation, ρ, which reflects the proportion of the total variance of a characteristic in the population that is accounted for by clusters (schools). Knowing the size of ρ and the size of each cluster's sample size b, the design effect for an estimate of a mean or percentage for a given characteristic y can be approximated using

$$deff(y) = 1 + (b - 1)\rho$$

Achievement data from NAP – ICTL 2008 were used to estimate the size of the intra-class correlation. The intra-class correlations for a design with one classroom per school were estimated at 0.23 and 0.26 for Year 6 and Year 10 respectively. The average cluster sample size was estimated as 18 from the 2008 survey, leading to design effects of approximately 4.9 for Year 6 and 5.5 for Year 10. Target sample sizes were then calculated by multiplying the desired effective sample size by the estimated design effect. Target sample sizes of around 900 students at both year levels were determined as sufficient for larger states.

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

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

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

	Year 6			Year 10		
	Enrolment	School in population	Schools in sample	Enrolment	School in population	Schools in sample
ACT	4628	93	20	4802	35	20
New South Wales	85945	2104	50	84888	783	50
Northern Territory	3095	113	20	2456	44	15
Queensland	56185	1147	50	58585	448	50
South Australia	18781	552	45	19738	194	50
Tasmania	6283	211	40	6593	86	35
Victoria	64391	1675	50	66922	566	50
Western Australia	27271	713	45	28815	242	50
Australia	266579	6608	320	272799	2398	320

First sampling stage

Stratification by state, sector and small schools was explicit, which means that separate samples were drawn for each sector within states and territories. Stratification by geographic location, SEIFA and school size was implicit, which means that 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 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.

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

On the basis of an analysis of small schools (schools with 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 below) was slightly larger than the designed sample (see Table 3.1 above). 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. Because of the use of stratification, the replacement schools were generally similar (with respect to geographic location, socio-economic location and size) to the school for which they were 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. Some students were excluded from being sampled.

Student exclusions

Within the group of sampled students, individual students were eligible to be exempted 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 2011 assessment, according to the reason given for their exclusion. The number of student-level exclusions was 377 at Year 6 and 1152 at Year 10. This brought the final exclusion rate (combining school and student exclusions) to 2.1 per cent of the total number of Year 6 students in sampled schools and 2.2 per cent of Year 10 students in sampled schools.

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 all students in Year 6
ACT	4	17	13	34	3.0%
New South Wales	10	17	3	30	1.0%
Northern Territory	0	2	18	20	2.7%
Queensland	49	44	22	115	3.0%
South Australia	24	19	13	56	2.5%
Tasmania	5	9	9	23	1.2%
Victoria	15	19	23	57	2.1%
Western Australia	16	11	15	42	1.7%
Australia	123	138	116	377	2.1%

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 all students in Year 10
ACT	24	27	28	79	2.2%
New South Wales	25	48	91	164	2.2%
Northern Territory	3	6	4	13	0.7%
Queensland	41	103	107	251	2.5%
South Australia	18	77	99	194	2.6%
Tasmania	41	26	60	127	2.9%
Victoria	62	24	113	199	2.4%
Western Australia	26	30	69	125	1.4%
Australia	240	341	571	1152	2.2%

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*)[4] 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 selected with certainty into the sample.)

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

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

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

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

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

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

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

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

In the case of a non-responding school (n_n^{sc}), neither the originally sampled school nor its replacements participated.

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

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

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

4 In practice the measure of size is the number of students enrolled in Year 6, or Year 10, in the school.

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

Second stage weight

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

- the total number of eligible students at relevant year level (n^{st})
- the number of students that participated (n_p^{st})
- the number of sampled students that were exclusions (n_x^{st})
- the number of non-responding, sampled students (n_n^{st}).

Note that $n_p^{st} + n_x^{st} + n_n^{st}$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. This was computed as

$$\mathrm{BW}_{st} = \frac{n^{st} - n_x^{st}}{n_p^{st} + n_n^{st}}$$

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

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

The final student weight was

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

Overall sampling weight and trimming

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

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

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 no outliers in the data, so no weights needed to be trimmed.

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, 2008).

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

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

where i indicates a school, $s + r1 + r2$ all responding schools, j a student and r_i the responding students in school i. First, the sum of the responding students' FW was computed within schools. 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

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

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

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

Weighted response rates excluding replacement schools

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

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

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

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

Reported response rates

The Australian school participation rate in Year 6 was 91 per cent including replacement schools and 89 per cent excluding replacement school. In Year 10, the respective percentages were 85 and 83 per cent. These are the unweighted response rates and are very similar to the weighted response rates.

When including replacement schools, the lowest unweighted school participation rates were recorded in the Northern Territory (86% in Year 6 and 87% 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% 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	0.90	1.00	0.90	0.90	1.00	0.90	0.90	1.00	0.90	0.90	1.00	0.90
New South Wales	0.92	1.00	0.92	0.92	1.00	0.92	0.92	1.00	0.92	0.92	1.00	0.92
Northern Territory	0.76	0.86	0.88	0.76	0.86	0.88	0.69	0.86	0.81	0.69	0.86	0.81
Queensland	0.93	1.00	0.93	0.93	1.00	0.93	0.92	1.00	0.92	0.92	1.00	0.92
South Australia	0.91	1.00	0.91	0.91	1.00	0.91	0.88	1.00	0.88	0.88	1.00	0.88
Tasmania	0.91	1.00	0.91	0.87	0.95	0.92	0.92	1.00	0.92	0.86	0.94	0.91
Victoria	0.92	1.00	0.92	0.87	0.94	0.92	0.92	1.00	0.92	0.86	0.94	0.92
Western Australia	0.92	1.00	0.92	0.90	0.98	0.91	0.91	1.00	0.91	0.89	0.98	0.91
Australia	0.91	0.99	0.92	0.89	0.97	0.91	0.91	1.00	0.91	0.90	0.98	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	0.84	0.95	0.88	0.84	0.95	0.88	0.83	0.95	0.87	0.83	0.95	0.87
New South Wales	0.86	1.00	0.86	0.78	0.90	0.87	0.85	1.00	0.85	0.77	0.89	0.87
Northern Territory	0.71	0.87	0.82	0.71	0.87	0.82	0.71	0.84	0.84	0.71	0.84	0.84
Queensland	0.88	1.00	0.88	0.86	0.98	0.88	0.86	1.00	0.86	0.85	0.97	0.87
South Australia	0.81	0.98	0.83	0.80	0.96	0.83	0.78	0.98	0.80	0.77	0.95	0.80
Tasmania	0.84	1.00	0.84	0.82	0.97	0.85	0.83	1.00	0.83	0.81	0.96	0.84
Victoria	0.89	1.00	0.89	0.84	0.94	0.89	0.88	1.00	0.88	0.83	0.93	0.89
Western Australia	0.89	1.00	0.89	0.87	0.98	0.89	0.88	1.00	0.88	0.86	0.98	0.88
Australia	0.85	0.99	0.86	0.83	0.95	0.87	0.86	1.00	0.86	0.81	0.93	0.87

CHAPTER 4:
DATA COLLECTION PROCEDURES

Kate O'Malley and Chris Freeman

Well-organised and high quality data collection procedures are crucial to ensuring that the resulting data were also of high quality. This chapter details the data collection procedures used in NAP – ICTL 2011.

The data collection phase for NAP – ICTL 2011 contained a number of steps that were undertaken by ACER and by the participating schools. These are listed in order in Table 4.1 and are further described in this chapter.

Table 4.1: Procedures for data collection

ACER Activity	School Activity
Contact is made with sample schools; registration details are requested	Complete registration details (principal name, school contact officer nomination etc)
Student List for Year 6 or Year 10 students requested	Upload requested information to the School Administration website
Computer resource information (including USB test for computer resource capabilities) requested	Inform ACER of computer resource availability (including USB test information) via the School Administration website
Test delivery method for each school and mini-lab schedule 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 artefact based tasks are scored	
Summary reports sent to schools (both in soft-copy and hard-copy)	Download summary reports from School Administration website

Contact with schools

The field administration of NAP – ICTL 2011 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 to inform them of their selection. If the sampled school was unable to take part (as confirmed by an education authority liaison officer), the replacement school was contacted.
- The initial approach to the principals of sampled schools included a request to nominate a school contact officer, who would coordinate the assessment in the school.
- Following their nomination, school contact officers were sent the *School contact officer's manual* and were asked to provide information about the computer resources at their school by running the test program from an accompanying USB stick. They were also 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.
- ACER test administrators then liaised with each school contact officer so as to confirm the time of assessment, and to discuss any special provisions needed for the assessment day (e.g. the creation of school computer logins with the necessary access rights).
- 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, further 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 definite timeframe was provided for the provision of this information. If the school did not respond in the designated timeframe, follow-up contact was made via fax, email and telephone.

The NAP – ICTL Online School Administration Website

In 2011, all information provided by schools was submitted to ACER via a secure website. The NAP – ICTL Online School Administration Website was designed to ease the administration burden on the selected schools, and provided a convenient, intuitive and secure repository for all school data relating to the NAP – ICTL assessment. In addition to a homepage which contained all the latest news, documents and information about the assessment, the website comprised the following web pages.

- The *School details* page. This page was used to collect information about the computer resources at each school and provided instructions on how to run the test program from the USB stick mailed to each school contact officer;
- The *Assessment date* page. This page asked the school contact officer to nominate three possible dates for the assessment to take place that were convenient for the school. The final date chosen by ACER was then displayed on this page for the school's reference;
- The *Cohort list* page. This page contained a downloadable student listing template, which enabled the school contact officer to complete and upload the list

of students in the designated year level (together with students' gender and exemption status), so that ACER could draw a random student sample for the cohort; and

- The *Student background* page. This page provided a downloadable template for school contact officers to complete and upload the background information for the sampled students.

