Chapter 7
Australian Bureau of Statistics

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7.1 Introduction

The Australian Bureau of Statistics (ABS) mission is to assist and encourage informed decision making, research and discussion within governments and the community, by leading a high quality, objective and responsive national statistical service.

The statistical literacy strategies of the ABS, which are consistent with its mission of assisting and encouraging informed decision making, have identified five target groups on the basis of the content and context of their statistical literacy needs. The five groups are:

- School students
- Tertiary students (including vocational education and university students, and teachers/lecturers)
- Opinion leaders (including journalists)
- Decision makers (including members of parliaments and staff from agencies in all levels of government)
- General community (including small business owners and community groups)

Up until now only one of the target groups, school students, has had specific strategies in place to improve their statistical literacy, although a number of broader strategies covering larger sections of the population have been implemented. The ABS is currently looking at ways to free up resources in order to put in place more specific strategies to improve the statistical literacy of the other four target groups.

7.2 Introduction to ABS Education Services

The ABS Education Services unit was established to further the ABS mission in the strategically important schools sector. The ABS recognised that the students of today are the decision makers of tomorrow and therefore established the Education Services unit to:

- increase statistical literacy in the school sector and the broader community,
- promote greater understanding, knowledge and access to statistics by teachers, school librarians and students with a particular emphasis on ABS statistics,
- promote statistics as a career choice for students.

In this role the unit actively assists schools in meeting statistical needs across the education curriculum. Services include:

- development of certain specialist products and services for use in the curriculum,
- selection and promotion of ABS general products suitable for curriculum use,
- assistance to authors of curriculum materials who require statistical data.

The ABS Education web page (http://www.abs.gov.au/websitedbs/cashome.nsf/Home/Entry+Page.es) is an entry page to a range of educational resources. These include educational resources for teachers designed to bring data to life in the classroom, as well as a range of fun educational resources

designed specifically for students. CensusAtSchool (C@S) is the flagship resource offered by Education Services, exposing teachers and students to each step in the statistical cycle and providing students with real relevant data about themselves, thus making it engaging to students. There are also help guides to navigate the data sets on the ABS website and other official statistics sites.

Many of the educational resources in the ABS Education Services web pages are able to be used by the other target groups, but the ABS has up to this point concentrated most of its available web based resources on improving the statistical literacy in Australian schools.

As a basis for the ABS' attempt to increase statistical literacy in the schools sector, it has developed a set of four criteria that are considered essential for statistical literacy. These are:

- Data awareness.
- The ability to understand statistical concepts.
- The ability to analyse, interpret and evaluate statistical information.
- The ability to communicate statistical information and understandings.

For each criterion, a set of competencies has been proposed against which statistical literacy can be assessed at three different levels:

- basic (upper primary)
- intermediate (junior secondary)
- advanced (middle and senior secondary).

The Statistical Literacy Competencies can be downloaded as a pdf file from (http://www.abs.gov.au/websitedbs/CaSHome.nsf/home/downloadable+files.es/$file/Statistical_Literacy_Competencies.pdf). They are a detailed list against which one can compare the activities and resources posted on the website to determine whether they are consistent with the development of statistical literacy. The description of the competencies makes clear the requirement that students be critical and inquires about the way the study was conducted and the sources of the data before accepting any conclusions. Thus, the program covers the whole data cycle at an informal level, without much statistical inference jargon of hypothesis testing and confidence intervals.

7.3 ABS Education Services website

As mentioned above, the ABS Education web page is an entry page to a range of educational resources (http://www.abs.gov.au/websitedbs/cashome.nsf/Home/Entry%20Page.es) which is split into two sections: **For Teachers** and **For Students**.

