

IMPROVING STATISTICAL LITERACY

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1. Introduction

Improving statistical literacy is a very important activity of the ABS. There are two key target audiences

existing users
potential users of the future, most notably those in schools.

This paper briefly describes four groups of activities aimed at improving statistical literacy.

2 Sophisticated Users

They are predominantly seeking information to help them understand and interpret statistics. They can talk to our statistical experts of course, but often they want to "self help". Our web site (www.abs.gov.au) contains "Concepts, Sources and Methods" manuals for a number of our key statistics. Some examples include:

National Accounts
Balance of Payments
Foreign Investment
Government Finance Statistics
Consumer Price Index
Producer and Foreign Trade Price Index
Labour Statistics
Household Expenditure Survey.

They are also available on a CD ROM product known as the Statistical Concepts Library, together with details on the standard classifications.

These reference manuals are backed up by occasional user workshops, particularly when there are changes in concepts, sources or methods.

3. Less Sophisticated Users

We produce some educational material aimed at these types of users. I will mention some examples - they are available on the web site as well as in printed form

(a) Measuring Australia's Economy

"Provides national statistics, non-technical definitions and reference to further reading for over 50 major economic indicators currently used by analysts and the media to measure the performance of the Australian economy."

(b) Measuring Wellbeing: Frameworks for Australian Social Statistics

"A textbook concerning the conceptual organisation of social statistics in Australia. After describing an overall system of social statistics, it addresses each major area of concern (ie population, family and community, health, education and training, work, economic resources, housing, crime and justice, and culture and leisure."

(c) An Introduction to Sample Surveys: A User's Guide

"Intended as a basic guide on the use of sample surveys, for the purpose of conducting all types of research. The chapters correspond to the basic steps that need to be taken in order to successfully conduct a sample survey using a variety of methodologies."

A lot of the users of these reference books access them through public libraries. For these reasons, we have education programs for librarians. These programs are aimed at ensuring they have a good understanding of the range of material available from the ABS, including the reference materials mentioned above.

4. School Students

These are the future users of our statistics. There are long term advantages for us if children know how to collect, display and use statistics. Therefore, we have made it a priority to establish a section within the ABS responsible for servicing the education sector - it is known as the National Education Services Unit (NESU). It works closely with education departments and teachers' associations. Its activities are described below. We have found it particularly useful to have teachers on 6-12 month secondments to help us develop the various products and services.

The main role of NESU has been to assist schools in Australia to use ABS data.

The Unit has concentrated on providing access to ABS statistics for students, teachers and librarians in high schools throughout Australia. Key initiatives have been aimed at making it easy for teachers and librarians to use ABS statistics:

- Production of a Statpak catalogue highlighting those ABS publications with a high degree of relevance to school curricula;

- Maintenance of a school subscription system by which teachers and librarians can order ABS publications at a reduced price;

- Staffing of a query line for teachers and librarians with questions about ABS statistics and collections;

- Provision for a 30% discount on all standard ABS products purchased by school sector;

- Production of special school publication such as *Statistics A Powerful Edge*, and *Measuring Australia's Economy*;

Development of curriculum activities by teachers on secondment to the ABS that give practical guidance to teachers using statistics in the classroom.

Since 1998, the Unit has progressively adopted the world wide web as one of the main means of disseminating materials to schools. There is now over 600 pages of curriculum materials, including a number of publications targeting specialised subject streams. See <http://www.schools.net.au/edu/abs>. A shorthand description is shown in the Attachment.

Whilst past work has generally focused on the Study Of Society and Environment learning areas in which students think about how statistics can be used to describe and to make decisions about aspects of Australian society, the Unit is shifting its focus to encourage students to take up further studies in the statistics field. This is explained in more detail in the next section.