Collection of student background information

In 2004, Australian Education Ministers agreed to implement standard definitions for student background characteristics (detailed in the 2010 Data Standards Manual (MCEECDYA, 2009)), to collect student background information from parents and to supply the resulting information to testing agents so that it can be linked to students' test results. The information collected included: sex, date of birth, country of birth, Indigenous status, parents' school education, parents' non-school education, parents' occupation group, and 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 2010 Data Standards Manual (MCEECDYA, 2009). For NAP – ICTL 2011, student background data were collected in one of two ways: either from the education authorities in each jurisdiction, or else from the schools themselves, Where possible, education authorities from each jurisdiction undertook to supply this 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 paste the relevant background details for each sampled student. This template was then uploaded by each school onto the NAP – ICTL Online School Administration Website.

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 and 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 student background information, responses to test items, achievement scale scores, responses to student questionnaire items, attitude scale scores, final student weights and replicate weights so as to confirm the quality and completeness of student and school data.

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

Within-school procedures

As the NAP – ICTL 2011 assessment took place within schools, during school hours, the participation of school staff in the organisation and administration of the assessment was an essential part of the field administration. This section outlines the key roles within schools.

The school contact officer

Participating schools were asked to appoint a school contact officer to coordinate the assessment within the school. Each school contact officer was provided with a manual (the *School contact officer's manual*) that 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 computer resources, preferred assessment dates, student cohort list and, if applicable, student background data for the selected students
- scheduling the assessment and booking a room – with an appropriate number of co-located computers with power supply equipment – for the assessment sessions
- notifying teachers, students and parents about the assessment, according to their school's policies
- checking that all of the computers to be used in the assessment were working in the week before the assessment
- assisting the test administrator with final arrangements on the assessment day (this did not involve assessment administration).

The test administrator

In total, 52 test administrators were employed nationally to administer the tests at all 648 standard delivery schools. Test administrators were trained at one of a series of test administrator training sessions which took place in Tasmania, Victoria, New South Wales, Queensland, South Australia and Western Australia. Test administrators from the ACT and the Northern Territory commuted to sessions in neighbouring states.

In addition to their training sessions, test administrators were given a manual which provided detailed instructions on both technical and procedural matters. Test administrators were also supported via email and telephone (toll-free help line) prior to, and for the duration of, the assessment period.

The primary responsibility of the test administrator was to administer NAP – ICTL 2011 to the sampled students, according to the standardised administration procedures provided in the *Test administrator's manual*. The test administrators' responsibilities included:

- liaising with the school contact officer at each of their assigned schools before the assessment day in order to confirm the assessment date and time, the list of selected students, and the assessment delivery method
- administering the test and the questionnaire in accordance with the instructions in the manual

- ensuring that students received a uniform testing experience and that the exact contents and meaning of each of the test administrator scripts was conveyed to each set of students
- recording student participation and any school-specific assessment issues via the *Test administrator web portal*
- ensuring that every student test file was uploaded to the ACER server after each testing session, and to back up these files on a weekly basis.

The test administrator web portal

In 2011, 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 the 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 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 which students did not take part in the assessment, and for what reason, and also enabled them to enter any 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, and they were encouraged to use it as much as possible throughout the administration of NAP – ICTL 2011.

Return visits to schools

Test administrators were obliged to return to a total of 52 schools. The reasons for these return visits could largely be summarised as either:

- fewer than 80 per cent of sampled students were available on the day of assessment (due to illness or other unexpected absenteeism); or
- school contacts officers failed to provide ACER with the correct computer resource information, and test administrators needed to return with mini-lab.

Assessment administration

Schools were allowed to schedule the assessment on a day that suited them within the official assessment period. In 2011, the assessment period for each jurisdiction was as follows:

- between 17 October and 18 November 2011 for schools in New South Wales and Victoria
- between 10 October and 11 November 2011 for schools in Queensland
- between 24 October and 18 November 2011 for schools in the ACT, South Australia and Western Australia
- between 26 September and 21 October 2011 for schools in Tasmania
- between 17 October and 4 November 2011 for schools in the Northern Territory.

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 so as 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 fit with known teaching patterns with the intent of allowing for minimal disruption to the school and pupil classroom attendance 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	Comment
Introductory Tutorial	10 minutes	Students complete the tutorial on computer to familiarise themselves with the assessment
Module 1	20 minutes	Students complete the first module on computer
Break	5 minutes	
Module 2	20 minutes	Students complete the second module on computer
Break	5 minutes	
Module 3	20 minutes	Students complete the third module on computer
Break	5 minutes	
Module 4	20 minutes	Students complete the fourth module on computer
Break	5 minutes	
Student Questionnaire	10 minutes	Students complete a survey regarding their access to, familiarity with, and interest in using computers

Mini-lab use

In order to determine which schools would require the use of a mini-lab, the school contact officer at each school was asked to perform a compatibility test on at least one computer expected to be used to run the assessment software on the scheduled assessment day. This process was referred to as *Task 1* in the *School contact manual* and required the school contact officer to run the compatibility software (which was given to them on a USB stick) on the intended assessment computers, and using a computer login that would be used on the day. The task essentially checked five things:

- that the USB port on the computer was enabled
- that an executable (.exe) file could be run from a USB drive
- that the computer had Java installed
- that the computer had Flash installed
- that the screen resolution on the computer was sufficient to run the software.

In schools whose computer resources did not meet the minimum requirements needed to run the assessment software, ACER-supplied laptops were used to run the assessment. This was known as the *mini-lab* option. Each mini-lab contained 10 laptop computers, and the assessment was generally delivered in two sessions of 10 students in these schools.

Data capture and back up

As outlined previously, the assessment was administered in all 648 standard delivery schools by an ACER-trained test administrator. After the administration of the assessment at a school, each USB stick that was used at the school was checked for viruses and the student session data were uploaded to the ACER server via the internet. At the conclusion of each week, test administrator would back-up the data stored on each USB stick to their laptops, so that each data file would be stored in three separate places, namely: the USB stick, the server (after upload), and the laptop (after backup). This backup system ensured that data were not lost due to any potential deficiency in any one of the storage devices.

Potential viruses were detected on USB sticks used in only six schools. In all cases, the sticks were removed from circulation (test administrators were then provided with replacement sticks), and the schools were notified that potential viruses had been found. It is, however, important to reiterate that these were potential viruses only, and all instances may have been examples of non-malicious content.

Flexible delivery

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

- the school contact officer administering the assessment instead of an external test administrator (ACER funded two teacher relief days for each flexible delivery school so that teachers could make use of additional assistance over the assessment period)
- administering the assessment to groups of students, or to individuals, when it was possible and appropriate (as opposed to one scheduled assessment)
- reducing the number of modules to be completed by each student from four to three and targeting those to less difficult modules
- removing the timer from the application to allow students additional time to complete the tasks
- being able to read out the instructions and questions to the students.

These provisions aimed to improve the quality and representativeness of data from the very remote schools sampled in NAP – ICTL, and therefore provided a more representative picture of the achievements of Australian students in ICT literacy.

Online marking procedures and marker training

The marking of both the trial and final survey assessment items 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 15 markers to score the ICTL student responses over a two week period in November 2011. The same markers from the field trial and previous cycles of the assessment were used for the main study marking operation. This assisted in maintaining the consistency of the application of the 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 so as to cover the complete range of student responses for that item. These pre-selected responses were given a score by the marking supervisor and, 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, 117,886 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 remarked. This in turn improved the quality of the data used in school and public reports.

School reports

Following data entry and cleaning (see Chapter 5), two bespoke reports of school and student performance were generated and sent to each participating school.

The school summary report provided each school with their overall percent-correct figure for each item, by item set. The average percentage correct for the entire sample of schools, for each item, was also presented for comparative purposes. Schools were advised to read this report in conjunction with the *School report descriptor sheet* provided in Appendix 2. For all items that had a maximum score of two or above, the descriptor sheet outlined the skills needed to obtain additional marks for this item.

The school student report 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 (four item sets were assigned to each student), each item set contained results from a subset of students from each school.

Schools were able to download their reports from the secure *School administration website* (using a school-specific username and password) in December 2011. These reports were also printed and sent out to schools in hard copy at this time. An example of the school summary report and school student report can be found in Appendix 3.

CHAPTER 5: DATA MANAGEMENT

Kate O'Malley and Eveline Gebhardt

As mentioned in Chapter 4, one central, secure database was created to track schools and students in NAP – ICTL 2011. The integrity and accuracy of the information contained in this database was central 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 concatenation of 1-digit codes relating to cohort, state and sector as well as a unique school number. The *student ID* included the school ID and also a student number (unique within each 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. After the 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 largely derived from the sample data, and contained information about all participating schools. These data related to 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 three sources: the cognitive assessment data and student questionnaire data; the student background data and student participation data obtained from the student tracking database; and school level variables transferred from the sample database. In addition to these variables, student weights and replicate weights were computed and added to the database.

Data capture

Student cognitive and questionnaire data were captured on USB sticks at the time of assessment by test administrators. Each individual USB stick had the capacity to store data from approximately 175 students but was used to administer the assessment to no more than 50 students.

After each assessment session, these data were uploaded by test administrators to a central ACER server. Test administrators were also expected to back up these student data files to their ACER-supplied laptops on a weekly basis. This meant that each data file would be stored in three separate places, namely: the USB stick, the server (after upload), and the laptop (after backup). This backup system ensured that data were not lost due to any potential deficiency in any one of the storage devices.