7.3.1 The **For Teachers** area has 7 different links to educational resources that assist teachers to bring data to life in the classroom. These are:

- Classroom Activities
- Education Projects
- Teaching Statistics
- ABS Datasets
- Education News
- Statistical Resources
- For Career Advisors

The *Classroom Activities* are aimed at years 7-10. They have been designed by practising teachers to develop statistical literacy within the framework of the various state/territory curricula with specific curriculum links being provided within the pages. They focus on the following subject areas: Commerce and Economics, Geography and Mathematics. They are provided free of charge in both HTML and RTF format to be used and modified as the teachers wish. The goal of these activities is to develop students statistical literacy against the criteria mentioned in Section 1. Most of the activities provide data awareness (i.e. they start with raw data) and contain data relevant to Australia (e.g. births, deaths, population). Most of the other activities start with a table of pre-prepared summary statistics, also about Australia, allowing the students to develop the ability to understand statistical concepts and to analyse, interpret and evaluate statistical information. The communication goal is achieved by presenting the activities as a set of questions that expect an answer. An area for further development is activities that encourage critical thinking about where the data came from and how that affects the conclusions of the study.

Education Projects includes a number of innovative projects for teachers and students including two projects developed outside the ABS. C@S, WISE and *A Tale of Two Worlds* are the main ABS developed projects. C@S is the flagship project and it has its own link from here and from the Education Services web page. C@S has its own Teacher and Student Area, and subsequent activities, with each activity linked to the corresponding strand in the school curriculum. The activities involve many subjects of interest to school students. In addition to that, most of them have a comparison component, and a multivariate component, with typical questions being: What do you think explains this or that? How does this compare with other populations? The ABS flagship project C@S is covered in more detail later in the paper.

WISE (Website Indigenous Statistics) is currently set up with six broad themes. Each theme has a number of topics for which there are information and statistics on Australia's Indigenous population. The themes are provided as links on the left-hand side of the page in addition to Learning Activities. This links to four types of suggested activities: multiple choice questions, practical tasks, research projects and case studies.

"A Tale of Two Worlds*"* is an award-winning interactive CD ROM that was developed for school children to show them how the Census plays a part in determining the future of Australia. The CD ROM caters for a range of learning styles and levels of difficulty. It is suitable for students from Years 3 to 10. 'A Tale of Two Worlds' also contains lesson plans and worksheets applying to society, the environment, geography, history, civics and citizenship, drama and art, as well as English and mathematics.

The *Teaching Statistics* link leads the teacher to the following: statistical literacy standards; explanation of common statistical concepts; case studies; professional development information; and further research.

The data provided in *ABS Datasets* are actual data spreadsheets sourced from ABS publications. They have been adjusted for a student audience which teachers can use in the classroom to aid different curriculum areas or to probe at different levels of statistical analysis. They currently cover a range of topics including population, crime, migration, marriage, health and leisure activities.

Education News is a link to the newsletter produced to highlight the latest curriculum related teaching resources, student activities and statistical tools that have been developed by ABS Education Services as well as other ABS resources that are useful for schools.

The collection of *Statistical Resources* includes a selection of ABS data and statistical publications, Learning Tools to assist teaching statistical concepts, other resources and links to other educational websites. The Learning Tools assist in teaching the concepts of the mean and median. Each learning tool has three parts: Discover It, Play it and Quiz It. For each learning tool, Discover It introduces and provides an explanation of a statistical concept. Play It is an interactive demonstration of the statistical concept and an opportunity for students to learn and experiment with the concept. Quiz It allows students to test their understanding of the concept after completing the other components.

The learning tools are designed so that students can proceed through the three parts sequentially or enter at any point. Each learning tool, and its components, is written using student-friendly language. The learning tools have been designed for use by a range of year levels. Students can progress through the tools independently, or with teacher supervision.

The other resources provide links to valuable publications. These include ABS Social Atlases (i.e. thematic maps of major cities in Australia) and a practical document on how to use Social Atlases in the classroom. Others are the ABS publications 'Statistics - A Powerful Edge!*',* a useful reference book for secondary students covering all the stages of the statistical cycle and 'Measuring Australia's Economy', a non-technical, comprehensive source of national statistics, definitions and explanations to over 50 major economic indicators.

The *For Career Advisors* subsection provides links to tertiary level statistics courses in Australia, ABS careers and graduate program and a brochure on careers in statistics.

7.3.2 The **For Students** area has six different sub-sections of pages. These are:

- Games and Puzzles
- Projects
- Statistics - What is it?
- Real Data
- Resource Centre
- Careers

The *Games and Puzzles* are educational and very engaging. They present correct statistical concepts and motivational activities.