As a result, more emphasis has been placed on mathematics education and the Unit is now undertaking several new projects aimed at increasing students' interest in Statistics as a subject area. These are:

- Development of new activity sheets with statistical focus to be distributed through the education webpages and promoted widely to mathematics classes;

- Negotiations with publishers of mathematics textbooks to include Australian datasets in the exercises;

- Negotiations with electronic calculator distributors to include real datasets in the calculators;

- Collaboration with other education bodies to develop "data collection" projects;

- Investigation into making mathematics web content more interesting and engaging; and

Some materials have been produced with direct application to school mathematics curricula. *Statistics - A Powerful Edge* (ABS cat. no. 1331.0), a publication aimed primarily at middle school students (Years 9 and 10) of mathematics and information studies. The 1998 second edition is available free on the ABS web site together with teacher supporting materials.

5. Teachers of Statistics

This describes a development known as the Australian Statistics Education System being led by Dr Nick Fisher (development started when he was President of the Statistical Society of Australia) and myself (as head of the Australian Bureau of Statistics, the largest employer of statisticians). It covers primary, secondary and tertiary levels. The Curriculum Corporation has been assisting with the schools component.

The commencement of this development was on July 10 2002, the Australian Bureau of Statistics (ABS) and the Statistical Society of Australia (SSAI) hosted a meeting of the leaders of the statistical profession in Australia, including a high proportion of the Professors of Statistics, to discuss a serious emerging issue: the increasing shortage of professional statisticians in Australia. Attendees also included the President of the Australian Association of Mathematics Teachers, and the Science Advisor to the Federal Minister for Education, Training and Science.

The major employers of statisticians in Australia include the universities, Federal and State/Territory Departments and agencies, Australian Bureau of Statistics, CSIRO, pharmaceutical companies and financial sector institutions such as the NRMA and APRA. All are experiencing serious difficulties

recruiting an adequate supply of new Statistics graduates. The universities in particular are deeply concerned: the demographic profile of their statistical staff is such that many will be retiring over the next few years yet younger statisticians are simply not emerging from graduate programs to replace them. This is creating problems for both teaching and research.

This is coming at a time when the demand for statisticians is increasing. Information is becoming an increasingly important asset in many industries, where statisticians are essential for proper design, collection, analysis and interpretation of statistical information.

The problem is clearly one of lack of supply. Why the shortage of interest in Statistics as a career?

For those with good numerical skills, being a statistician can be a very rewarding career. This is a strong view held by those who have pursued such a career. Finding work has not been difficult (there are not too many unemployed statisticians) and the pay is good, although not too many statisticians make a fortune from their career. Nevertheless, some of the pharmaceutical companies are offering six-figure salaries in order to good quality recent Statistics graduates who have some bioscience training as well.

The meeting agreed that there appear to be three major components to a strategy which, when implemented in an integrated way, should reverse the current downward trend:

- (a) Interest students at Primary and Secondary schools in Statistics, so they are keen to learn more.
- (b) With their interest captured by what they have been exposed to at school, endeavour to attract them to major in Statistics at University.
- (c) Once they have graduated, seek to attract them to post-graduate study in Statistics, or to enter the job market directly.

5.1 Rationale

Statistical understanding is of increasing importance to ordinary life. Australians as citizens, workers and social participants are continually faced with data that they must understand if they are to make sensible decisions. Yet most Australians have a very limited grasp of even the simplest concepts for interpreting and using data in what is evolving as a 'data-driven' society. Such limitations are likely to have significant consequences for Australia's competitiveness, and for the quality of decisions made in people's lives.

Statistical capability is of growing importance to government, business and industry. Government decision-making, business management and industrial activities are increasingly dependent on transformation of masses of data into timely, actionable and trustworthy information. (The *Challenger* Disaster could well have been averted by applying sound statistical analysis to pre-launch data.) Evolving statistical methods play a crucial and central role in critical new sciences like Bioinformatics. In all of these areas, professional skills, research and innovation are required.

Yet, at the same time as there is an increasing demand for professionally trained statisticians in the workforce, demand exceeds supply and the supply (from the Australian tertiary system) is declining. There are now very few adequately trained Australian applicants for academic posts in Statistics in Australia. And the situation for employers is equally grim. The natural starting point for remedial action is with what is taught at schools. However, the ABS and the SSAI are committed to ensuring that school students attracted to the career possibilities of Statistics at school are encouraged to enter tertiary programs in Statistics and then move into the workforce as statisticians.