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 (four students).
- 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 nine to 13 years in Year 6 and from 13 to 18 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 conducted by the spreadsheet which rendered dates of birth illegible was reversed and corrected.

Student background data

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

Table 5.1: Variable definitions for student background data

Category	Description	Codes
Sex	Sex of student	1 = male 2 = 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 a 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 2
Parent Non-School Education	The highest qualification attained by a parent/guardian in any area of study other than school education.	5 = Certificate I to IV (including Trade Certificate) 6 = Advanced Diploma/Diploma 7 = Bachelor Degree or above 8 = No non-school qualification 0 = Not stated/unknown/Does not have Parent 2
Parent Occupation Group	The occupation group which includes the main work undertaken by the 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 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 2010 Data Standards Manual (MCEECDYA, 2009). 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
Geolocation - 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 if response was 'yes' to Aboriginal, OR Torres Strait Islander OR Both.
Country of Birth	COB	The reporting variable (COB) was coded as 'Australia' (1) or 'Not Australia' (2) 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' (2). 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, 105 items were used for scaling, of which 60 were used for both year levels, 9 for only Year 6 students and 36 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** was used for *embedded missing* responses, code **r** was used 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 described in the assessment framework. The content of the constructs are described in Table 5.3 and the questionnaire is provided in Appendix 1. Seventeen 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 two or three original items. The index *years of experience* was derived by recoding Q01 into units of years. *Number of computers at home* was the sum of the number of desktop computers and laptops, 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 the 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 **9999**.

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
EXPERNC	Years of experience	Q01	1	1,2,3,4	1,2,4,6	Recode
NUMCOMP	Number of computers	Q02a+b	2	0-12	0,1,2,3+	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
USEHOME	Frequency of use at home	Q04a	1	1,2,3,4,5	4,3,2,1,0	Recode
USESCHL	Frequency of use at school	Q04b	1	1,2,3,4,5	4,3,2,1,0	Recode
INTEREST	Interest and enjoyment	Q05	5	1,2,3,4	3,2,1,0	Scale
STUDYH	Frequency study utilities - Home	Q06*1	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
STUDYS	Frequency study utilities - School	Q06*2	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
ENTERTH	Frequency entertainment- Home	Q07*1	4	1,2,3,4,5,6	5,4,3,2,1,0	Scale
ENTERTS	Frequency entertainment - School	Q07*2	4	1,2,3,4,5,6	5,4,3,2,1,0	Scale
COMMH	Frequency communication - Home	Q08*1	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
COMMS	Frequency communication - School	Q08*2	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
TECHH	Frequency technological tasks - Home	Q09*1	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
TECHS	Frequency technological tasks - School	Q09*2	5	1,2,3,4,5,6	5,4,3,2,1,0	Scale
EFFICACY	Self-efficacy	Q10	8	1,2,3,4	3,2,1,0	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

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 different scales were constructed based on the questionnaire items.

The scaling model

Test items were scaled using IRT scaling methodology. Using the one-parameter model (Rasch, 1960) in the case of dichotomous items, the probability of selecting a correct response (value of one) instead of an incorrect response (value of zero) is modelled as

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

where $P_i(\theta)$ 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

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

where $P_{xi}(\theta)$ 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.

The analysis of item characteristics and the estimation of model parameters were carried out with the ACER ConQuest software package (Version 2.0 software: see Wu, Adams, Wilson, & Haldane, 2007).

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 121 items in the test, 16 were removed from the scale due to poor fit statistics at both year levels (ASH03, ASH07, ASH09, ASH14, ASH15, FPC02, FPC11, FPC12, GNS02, GNS18, GNS27, LPR04, LPR10, SEL01, SEL04 and SPN17), six were removed at Year 6 (FPC01, FPC07, GNS06, GNS26, SPW03 and SPW04) and nine were removed at Year 10 (FPC01, FPC07, GNS06, GNS26, SPW03, SPW04). 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 significantly higher infit statistic (e.g. infit>1.2 or infit<0.8) 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 sex. Differential item functioning 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 sex may result in bias of performance estimates across gender groups.

The item in this example is presented in Figure 6.1 and advantages boys. The graph shows that at any ability (the horizontal axis) the probability is higher for boys (blue line) than for girls (green line). No items were removed only on the basis of DIF.

Another form of DIF that was used to evaluate the items was year level DIF. Items with substantial year level DIF were removed for one of the year levels and not used as link items between the Year 6 and the Year 10 assessments.

To review measurement equivalence across states and territories for each item, jurisdictional DIF statistics were computed. Test items were calibrated separately for each state and territory and these parameters were then compared with the respective item parameters at the national level. As in previous assessments, item DIF by jurisdictions was generally negligible and did not warrant any item deletions.

Figure 6.1: Example of item that advantages boys

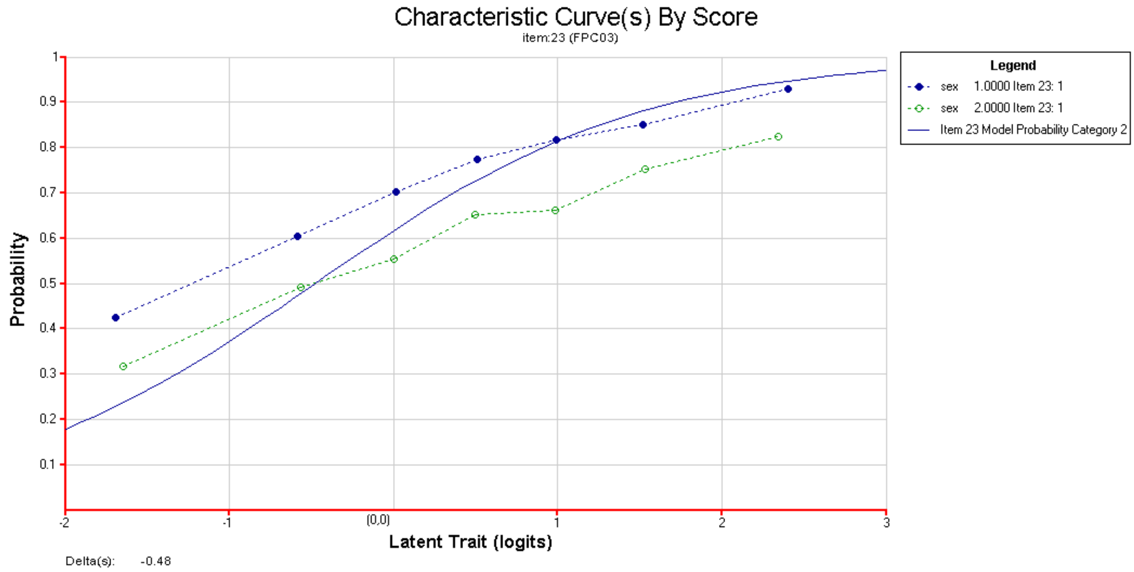


Figure 6.2 shows an example of an item with (significant but small) jurisdictional DIF. The broken, horizontal orange line reflects the difficulty of the item at the national level. The vertical green lines are the confidence intervals of the jurisdictional difficulties. If the green line crosses the orange line, the item difficulty at the jurisdictional level is not significantly different from the national item difficulty. For example, item GNS30 was found to be harder at a jurisdictional than at a national level only in Tasmania. The item DIF for this jurisdiction was not large but statistically significant.

Item calibration

Missing student responses that were likely to be due to problems with test length (not reached items)[5] were omitted from the calibration of item parameters but were treated as incorrect for the scaling of student responses. All other missing responses were included as incorrect responses for the calibration of items (except for the ones that were not administered).

Item parameters were calibrated using all sampled student data, except for students from very remote, flexible delivery schools. These 22 students were only assessed with two modules and no background data was collected. 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 and/or year level DIF, 105 items were deemed as used for scaling, and 60 of these items were common for both Year 6 and Year 10. The difficulties of these 60 link items are plotted in Figure 6.3 with Year 6 estimates on the horizontal axis and Year 10 estimates on the vertical axis. Each set of 60 item difficulties are centred to having a mean of zero for this graph. The solid

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

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: Example of an item with state DIF