The *Projects* link is to the earlier mentioned Education Projects that can be accessed through the For Teachers area.

Statistics - What is it? explains statistics as a step-by-step investigative process and stresses the importance of making the connection between the study design and conclusions made.

The *Real Data* section includes Interesting Statistics. This page of interesting statistics is sourced from recently released ABS publications.

The *Resource Centre* contains pages of background information to the Census and the ABS. In addition, there are interesting Statistical Stories of worldwide use of statistics.

The *Careers* link provides students with extensive information on careers in statistics, including using the Statistics Career Wheel.

This completes the brief description of the Education Services part of the ABS website. In these web pages students and teachers are exposed through various activities to good practice in statistics. The ABS is continuing to develop activities that will develop the statistical competencies outlined earlier. The priority in developing future activities will be to get the students to question data sources and data quality, as this is an area that has been identified as needing greater emphasis. The remainder of the paper provides a detailed summary of the Education Services flagship project, CensusAtSchool. The section includes the history of the project, project governance, maintenance, challenges, dissemination, evaluation and the future of the project.

7.4 Introduction to CensusAtSchool (C@S)

C@S is ABS Education Services flagship project. Launched in October 2005, C@S is a free and voluntary internet-based data collection and data analysis project. It is designed for the participation of students in Years 5 to 10 and can be extended for use in Years 11 and 12. It allows students to contribute to, and engage with, real data about themselves. The project involves school children participating in an online questionnaire and then utilising the resulting data from student responses across Australia for their own research purposes. These data samples can be used for teaching and learning across a whole range of key learning areas.

The ABS has a strong interest in promoting statistical literacy in schools. C@S has the explicit objective of increasing the statistical literacy of students which is consistent with the mission statement of ABS Education Services. The C@S project was designed with the four criteria considered essential for statistical literacy discussed earlier in mind.

C@S also aims to demonstrate the purpose and processes involved in conducting national censuses through students collecting and using information about themselves. The first data collection in 2006 was highly successful with 112,173 students across Australia completing the questionnaire. This rate of student participation was the highest of the international C@S projects with voluntary participation. C@S has been very well received by schools around Australia with over 28% of schools registering to participate in 2006. An independent evaluation report indicated that C@S was succeeding in its objective of improving the statistical literacy of students and teachers, with over 50% of teachers who responded to the online survey indicating the value of the resource as a tool to increase the statistical literacy of students. It was also seen to raise awareness of the use of data in decision making and lifted the image of ABS within the schools community. C@S also presents the opportunity for ABS to be a meaningful contributor in curriculum development around the country.

7.5 History of the project

In Australia, the establishment of the national C@S project followed other countries including the UK, South Africa, Canada and New Zealand. Before ABS Education Services began C@S nationally, it was run in Queensland by the Office of Economics and Statistical Research (OESR) and in South Australia by the Noel Baker Centre for School Mathematics.

Feedback was received from teachers indicating that although the ongoing activities undertaken by Education Services worked well, students would benefit from a holistic package on statistical processes presented in an exciting, dynamic and engaging way. After the success of the OESR and Noel Baker Centre initiatives, the ABS chose the C@S project to pursue the identified requirement.

7.6 Project governance

The national C@S proposal was approved by the Australian Statistician with recognition of the strategic importance of the project to schools, teachers, students and the wider community. As such the following planning and governance arrangements were established:

- appointment of a Project Governance Board (PGB) which consisted of 4 Senior Executive level officers
- establishment of a project team with the project manager reporting directly to the PGB
- the development of a detailed implementation plan which was approved by the PGB
- appointment of an external C@S Reference Group which comprised of representatives from the State Departments of Education, Catholic Education Offices and Independent Schools Associations as well as representatives from the South Australian and Queensland projects.

As the Reference Group represented the needs of the school sector their role was very important and provided expert guidance for the project team in developing content. The proceedings and discussions of the Reference Group were forwarded to the PGB. The C@S project was launched in October 2005 by the Federal Minister assisting the Treasurer.