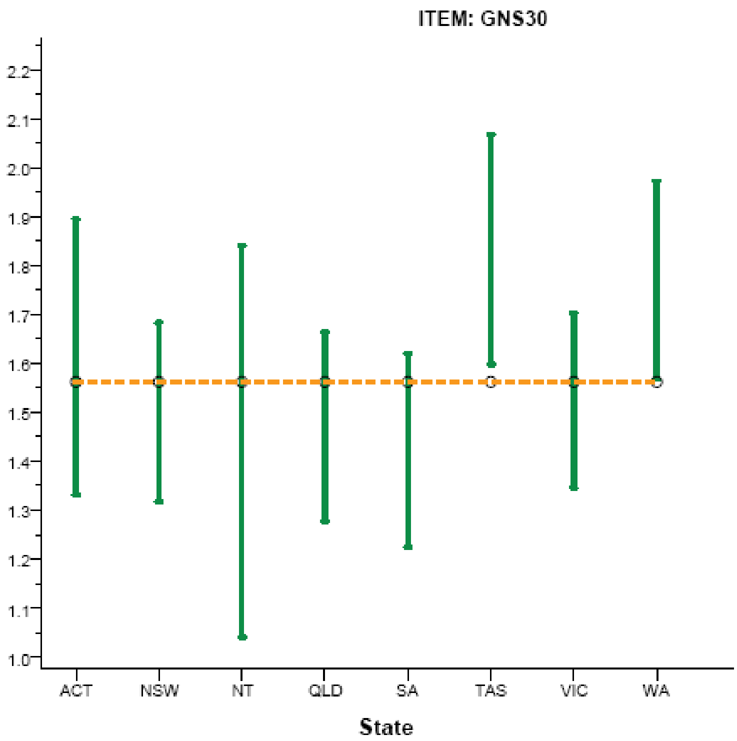
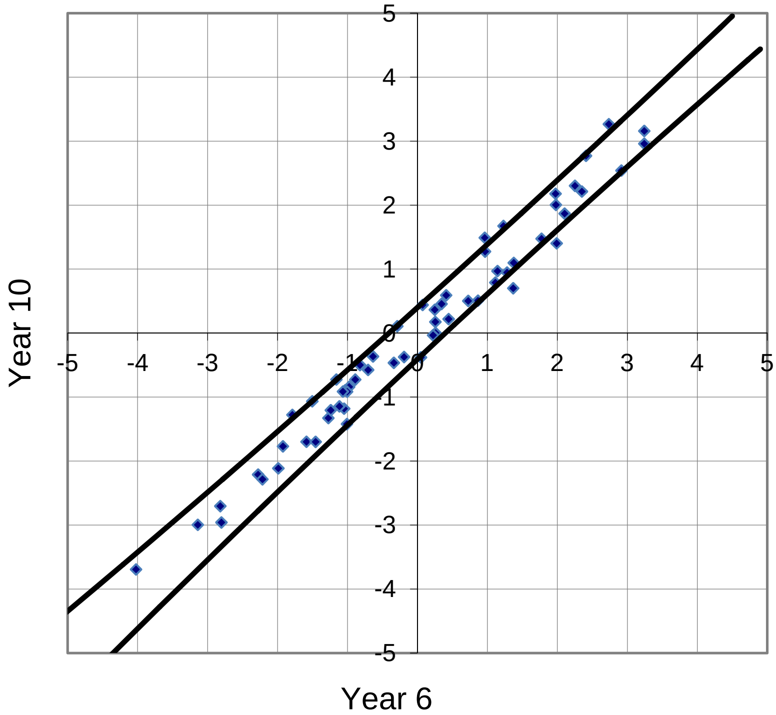


Figure 6.3: Scatter plot of relative item difficulties for Year 6 and Year 10



Only a few of the 60 items fall outside the confidence intervals and showed statistically significant year level DIF. These few items were close to the lines, indicating the confidence interval, and had otherwise satisfactory scaling characteristics. In addition, they constituted only a very small proportion of the 60 link items common at both year levels. Therefore, it was decided to retain them for scaling.

So called item maps for the year levels are presented in Figure 6.4.The crosses represent students, the numbers items and in case of a partial credit item, their threshold. The vertical line is a theoretical 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.

In the second stage, the data of the two year levels were merged and scaled together so that each item only received one final item difficulty. Year level was included in the calibration as a regressor variable to indicate that students came from two different populations.

Appendix 4 shows the item difficulties on the historical scale with a response probability of 0.62 in logits and on the reporting scale. It also shows their 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 and used in previous cycles and could be used as horizontal link items to equate the assessments. To ensure that the link items had the same measurement properties across cycles, their relative difficulties in 2011 and 2008 were compared. Two out of 32 common items showed large DIF between 2008 and 2011 and were not used for equating. For both assessments, this set of link item showed similar average discrimination (item-rest correlation) and the average DIF with respect to sex in both cycles was close to zero (0.02 logits).

Figure 6.5 shows a scatter plot of item difficulties for horizontal link items in 2011 and 2008. 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 2.4, the approximate design effect in 2008. 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).

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 2008 and 2011 values of these discrimination indices are plotted in Figure 6.6.

Figure 6.4: Item maps for Year 6 and Year 10

```
Year 6

          |
          |
          |
          |
          |
          |
          |93.2
          |
          |
          |
          |120.2
          |110
          |91.2 116 120.1
          |119
         X|105
         X|
         X|25.2 67.2 92.2 95 121
        XX|96
       XXX|88.2
      XXXX|67.1 69
      XXXX|48
    XXXXXX|66 92.1
  XXXXXXXX|30 45
  XXXXXXXX|61 68
  XXXXXXXX|29
 XXXXXXXXX|25.1 51 99
XXXXXXXXXX|65 89 91.1
  XXXXXXXX|
 XXXXXXXXX|104 115
 XXXXXXXXX|26 36 106 117 118
 XXXXXXXXX|53 88.1 114
   XXXXXXX|41
   XXXXXXX|24
   XXXXXXX|23 33
   XXXXXXX|
   XXXXXXX|97 98
     XXXXX|52 100
     XXXXX|28 42 60 101 102 103
      XXXX|44 107 111
       XXX|59
      XXXX|37 108
       XXX|35
        XX|49
        XX|34 54 93.1
        XX|47 56
         X|40 62
         X|94
         X|
         X|46 57
          |
          |38 58
         X|
          |
          |
          |
          |
          |50
```

```
Year 10

          |86
          |
          |
          |63 93.2
          |84
          |
         X|91.2
        XX|
        XX|75 120.2
        XX|105
      XXXX|
       XXX|110 120.1
     XXXXX|19.2 95
   XXXXXXX|6
    XXXXXX|16 119
  XXXXXXXX|17 92.2 96 116
  XXXXXXXX|67.2 121
 XXXXXXXXX|20.2 88.2
XXXXXXXXXX|18.2 72
XXXXXXXXXX|68
XXXXXXXXXX|27 48 67.1 82 85 92.1
  XXXXXXXX|69
   XXXXXXX|11.3 12.3 13 77 99 112 113
   XXXXXXX|4 11.2 12.2 19.1 20.1 30
   XXXXXXX|11.1 12.1 21 61 71 76 78
    XXXXXX|18.1 29 45 66 83 91.1
    XXXXXX|10 104
     XXXXX|51 89 106 114
       XXX|115 118
       XXX|8 23 81 117
       XXX|26 36 74 88.1
       XXX|1
        XX|24 53 98
        XX|33 52
         X|97
         X|100 101 107
         X|5 60 102 103
         X|42 44 108
         X|2 49 59 93.1 111
          |28 80
          |70
         X|34 35 37
          |
          |43 54
          |40 56
         X|
          |
          |57
          |
          |38 46
          |50
          |
          |
          |
          |
          |
          |
```

Figure 6.5: Relative item difficulties in logits of horizontal link items between 2008 and 2011

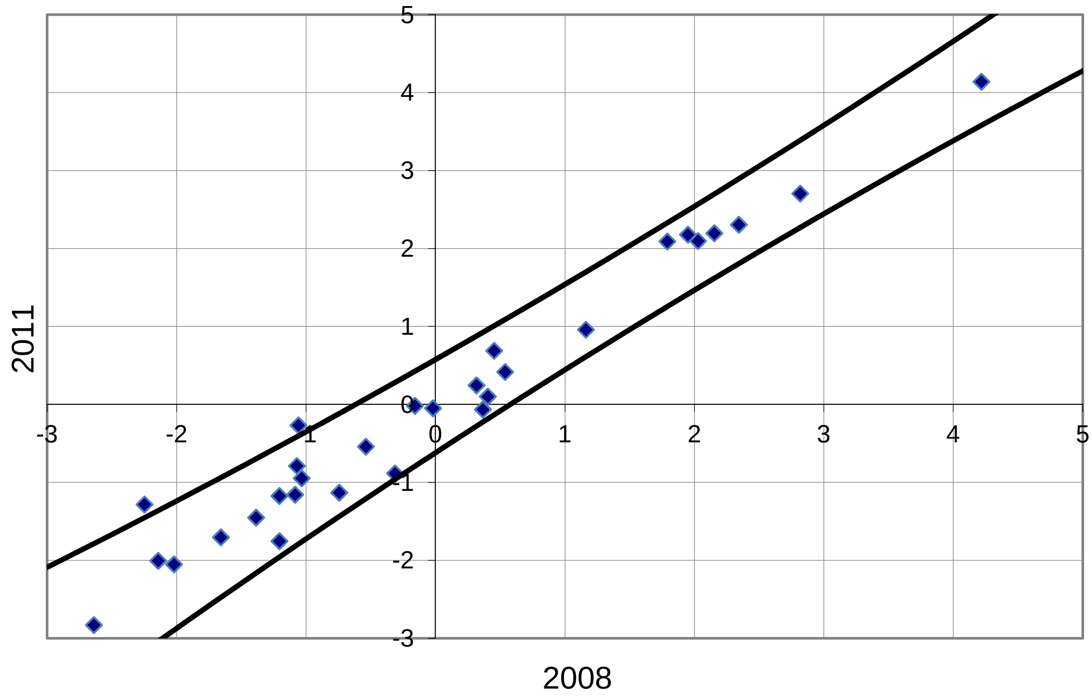
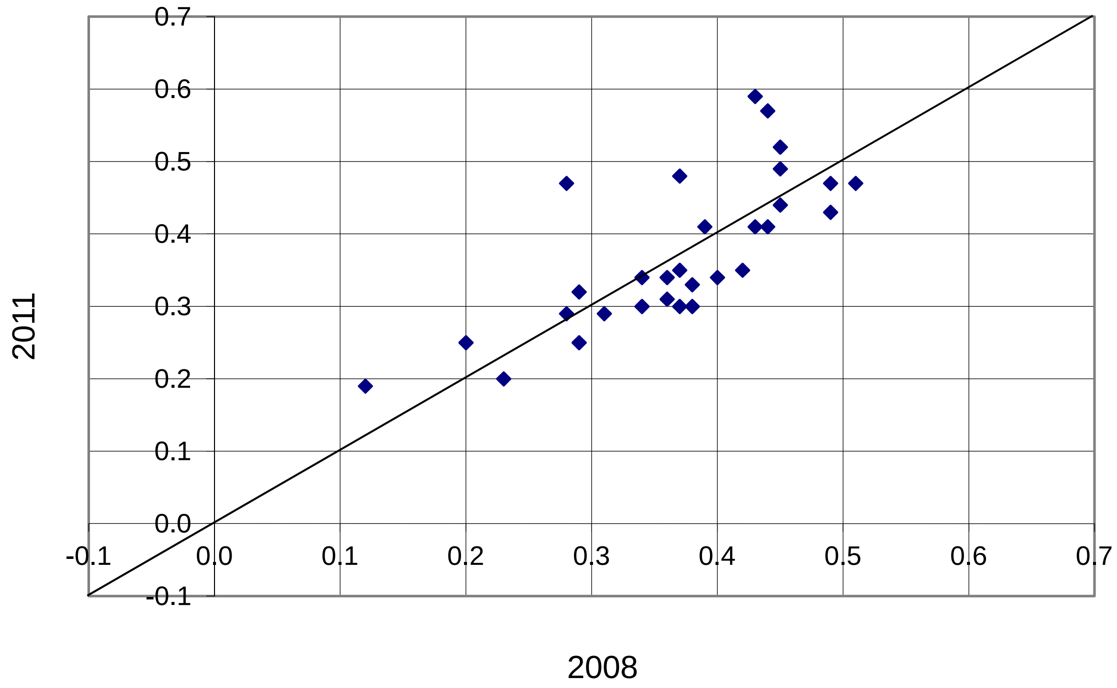