7.7 Project maintenance and progression

One of the keys to the success of C@S has been the alliances formed with education intermediaries through the initial and follow-up processes of consultation, feedback and testing. The strength of the alliances formed in the first project and the framework of contacts in place at the national, state, regional and school levels meant the intense efforts to establish these contacts in the set-up of the first questionnaire were not required for 2008. With the introduction of a new questionnaire for 2008, the process had already been established. It only required the re-activation of established contacts to carry this new process forward. The many registered schools who were familiar with the first questionnaire and the Random Sampler (a facility which allows access to the raw data) became valuable contributors to the development of the new questionnaire.

Support for C@S is provided by the training of teachers. It is an important ongoing element to the project. Teachers need to be trained to understand the concepts and principles involved and how to use the data with modern technologies. This is achieved through face-to-face professional development sessions, professional development resources such as the free professional development DVD 'Getting Started with C@S', an introductory CD 'Using C@S', online support materials and classroom activities. These support materials enable teachers to develop the skills and confidence to use C@S in the classroom. ABS Education Services hires specialist teacher consultants to develop the learning and support materials and deliver the professional development sessions. In addition, a section of the C@S community pages on the ABS website have been developed to promote sharing of ideas and input from individual teachers. C@S is enhanced, refined and progressively developed through continual liaison and input from teachers to ensure the materials and resources we are providing are meeting the changing needs of the education community.

Being the first project of its kind endorsed by the ABS, the top down management and governance structure was required for the initiation and ongoing management of the inaugural C@S project. In 2008 and future years, the project will be managed by the Education Services unit with approval from senior management. The management of each new project requires an updated work program and timeline. This includes three phases: development and preparation, implementation, and data usage. Tasks can be categorised into questionnaire redesign and redevelopment, maintenance of the C@S part of the website and updates, marketing/promotion and C@S learning resources/classroom activities. Each of these tasks has a number of steps to be completed. The initial outlay of time and resources to set up C@S was extensive with many efforts not needing to be repeated in future projects. However, the project is dynamic rather than static, and relies heavily on marketing and promotion, ongoing improvements and innovations as well as timely responses to user needs for the project to remain relevant and valuable to teachers and students and for participation to continue.

7.8 Project challenges

Maintenance of the school mailing list and registered school list is an ongoing issue. This is due to school details potentially changing over time or being provided incorrectly initially and the difficulty of picking up information inaccuracies in the administrative data. Ongoing data validation processes are needed to maintain a high quality list of school details. With the extent of staff turnover in schools, contact people and their details are particularly likely to change over time. Trying to ensure details are up-to-date is important to communication efforts.

Email is the primary means of communicating with registered school contacts and its continuation was a key recommendation of the project evaluation in 2006. However, the increased use of spam filters for emails has impeded this avenue and therefore the promotion of C@S in 2008. The spam filters have been found to be blocking many notification emails sent to contacts in registered schools. Attempts to find new software which enable personalised bulk emails rather than a group recipient list are continuing in order to overcome this challenge.

One of the concerns to be addressed with C@S was to ensure ABS standards of privacy, security and confidentiality were met. To encourage participation, careful consideration was given to these issues. The project is run on the basis that no individual student can be identified. A 10% confidentiality rule has been applied to the random sampler facility which means that for any set of required specifications, if a random sample is to be generated there needs to be 10 times the sample size selected in the database that meets the specific criterion requested in order for the sample to be produced. In other words if I select a sample of 50 right-handed girls from postcode 3000, there will need to be 500 students with those same characteristics for the sample of 50 to be generated.

Furthermore, no personal identifiers are collected and no individual student response to the questionnaire can be tracked. Students are given an 'opt-out' option in the questionnaire if they do not wish for their responses to be added to the central database. Before accessing the questionnaire response data, users have to agree to the condition that the data accessed can only be used for teaching and learning purposes. The results are not released for any commercial benefit or to any outside organisations.

7.9 Project funding and costs

With the high strategic importance of the C@S project and strong support from the Australian Statistician, funding was made available for the extensive work needed to begin and run the first national C@S in Australia. Following its huge success, funding was provided for the second run moderated to take into account the reduced amount of development required and the different organisational climate (i.e. being run in a non-Census year).