Figure 6.6: Discrimination of link items in 2008 and 2011



After the selection of link items, common item equating was used to shift the 2011 scale onto the historical scale. The value of the shift is the difference in average difficulty of the link items between 2008 and 2011 (0.210). After applying these shifts, the same transformation was applied as in 2008. Original scale scores (logits) were converted as

$$\theta_n^* = \left\{ \left(\theta_n + 0.210 - 0.032 - \overline{\theta}_{05} \right) / \sigma_{05} \right\} \times 100 + 400$$

where θ_n^* is the transformed knowledge estimate for student *n*, θ_n is the original knowledge estimate for student *n* in logits, $\bar{\theta}_{05}$ is the mean ability in logits of the Year 6 students in 2005 (-0.34197) and σ_{05} is the standard deviation in logits of the Year 6 students in 2005 (1.04072).

Uncertainty in the link

The shift that equates the 2011 data with the 2008 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 chosen. As a consequence, there is an uncertainty associated with the equating which is due to the sampling of the link items, similar to the uncertainty associated with the sampling of schools and students.

The uncertainty that results from the selection of a subset of link items is referred to as 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 estimation of the linking error for trend comparisons between the 2011 and the 2008 assessments was computed as follows. 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* (after fixing the average of the link items to zero) in unit *j* for year *y*, and let

$$error_{2008-2011} = \frac{S\left(\hat{\delta}_{ij}^{2011} - \hat{\delta}_{ij}^{2008}\right)}{\sqrt{N}} = 5.712,$$

where S is the standard deviation and N is the number of link items. The equating error between 2005 and 2011 is the sum of the two equating errors between adjacent cycles.

$$error_{2005-2011} = \sqrt{4.300^2 + 5.712^2} = 7.150$$

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 random draws 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 2.0 software was used for drawing plausible values.

Twenty-one 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, and SEIFA levels. 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 5.

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 6, 7, 8 and 9) 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 eight items reflecting confidence (*self-efficacy)* in using ICT (Q10). 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 2.0 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 metric with a mean score of 50 and a standard deviation of 10 for 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 Year 6	Cronbach's alpha Year 10	Correlation with achievement Year 6	Correlation with achievement Year 10
Study utilities at home	STUDYH	Q6.1	5	0.77	0.80	0.06	0.17
Study utilities at school	STUDYS	Q6.2	5	0.73	0.78	-0.06	0.02
Entertainment at home	ENTERH	Q7.1	4	0.74	0.74	0.02	0.15
Entertainment at school	ENTERS	Q7.2	4	0.69	0.77	-0.21	-0.08
Communication at home	COMMH	Q8.1	5	0.82	0.77	0.02	0.06
Communication at school	COMMS	Q8.2	5	0.79	0.82	-0.22	-0.11
Technological tasks at home	TECHH	Q9.1	5	0.77	0.80	-0.08	0.04
Technological tasks at school	TECHS	Q9.2	5	0.78	0.82	-0.24	-0.05
Interest and enjoyment in using ICT	INTEREST	Q5	5	0.75	0.84	0.15	0.19
Self-efficacy in ICT Literacy	EFFICACY	Q10	8	0.82	0.80	0.29	0.28

CHAPTER 7:
PROFICIENCY LEVELS AND THE PROFICIENT STANDARDS

Julian Fraillon

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 measure was the percentage of students in each proficiency level. The second referenced the Proficient Standards which represented points on the NAP – ICTL scale that represented a 'challenging but reasonable' expectation for typical Year 6 and 10 students to have reached by the end of each of those years of study. The measure was the percentage of students who had attained (i.e. reached or exceeded) the Proficient Standard. The proportion of students achieving at or above the Proficient Standard is the national Key Performance Measure for ICT literacy specified in the MCEECDYA Measurement Framework for Schooling in Australia (ACARA, 2011). 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). For PISA, a method was developed 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. This method ensured that there was some common understanding about what *being at a level* meant and that the meaning of *being at a level* was 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 by the PMRT:

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

With these parameters established, the following statements could be made 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 together with a standards setting exercise in which a *Proficient Standard* was established as part of NAP – ICTL 2005 for 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 established as the cut-point between Level 3 and Level 4.

Other solutions with different parameters defining the proficiency levels and alternative inferences about the likely per cent correct on tests could also have been chosen. 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 2011.

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 method of representing progress. The texts of the proficiency level descriptions together with descriptions of examples of achievement at each level have been included as Appendix 6.

Table 7.1: Proficiency level cut-points and percentage of Year 6 and Year 10 students in each level in 2011

	Cut points		Percentage	
	Logits	Scale	Year 6	Year 10
Level 6			0	2
	3.50	769		
Level 5			1	19
	2.25	649		
Level 4			20	44
	1.00	529		
Level 3			40	25
	-0.25	409		
Level 2			27	8
	-1.50	289		
Level 1			11	2

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 6 March 2003 meeting 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 represent points on the proficiency scale that represent a ‘challenging but reasonable’ expectation for typical Year 6 and 10 students to have reached by the end of each of those years of study. The concept of Proficient Standard refers to the knowledge, skills and understanding that one would expect to observe in a student who was functioning adequately for their year level. Proficiency at Year 6, and the expectations of a Year 6 performance, is different to what one would expect to exhibit as proficiency for a Year 10 student. 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 and representatives from all states and territories and all 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 of NAP – ICTL 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 2011, 62 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 and in 2011 65 per cent of Year 10 students reached or exceeded the Year 10 Proficient Standard.

CHAPTER 8: REPORTING OF RESULTS

Wolfram Schulz & Eveline Gebhardt

The students assessed in NAP – ICTL 2011 were selected using a two-stage cluster sampling procedure. In the first stage, schools were sampled from a sampling frame with a probability proportional to their size as measured by student enrolments in the relevant year level. In the second stage, 20 students at each year level were randomly sampled within schools (see 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 simple random sampling, standard formulae to obtain sampling errors of population estimates are not appropriate. In addition, ICT literacy estimates are plausible values (see Chapter 6 on scaling procedures for further details) which allow 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 2011.

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 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 *jack-knife repeated replication technique* (JRR). The other component of the standard error of achievement test scores, the measurement variance, can be derived from the variance among the five plausible values for ICT literacy. In addition, for comparing achievement test scores with those from previous cycles in 2005 and 2008, 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 2011, there were 159 sampling zones in Year 6 and 154 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 jack-knife 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, 159 replicate weights were computed. In Year 10, which had only 154 sampling zones, the last five 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 jack-knife replicates J_h. The JRR variance is computed using the formula

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

where H is the number of sampling zones, $t(S)$ 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} jack-knife 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]

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

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

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).

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

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

To obtain the final standard error of ICT literacy scores, 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 2011, 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 2011 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 with a probability of less than five per cent ($p > 0.05$) that differences were <u>not</u> 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 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 that 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).

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 and 2011

The NAP – ICTL Years 6 and 10 Report 2011 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 2008 and 2011 is 5.7 score points on the NAP – ITC Literacy scale for both year levels (see also Chapter 6). When testing the difference of a statistic between these two assessment cycles, the standard error of the difference was computed as follows

$$SE(t_{11} - t_{08}) = \sqrt{SE_{11}^2 + SE_{08}^2 + EqErr_{11\_08}^2}$$

where t can be any statistic in units on the NAP – ICTL scale (mean, percentile, gender difference, but *not* percentages), SE_{11}^2 is the respective standard error of this statistic in 2011, SE_{08}^2 the corresponding standard error in 2008 and $EqErr_{11\_08}^2$ the equating error for the equating between 2008 and 2011.

When comparing population estimates between 2011 and the first assessment in 2005, two equating errors (between 2011 and 2008 and between 2008 and 2005) 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 2011 and 2005:

$$SE(\mu_{11} - \mu_{05}) = \sqrt{SE_{11}^2 + SE_{05}^2 + EqErr_{11\_05}^2}$$

where $EqErr_{11\_05}^2$ reflects the uncertainty associated with the equating between the assessment cycles of 2011 and 2008 (5.7 score points) as well as between 2008 and 2005 (4.3 score points). This combined equating error was equal to 7.1 score points and was calculated as

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

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

For the cut-point that defines the corresponding Proficient Standard at each year level (409 for Year 6 and 529 for Year 10), a number of n replicate cut-points were generated by adding a random error component with a mean of 0 and a standard deviation equal to the estimated equating error of 5.7 score points for comparisons between 2011 and 2008, and 7.1 score points for comparisons between 2011 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 2011 and 2008 were calculated as

$$SE(\rho_{11} - \rho_{08}) = \sqrt{SE(\rho_{11})^2 + SE(\rho_{08})^2 + EqErr(\rho_{11\_08})^2}$$

where ρ_{11} is the percentages at or above the Proficient Standard in 2011 and ρ_{08} in 2008, $SE(\rho_{11})$ and $SE(\rho_{08})$ their respective standard errors, and $EqErr(\rho_{11\_08})$ the equating error for comparisons. For estimating the standard error of the corresponding differences in percentages at or above Proficient Standards between 2011 and 2005 the following formula was used

$$SE(\rho_{11} - \rho_{05}) = \sqrt{SE(\rho_{11})^2 + SE(\rho_{05})^2 + EqErr(\rho_{11\_05})^2}$$

For NAP – ICTL 2011, 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 on percentages between 2005 and 2011

	2008-2011		2005-2011	
	Year 6	Year 10	Year 6	Year 10
All	1.86	1.80	2.27	2.21
ACT	1.78	1.78	2.08	2.36
New South Wales	1.97	2.00	2.38	2.37
Northern Territory	2.45	2.28	2.93	2.60
Queensland	1.73	1.94	2.11	2.41
South Australia	1.82	1.78	2.29	2.04
Tasmania	2.01	1.89	2.52	2.51
Victoria	1.94	1.63	2.34	2.06
Western Australia	1.66	1.70	2.16	2.08
Boys	1.72	1.71	2.11	2.11
Girls	2.02	1.91	2.45	2.33
Metropolitan	1.84	1.76	2.25	2.15
Provincial	1.94	1.96	2.38	2.42
Remote	2.33	1.57	2.82	2.17

Other statistical analyses

While most tables in the NAP – ICTL 2011 Year 6 and 10 Report 2011 present 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 2011, 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 one part of the public report, a 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, replication was not necessary. Only one plausible value was used, therefore the standard errors were slightly underestimated (however, sampling variance forms the major part of the error variance). The analysis was conducted in Mplus Version 5 (Muthén & Muthén, 2007). 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, were estimated based on aggregated data to the school level. School final weights (see Chapter 3) were used at the school level. Weights of one were used at the student level, because all students in a school had equal within-school student weights.

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APPENDICES

Appendix 1: Student questionnaire

Q1 How long have you been using computers?

(Please click on only one response button.)

- ☐ Never or less than one year
- ☐ One to three years
- ☐ Three to five years
- ☐ More than five years

Q2 How many computers and handheld devices are used regularly in your home?

(Please select a number for each type of device.)

	Number of devices
Desktop computer	▼
Portable computer (notebook, netbook)	▼
Games console with internet connectivity	▼
Handheld mobile devices such as smartphones, organisers, tablet devices	▼

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 Linux or other operating systems	None
At home	☐	☐	☐	☐
At school	☐	☐	☐	☐
At other places (e.g. local library, internet cafe, friends place)	☐	☐	☐	☐

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 How often do you do each of the following:
Please use the drop down menu for each task for HOME and for SCHOOL to indicate one of the following:

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

	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	▼	▼

Q7 **How often do you do each of the following:**
Please use the drop down menu for each task for HOME and for SCHOOL to indicate one of the following:

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

	At Home	At School
Download games and/or other software applications from the Internet	▼	▼
Download or stream videos, music and/or podcasts from the Internet	▼	▼
Play games on a computer	▼	▼
Use software to create sounds/music, movies or animations	▼	▼
Use a computer to listen to music or watch DVDs	▼	▼

Q8 **How often do you do each of the following:**
Please use the drop down menu for each task for HOME and for SCHOOL to indicate one of the following:

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

	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	▼	▼

Q9 **How often do you do each of the following:**
Please use the drop down menu for each task for HOME and for SCHOOL to indicate one of the following:

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

	At Home	At School
Write computer programs or macros (e.g. Logo, Basic or Pascal)	▼	▼
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	▼	▼

Q10 **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	☐	☐	☐	☐

Appendix 2: School report descriptor sheet

Item Set: Art Show

Q05: *Explain the need to delete private data from public equipment.*	
Code 1:	Identifies that leaving files on a shared ICT resource can inconvenience users.
Code 2:	Identifies that leaving files on a shared ICT resource is a privacy risk.

Q10: *Add a new web page to an existing website.*	
Code 1:	Adds a new blank web page to a website.
Code 2:	Adds a new blank web page with a specified name to a website.

Q11: *Add any background image to any web page.*	
Code 1:	Applies a background image to a web page.
Code 2:	Applies a background image to a specified web page.
Code 3:	Applies a specified background image to a specified web page.

Q12: *Import a specific set of image files into a web page.*	
Code 1:	Imports image files to a web page.
Code 2:	Imports some specified image files to a specified web page.
Code 3:	Imports all specified image files to a specified web page.

Q14: *Interpret a link chart to create a link from an existing web page to a newly created web page.*	
Code 1:	Inserts a button on a web page.
Code 2:	Inserts a button with a specified destination link on a web page.
Code 3:	Inserts a button with a specified destination link and a specified label on a web page.

Item Set: Art Show - *Continued*

Q15: *Interpret a link chart to create a link to an existing web page from a newly created web page.*	
Code 1:	Inserts a button to a specified web page to match a website link chart.
Code 2:	Inserts a button with a specified destination link to match a website link chart.
Code 3:	Inserts a button with a specified label and destination link to match a website link chart.

Q18: *Align images on a web page according to interface design principles.*	
Code 1:	Places and aligns images with minor imbalances or overlap.
Code 2:	Places and aligns images with balance and/or symmetry.

Q19: *Create a balanced web page layout.*	
Code 1:	Creates a web page where the elements are mostly balanced and logically connected.
Code 2:	Creates a web page where the elements are balanced and logically connected.

Q20: *Create a title for a web page.*	
Code 1:	Creates a text title.
Code 2:	Creates a text title that clearly contrasts with the background through the use of colour and stands out from other elements through the use of text formatting features such as text size.

Item Set: Friend's PC

Q04: *Identify a benefit of saving files from the Internet before running them.*	
Code 1:	Identifies that saving a file from the internet makes it easier to use the file in the future.
Code 2:	Identifies that saving a file from the internet makes it possible to scan the

	file for viruses before using it.

Q05: ***Give an example of what happens to anti-virus software when it is updated.***	
Code 1:	Identifies a generic improvement to anti-virus software when the software is updated.
Code 2:	Explains with an example how anti-virus software is improved by software updates.

Item Set: Language Preservation

Q13: ***Explain why allowing other users to record video chats can result in misuse or privacy issues.***	
Code 1:	Identifies in principle that recorded video chats can be misused or that they can lead to an invasion of privacy.
Code 2:	Provides an example of how recorded video chats can be misused or how recorded video chats can lead to an invasion of privacy.

Item Set: Saving Electricity

Q04: *Create a short video that has good timing.*	
Code 1:	Arranges video clips in a timeline.
Code 2:	Arranges video clips in a timeline and controls the timing so that most captions and the clips can be seen.
Code 3:	Arranges video clips in a timeline and controls the timing so that all captions and the clips can be seen.

Q05: *Create a short video that includes well designed and legible captions.*	
Code 1:	Creates captions.
Code 2:	Creates captions that are appropriate in text size so that they allow important parts of the video to be seen.

Q06: *Create a short video that communicates electricity saving tips justified by environmental protection.*	
Code 1:	Creates a video that communicates one energy saving tip.
Code 2:	Creates a video that communicates two energy saving tips or one energy saving tip contextualised by environmental protection.
Code 3:	Creates a video that communicates two energy saving tips contextualised by environmental protection.

Q07: *Use transitions to enhance the communicative effect of the video content.*	
Code 1:	Uses video transitions that neither support nor hinder communication.
Code 2:	Uses video transitions to support communication.

Item Set: Sports Wiki

Q09: *Create a new page in an existing wiki website.*	
Code 1:	Adds a new blank page to a wiki.
Code 2:	Adds a new blank page with a specified file name to a wiki.

Q10: *Copy and paste text from a document to a specified editable wiki page.*	
Code 1:	Copies and pastes some specified text from an email to a wiki page.
Code 2:	Copies and pastes only specified text from an email to a wiki page.

Q11: *Create an interactive poll using a specified question and answers.*	
Code 1:	Creates an interactive poll with specified content.
Code 2:	Creates an interactive poll with specified content on a specified page of a wiki.

Item Set: Sports Picnic

Q11: *Enter search criteria into an online map tool.*	
Code 1:	Uses the search feature of map software to find one location.
Code 2:	Uses the search feature of map software to find two locations.

Q13: *Align a map to show both an origin and destination.*	
Code 1:	Aligns a map so that some key features are visible.
Code 2:	Aligns a map so that all key features are visible.