The cost of running a C@S project varies from year to year depending on phases of development, implementation and data usage. The costs were obviously highest in the initial development of C@S in Australia when it was also used to promote the 2006 Population Census. The expenditure on C@S was approximately $520,000 in 2005/06 and $450,000 in 2006/07. For the second run in a non-Population Census year, the cost is expected to be $280,000 in 2007/08 and $180,000 in 2008/09.

7.10 Project audience

The target audience of the project's communication strategies is the education sector. This includes teachers, students, parents, education institutions, education media and other education stakeholders. Direct communication with schools has been in the form of written invitations to participate from the Australian Statistician to all State, Catholic and Independent schools along with an accompanying information pack. This pack included letters to be passed on to curriculum and subject coordinators, different sized posters, a brochure, school registration form and reply paid envelope. For 2008, information packs were again sent to all schools, addressed to Principals, including letters tailored to previously registered schools and unregistered schools.

7.11 Project dissemination

Many different avenues of presenting C@S have been utilised. These range from the website to raise awareness, mailing of packages to schools, magazine and journal articles, through to the successful media launch in 2005. The media has also disseminated the C@S message following a number of media releases, with subsequent articles in state and local newspapers in addition to radio grabs on various radio shows.

Website

As C@S is an online learning resource this domain is the main vehicle for presentation and dissemination. The C@S part of the ABS website is aimed at teachers and students, but being a public domain it can be used by any interested person. The Results section has summary statistics of the 2006 project and the Teacher area has access to the Random Sampler, Prepared Samples and Information Tables which are the primary means of disseminating data from the C@S database. Data have also been disseminated in school textbooks. Education Services have been approached by a number of textbook publishers enquiring about the use of C@S data in textbooks and/or associated websites. To date, C@S material has been used and referred to in both mathematics and geography textbooks. C@S has also been included as a learning resource tool in an interactive CD-ROM to aid in the teaching of mathematics.

The ABS website has an updated C@S Community section which builds on the input from teacher and student users. This initiative harnesses the opportunity to further involve C@S users around Australia by including their experiences and suggestions for use. Case studies and examples of students' work are displayed to illustrate how the data is being used in the classroom.

Marketing

Marketing of the 2008 C@S online learning resource has been wide and varied. Promotion has been conducted through a wide range of professional publications. Both print and online marketing vehicles have been used, with advertisements, articles, feature reports, sponsored links and events being the most widely used marketing tools. Key contacts within the education community have assisted in dispersing promotional materials to their constituents and relaying messages. Media have been utilised on several occasions to highlight key dates in the project cycle and to encourage participation.

Schools have also been faxed to ensure the message encouraging participation is getting through. This has been in response to difficulties with email filters in school systems blocking email communication of the bimonthly C@S newsletters. These e-Newsletters contain recent activities, information about future developments, highlights, school case studies and classroom ideas. Email notifications are also sent at key times along the project timeline informing recipients of each phase of the project.

Conferences and workshops

Further, attendance at education conferences in each state and territory and the delivery of face-to-face professional development training has increased the word of mouth marketing. Education Services representatives attend various teacher conferences and workshops across Australia to promote C@S. This includes free information sessions and professional development workshops for teachers at both primary and secondary level across Australia on the use of C@S data. Conferences provide the opportunity to meet a wide range of teachers and contacts in educational bodies and showcase the opportunities C@S provides. Trade displays are involved as are formal presentations to conference attendees. Promotional materials such as C@S rulers/calculators, pens, measuring tapes, stickers and mugs are distributed at these events. For conferences without a physical Education Services presence, fliers have been included in take-home satchels for participants.

7.12 Project evaluation

C@S has proven to be a high quality project, with positive feedback from across the education spectrum. A formal assessment of the C@S project was undertaken by an independent education body, Curriculum Corporation of Australia. The overall key finding was that "C@S is remarkably successful and all users are enthusiastic about its future use in their schools."

A multi-faceted evaluation strategy was employed that included:

- an online survey of registered schools to assess the C@S project in general, the website, registration process, questionnaire, teacher resources and data usage in the classroom,
- teacher evaluation at conferences and professional development sessions,
- focus groups of teachers and students to explore more deeply issues raised by the online survey,
- telephone survey to identify issues preventing schools from continuing past the registration process, and
- examination of Web Server logs for the C@S part of the ABS website.

The assessment reported that C@S had provided ABS with a leadership role in promoting statistical literacy. A key finding was "Teachers reported that in a significant number of classes there was an increase in students' understanding of data collection, use of data in an investigation and increased engagement in tasks using statistics."

In addition to the independent evaluation undertaken, further external reviews were conducted:

- through the Reference Group,
- from teachers on the subscription list for C@S,
- directly with education intermediaries,
- directly with teacher focus groups, and
- at conferences and teacher workshops.

Internally, reviews were conducted:

- from the management information set up within the C@S database,
- ongoing pilot testing at different stages of the project, and
- internal testing of the infrastructure supporting the project.

All improvements as a result of the feedback received were considered and implemented appropriately. These changes were then further tested with teachers before finalisation, to ensure that client satisfaction was met.

Teacher and education intermediary feedback has been extremely valuable to C@S 2006 and 2008. The information provided has been vital to further improving C@S and initiating ideas for overcoming the challenges of the project. As education intermediaries communicate directly with schools, they have also provided encouragement to participate and active support of the project in schools.

7.13 Further performance indicators

Data on a number of performance indicators are available to project managers throughout the project from online system reports. The reports cover Student Access Number activity (i.e. number of questionnaires completed) and account activity (i.e. school activity) by state/territory, school type (primary, secondary) and school category (Catholic, Government, Independent) and application usage. The application usage report shows how many times the questionnaire has been accessed and most importantly, how many have been completed. Such administrative reports enable constant monitoring of the project progress in the data collection phase and therefore provide the knowledge to guide future actions.

Further evidence of the effectiveness of C@S is that it has been accepted as a valuable resource within the education community. C@S data has been included in school textbooks for maths and geography, and various education websites have links to C@S as a learning resource. Furthermore, ABS is pursuing opportunities to form collaborations with software companies and developers to provide a seamless transfer of C@S data to emerging technologies such as graphics calculators, spatial software and spreadsheet applications.

To ensure that a high standard of statistical leadership is maintained, ABS is currently involved in StatSmart, a 3 year study with 45 teachers in Victoria, South Australia and Tasmania to evaluate the effectiveness and efficiency of the use of C@S data in the classroom, and to assess whether statistical literacy of both teachers and students has improved. The study, partly funded by the Australian Research Council, is undertaken in collaboration with four other external organisations, the University of Tasmania, University of New England, The Noel Baker Centre for School Mathematics and Key Curriculum Press.

A 2008 survey of secondary school maths teachers has just been undertaken by ABS Education Services in order to evaluate the services being provided. The survey included some C@S specific questions and found that 49% of teachers were familiar with C@S. Analysis of web usage has also begun with counts of the number of page views of the different types of C@S classroom activities in each month since their inception. A new web analytic tool will be available later this year to continue with more advanced analysis of C@S web pages.

7.14 Future direction

Education Services plans to run the C@S project on an ongoing basis, one in each Population Census year and once in between. After the current 2008 project, the next C@S will be in 2011, coinciding with the next Australian Population Census. Expansion of the number and scope of activities surrounding C@S will continue to be explored. For example, opportunities for use of new data visualisation tools are currently being explored. With the second data collection phase currently underway, the 2008 results will provide the opportunity to compare student characteristics at two points in time. This time-series of data will continue to build with each subsequent data collection phase. With an increasing number of countries participating in C@S and a set of common international questions in the 2008 C@S questionnaire, there is a much wider scope to directly compare Australian students' characteristics with those of other countries. The range and diversity of topics covered in the C@S questionnaire also allows teachers and students to begin to map a 'profile of the Australian student', covering their lifestyle, interest, opinions, school and environment.

As marketing of this project is crucial to its success, different avenues for reaching schools and teachers are being investigated and tested, in addition to strengthening the existing means. The web provides the ideal base to extend communication in more innovative ways. These include YouTube videos of interviews with C@S participants and chapters of virtual learning of C@S for teachers.