Q16: *Apply appropriate formatting changes to an invitation.*	
Code 1:	Designs an invitation that uses a range of colours.
Code 2:	Designs an invitation with colours that contrast and are applied consistently.

Appendix 3: Example of school summary report and student report

MCEECDYA Ministerial Council for Education, Early Childhood Development and Youth Affairs

NAP NATIONAL ASSESSMENT PROGRAM

ACER

Monday, 23 April 2012

NAP - ICT Literacy 2011 - School Report

Year 10

School Sample School **Item Set** Language Protection **State** TAS

Item Code	Descriptor	Max Score on Item	% Correct Item Set By Score									
			Score 1		Score 2		Score 3		Score 4		Score 5	
			School	Sample	School	Sample	School	Sample	School	Sample	School	Sample
q01	Locate and click on a hyperlink.	1	100.0	92.1								
q02	Sort data according to given criteria.	2	50.0	63.2	50.0	61.1						
q03	Locate and click on a hyperlink in a new web browser tab.	1	66.7	41.8								
q04	Use two fields of data to search for information.	1	0.0	4.2								
q05	Locate and click on a button in a web browser toolbar.	1	100.0	76.6								
q06	Adjust a selection tool to create a screenshot of only a map shown on the screen.	1	16.7	16.0								
q07	Locate a spreadsheet cell according to contextual information and paste a URL.	1	50.0	58.9								
q08	Compare multiple versions of a spreadsheet to locate missing information.	1	66.7	54.8								
q09	Observe search result behaviour and explain the process of filtering.	1	83.3	59.9								
q10	Click on a search result that matches given criteria.	1	50.0	39.7								
q11	Locate the settings for a video chat program.	1	100.0	89.3								
q12	Change the settings for a video chat program to prevent other users from recording video sessions.	1	83.3	73.9								
q13	Explain why allowing other users to record video chats can result in misuse or privacy issues.	2	66.7	48.3	33.3	26.4						
q14	Use a mini calendar to choose a specified date.	1	16.7	60.7								
q15	Use scheduling software to create an event that is exactly 2 hours long.	1	0.0	10.3								
q16	Use scheduling software to locate a time slot that is available at a specified time.	1	16.7	46.7								
q17	Use scheduling software to create an event on the correct day at the correct time.	1	0.0	6.2								

MCEECDYA Ministerial Council for Education, Early Childhood Development and Youth Affairs

NAP NATIONAL ASSESSMENT PROGRAM

ACER

Monday, 23 April 2012

NAP - ICT Literacy 2011 - School Report

Year 6

School *Sample School*

Item Set *Sports Wiki*

State TAS

Surname	Other Names	q01	q02	q03	q04	q05	q06	q07	q08	q09	q10	q11	q12	Score on Item Set: Individual	Score on Item Set: Sample Mean
	Max Score	1	1	1	1	1	1	2	1	2	3	2	1		
Student	01	0	1	0	0	0	0	0	0	2	0	0	0	3	4
Student	02	0	1	0	0	0	0	0	1	1	0	0	1	4	4
Student	03	0	1	0	0	0	0	2	1	2	0	0	0	6	4
Student	04	0	1	0	0	1	0	1	1	2	0	0	0	6	4
Student	05	0	1	0	0	1	1	0	0	0	0	0	0	3	4
Student	06	0	1	1	0	1	0	2	1	0	0	0	0	6	4
Student	07	0	0	0	0	1	1	1	1	2	0	0	0	6	4
Student	08	0	0	1	0	1	1	0	0	1	0	0	1	5	4
Student	09	0	1	0	0	1	1	1	1	0	0	0	0	5	4
Student	10	0	1	0	1	0	0	1	0	2	0	0	0	5	4
Student	11	0	1	0	0	1	0	0	1	2	3	1	0	9	4
Student	12	1	1	1	0	1	0	0	1	2	3	2	0	12	4
Student	13	0	1	0	0	0	1	0	1	0	0	0	1	4	4
Student	14	0	1	1	0	0	1	1	0	0	0	0	0	4	4

Appendix 4: Item difficulties

Item	Vertical link	Horizontal link	RP=0.50	RP=0.62	ICTL Scale	Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
ASH01	Year 10	No	-0.46	0.03	453		77%	1.13
ASH02	Year 10	No	-1.62	-1.13	342		10%	1.00
ASH04	Year 10	No	0.66	1.15	560		62%	1.04
ASH05	Year 10	No	-1.38	-0.89	365		89%	0.99
ASH06	Year 10	No	2.35	2.84	723		30%	1.09
ASH08	Year 10	No	-0.23	0.26	475		74%	0.95
ASH10	Year 10	No	0.19	0.68	515		71%	0.72
ASH11	Year 10	No	0.69	1.18	563		68%	0.93
ASH12	Year 10	No	0.72	1.21	567		67%	0.83
ASH13	Year 10	No	0.93	1.42	587		59%	0.73
ASH16	Year 10	No	2.16	2.65	704		33%	0.85
ASH17	Year 10	No	2.04	2.53	693		35%	0.81
ASH18	Year 10	No	0.95	1.44	588		59%	0.83
ASH19	Year 10	No	1.59	2.08	650		45%	0.76
ASH20	Year 10	No	1.20	1.69	612		53%	0.88
FPC01	Year 10	Yes	0.65	1.14	559		6%	1.16
FPC03	Link	Yes	-0.48	0.01	451	61%	74%	1.22
FPC04	Link	No	-0.63	-0.14	436	59%	82%	0.98
FPC05	Year 06	No	1.28	1.77	620	23%		1.09
FPC06	Link	No	-0.22	0.27	476	51%	79%	0.93
FPC07	Year 10	Yes	1.26	1.75	618		49%	1.09
FPC08	Link	Yes	-1.51	-1.02	352	73%	92%	0.94
FPC09	Link	No	0.59	1.07	553	34%	66%	1.00
FPC10	Link	Yes	0.86	1.35	580	28%	59%	1.06
FPC13	Link	Yes	-0.75	-0.26	425	62%	84%	0.98
FPC14	Link	Yes	-2.23	-1.74	283	86%	94%	1.00
FPC15	Link	Yes	-1.98	-1.49	306	82%	93%	1.04
FPC16	Link	No	-0.25	0.24	473	52%	79%	1.01
FPC17	Link	No	-1.90	-1.41	315	80%	94%	0.94
GNS01	Link	Yes	-3.45	-2.96	166	94%	98%	1.07
GNS03	Link	Yes	-2.62	-2.13	246	89%	96%	0.95
GNS04	Year 06	No	-0.42	0.07	457	55%		0.99
GNS05	Link	Yes	-1.46	-0.97	357	73%	89%	1.03
GNS06	Year 10	Yes	-2.33	-1.84	274		95%	1.05
GNS07	Link	Yes	-1.49	-1.00	354	74%	90%	1.00
GNS08	Link	Yes	0.66	1.14	560	29%	65%	0.98
GNS09	Link	Yes	-3.20	-2.71	190	92%	97%	0.99
GNS10	Year 06	Yes	-2.57	-2.08	250	87%		1.02
GNS11	Link	No	1.24	1.73	616	22%	51%	1.04
GNS12	Link	No	-1.97	-1.48	308	83%	90%	1.08
GNS13	Link	Yes	-4.27	-3.78	87	97%	99%	0.94
GNS14	Link	No	0.32	0.81	528	38%	68%	0.93
GNS15	Link	No	-1.06	-0.57	395	69%	82%	1.08
GNS16	Link	No	-0.50	-0.01	449	54%	82%	0.99
GNS17	Link	Yes	-2.39	-1.90	267	85%	95%	0.92
GNS19	Link	Yes	-2.60	-2.11	247	88%	95%	0.98
GNS20	Link	Yes	-3.15	-2.66	195	92%	97%	0.96
GNS21	Year 06	Yes	-3.49	-3.00	161	94%		0.92
GNS22	Link	No	-1.66	-1.17	337	77%	91%	0.92
GNS23	Link	No	-1.35	-0.86	367	74%	89%	1.07
GNS24	Link	Yes	0.74	1.23	568	31%	63%	0.94

Item	Vertical link	Horizontal link	RP=0.50	RP=0.62	ICTL Scale	Correct Year 6	Correct Year 10	Weighted fit (MNSQ)
GNS25	Year 06	Yes	-2.72	-2.23	235	9%		1.14
GNS26	Year 10	No	3.93	4.42	875		9%	1.06
GNS28	Year 06	No	0.40	0.89	535	40%		1.11
GNS29	Year 06	No	1.12	1.61	605	28%		0.96
GNS30	Link	No	1.60	2.09	650	14%	43%	1.12
GNS31	Link	No	1.11	1.60	603	32%	46%	1.19
GNS32	Link	No	1.27	1.76	619	21%	54%	0.92
LPR01	Year 10	No	-1.88	-1.39	316		93%	0.99
LPR02	Year 10	No	0.55	1.04	550		63%	0.91
LPR03	Year 10	No	1.47	1.96	638		43%	0.96
LPR05	Year 10	No	-0.39	0.10	460		78%	0.90
LPR06	Year 10	No	3.14	3.63	798		16%	1.07
LPR07	Year 10	No	0.63	1.12	558		59%	1.07
LPR08	Year 10	No	0.84	1.33	578		55%	1.06
LPR09	Year 10	No	0.64	1.13	558		62%	0.93
LPR11	Year 10	No	-1.74	-1.25	330		10%	1.02
LPR12	Year 10	No	-0.22	0.27	476		76%	0.94
LPR13	Year 10	No	1.20	1.69	613		6%	1.13
LPR15	Year 10	No	0.40	0.89	535		65%	1.10
LPR16	Year 10	No	3.64	4.13	847		12%	0.94
LPR17	Year 10	No	1.19	1.68	611		49%	1.11
LPR18	Year 10	No	4.22	4.71	902		7%	0.85
SEL02	Link	No	0.71	1.20	565	35%	60%	1.00
SEL03	Link	No	0.28	0.77	524	41%	69%	0.99
SEL06	Link	No	1.73	2.22	663	24%	41%	1.02
SEL07	Link	No	1.62	2.11	652	17%	39%	1.13
SEL08	Link	No	0.75	1.24	569	46%	51%	1.18
SPN01	Year 06	Yes	-2.89	-2.40	219	9%		1.02
SPN02	Link	No	2.26	2.75	714	15%	27%	1.09
SPN03	Link	No	1.91	2.40	681	16%	36%	1.09
SPN04	Link	Yes	-1.03	-0.54	399	69%	84%	1.03
SPN05	Link	No	-0.90	-0.41	411	69%	82%	1.14
SPN06	Link	Yes	0.76	1.24	570	38%	57%	1.00
SPN07	Link	Yes	-1.20	-0.71	382	71%	87%	0.83
SPN08	Link	No	-1.29	-0.80	373	73%	87%	0.80
SPN09	Link	Yes	-1.34	-0.85	368	73%	88%	0.79
SPN10	Link	No	-1.38	-0.89	365	75%	88%	0.78
SPN12	Link	No	0.13	0.62	509	48%	69%	0.81
SPN13	Link	Yes	2.70	3.19	756	11%	19%	1.06
SPN14	Link	No	0.03	0.52	500	48%	71%	0.79
SPN15	Link	No	-1.36	-0.87	366	76%	87%	0.92
SPN16	Link	Yes	-1.71	-1.22	333	80%	89%	0.92
SPW01	Link	No	2.72	3.21	758	8%	25%	1.02
SPW02	Link	No	-1.60	-1.11	343	76%	91%	1.00
SPW03	Year 10	No	0.91	1.40	584		57%	1.09
SPW04	Year 10	No	0.93	1.42	586		57%	1.08
SPW05	Link	No	-0.19	0.30	478	54%	72%	1.10
SPW06	Link	No	0.00	0.49	497	48%	76%	1.11
SPW07	Year 06	No	2.73	3.22	759	8%		0.94
SPW08	Link	No	-0.14	0.35	483	50%	77%	1.04
SPW09	Link	No	-0.09	0.40	488	51%	74%	0.89
SPW10	Link	No	2.35	2.84	723	10%	31%	0.92
SPW12	Link	No	2.83	3.32	769	3%	15%	1.03
SPW13	Link	No	1.92	2.41	681	16%	36%	1.05

Appendix 5: Variables for conditioning

Variable	Name	Values	Coding	Regressor
Flexible delivery school	FD	Yes	1	Direct
		No	0	Direct
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	SEIFA_1	1000	Direct
		SEIFA_2	0100	Direct
		SEIFA_3	0010	Direct
		SEIFA_4	0001	Direct
		SEIFA_5	0000	Direct
Sex	SEX	Male	0	Direct
		Female	1	Direct
Age	AGE	Value	Copy,0	PCA
		Missing	Mean,1	PCA
LOTE spoken at home	LBOTE	Yes	10	PCA
		No	00	PCA
		Missing	01	PCA
Student Born in Australia	COB	Australia	00	PCA
		Overseas	10	PCA
		Missing	01	PCA
Parental Occupation Group	POCC	Mode of state 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
Highest Level of Parental Education	PARED	Mode of state state and year level	0000000	PCA
		Other category 1	1000000	PCA
		Other category 2	0100000	PCA
		Other category 3	0010000	PCA
		Other category 4	0001000	PCA
		Other category 5	0000100	PCA
		Other category 6	0000010	PCA

Variable	Name	Values	Coding	Regressor
		Not stated or unknown	0000001	PCA
Indigenous Status Indicator	INDIG	Indigenous	10	PCA
		Non-Indigenous	00	PCA
		Missing	01	PCA
EXPERNC - Experience with computers	Q01	Never or less than one year	1000	PCA
		One to three years	0100	PCA
		Three to five years	0010	PCA
		More than five years	0000	PCA
		Missing	0001	PCA
NUMCOMP - Number of desktop computers	Q02a	Integer	Copy value, replace missing by year level mode and four dummies for missing values	PCA
NUMCOMP - Number of portable computers	Q02b	Integer		PCA
- Number of games consoles	Q02c	Integer		PCA
- Number of mobile devices	Q02d	Integer		PCA
SYSWIN - Home computer systems - Windows	Q03a1	Yes No Missing	Two dummies for each variable with the year level mode 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 place computer systems - Windows	Q03c1			PCA
SYSMAC - Other place computer systems - Mac	Q03c2			PCA
SYSOTH - Other place computer systems - Other	Q03c3			PCA
USEHOME - Use at home	Q04a	Several times every day Every day Almost every day A few times each week Less than once a week or never Missing	4,3,2,1,0 missing replaced by mode dummies for missing	PCA
USESCHL - Use at school	Q04b			PCA
INTEREST - Computer work important	Q05a	Strongly agree Agree Disagree Strongly disagree Missing	3,2,1,0 missing replaced by mean dummies for missing	PCA
INTEREST - Computer is fun	Q05b			PCA
INTEREST - Interested in technology	Q05c			PCA
INTEREST - Like learning new things	Q05d			PCA
INTEREST - Always looking for new ways	Q05e			PCA
STUDYH - Home: Search internet	Q06a1	At least once every day	5,4,3,2,1,0	PCA

Variable	Name	Values	Coding	Regressor
for information		Almost every day	missing	
STUDYH - Home: Use word processing	Q06b1	A few times each week	replaced by mean	PCA
STUDYH - Home: Use spreadsheets	Q06c1	Between once a week and once a month	dummies for missing	PCA
STUDYH - Home: Use learning programs	Q06d1	Less than once a month Never Missing		PCA
STUDYH - Home: Create presentations	Q06e1			PCA
STUDYS - School: Search internet for information	Q06a2			PCA
STUDYS - School: Use word processing	Q06b2			PCA
STUDYS - School: Use spreadsheets	Q06c2			PCA
STUDYS - School: Use learning programs	Q06d2			PCA
STUDYS - School: Create presentations	Q06e2			PCA
ENTERTH - Home: Download software	Q07a1	At least once every day Almost every day	5,4,3,2,1,0 missing	PCA
ENTERTH - Home: Download/stream media	Q07b1	A few times each week Between once a week and	replaced by mean	PCA
ENTERTH - Home: Play games on computer	Q07c1	once a month Less than once a month	dummies for missing	PCA
- Home: Use software to create media	Q07d1	Never Missing		PCA
- School: Use software to create media	Q07d2			PCA
ENTERTH - Home: Use computer to play media	Q07e1			PCA
ENTERTS - School: Download software	Q07a2			PCA
ENTERTS - School: Download/stream media	Q07b2			PCA
ENTERTS - School: Play games on cumputer	Q07c2			PCA
ENTERTS - School: Use computer to play media	Q07e2			PCA
- Home: Search internet for information that is not for school	Q08a1	At least once every day Almost every day A few times each week	5,4,3,2,1,0 missing replaced by	PCA
- School: Search internet for information that is not for school	Q08a2	Between once a week and once a month Less than once a month	mean dummies for missing	PCA
COMMH - Home: Use computer for e-mail/chat	Q08b1	Never Missing		PCA
COMMH - Home: Write/reply to blogs/forum threads	Q08c1			PCA
COMMH - Home: Use video/voice chat	Q08d1			PCA
COMMH - Home: Upload media to online profile	Q08e1			PCA
COMMH - Home: Edit images on computer	Q08f1			PCA
COMMS - School: Use computer	Q08b2			PCA

Variable	Name	Values	Coding	Regressor
for e-mail/chat				
COMMS - School: Write/reply to blogs/forum threads	Q08c2			PCA
COMMS - School: Use video/voice chat	Q08d2			PCA
COMMS - School: Upload media to online profile	Q08e2			PCA
COMMS - School: Edit images on computer	Q08f2			PCA
TECHH - Home: Write programs/macros	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 mean dummies for missing	PCA
TECHH - Home: Upload created media on Internet	Q09b1			PCA
TECHH - Home: Construct websites	Q09c1			PCA
TECHH - Home: Use "art" programs	Q09d1			PCA
TECHH - Home: Use antivirus software	Q09e1			PCA
TECHS - School: Write programs/macros	Q09a2			PCA
TECHS - School: Upload created media on Internet	Q09b2			PCA
TECHS - School: Construct websites	Q09c2			PCA
TECHS - School: Use "art" programs	Q09d2			PCA
TECHS - School: Use antivirus software	Q09e2			PCA
EFFICACY - Use antivirus software	Q10a	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	3,2,1,0 missing replaced by mean dummies for missing	PCA
EFFICACY - Edit images	Q10b			PCA
EFFICACY - Create database	Q10c			PCA
EFFICACY - Use spreadsheet to plot graph	Q10d			PCA
EFFICACY - Download music	Q10e			PCA
EFFICACY - Create multi-media presentation	Q10f			PCA
EFFICACY - Construct web page	Q10g			PCA
EFFICACY - Upload files to a website	Q10h			PCA

Appendix 6: 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
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, edit 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

Level	Proficiency level description	Examples of student achievement at this level
3	Students working at level 3 generate simple general search questions and select the best information source to meet a specific purpose. They retrieve information 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
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

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