5.2 Objectives of ASES

1. To support Australian science and scientific research, and business and industrial innovation through the availability of high quality and appropriately trained statisticians and a statistically informed population.
2. To ensure that Australian school children acquire a sufficient understanding and appreciation of how data can be acquired and used to make decisions that they can make informed judgments in their daily lives, as children and then as adults.
3. To instil in more statistically able school students sufficient interest and enthusiasm for Statistics that they will seek to pursue tertiary studies in Statistics with a view of making a career in the area.

The ASES project will comprise four separate but inter-related components:

- (i) School education
- (ii) Undergraduate university education
- (iii) Postgraduate university education
- (iv) Careers advisory process.

Discussions will take place with key stakeholders in early November so it will be possible to report outcomes at the 2003 Statistical Days Conference.

Possible outcomes will be to agree on a national curriculum framework for teaching statistics at schools, with a centre for developing resource materials for teachers and students (ABS will be a major contributor); and increased specialisation of university level teaching and research in statistics - centres of excellence.

5.3 The overall system

The proposal may be summarised by two figures. Figure 1 shows the three educational stages and a possible approach and goals for each; and Figure 2 shows the support processes required to develop and facilitate each stage.

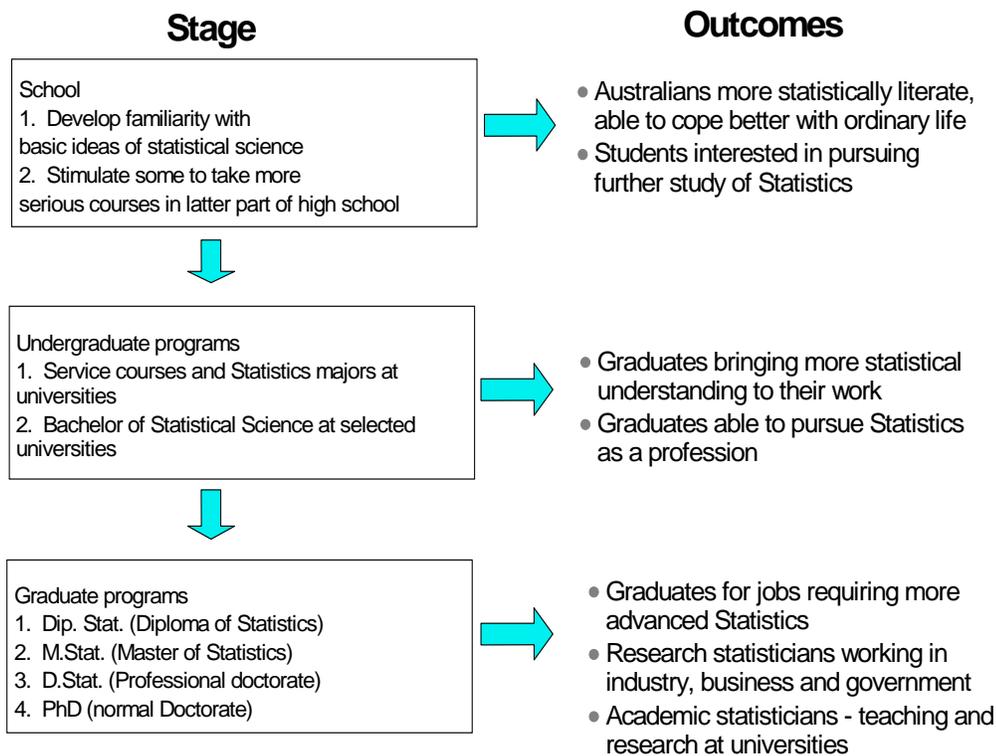


Figure 1: The proposed Australian Statistics Education System (ASES), with its teaching activities at school, undergraduate and postgraduate levels, and desired outcomes for Australian people, business, industry, government and academia.

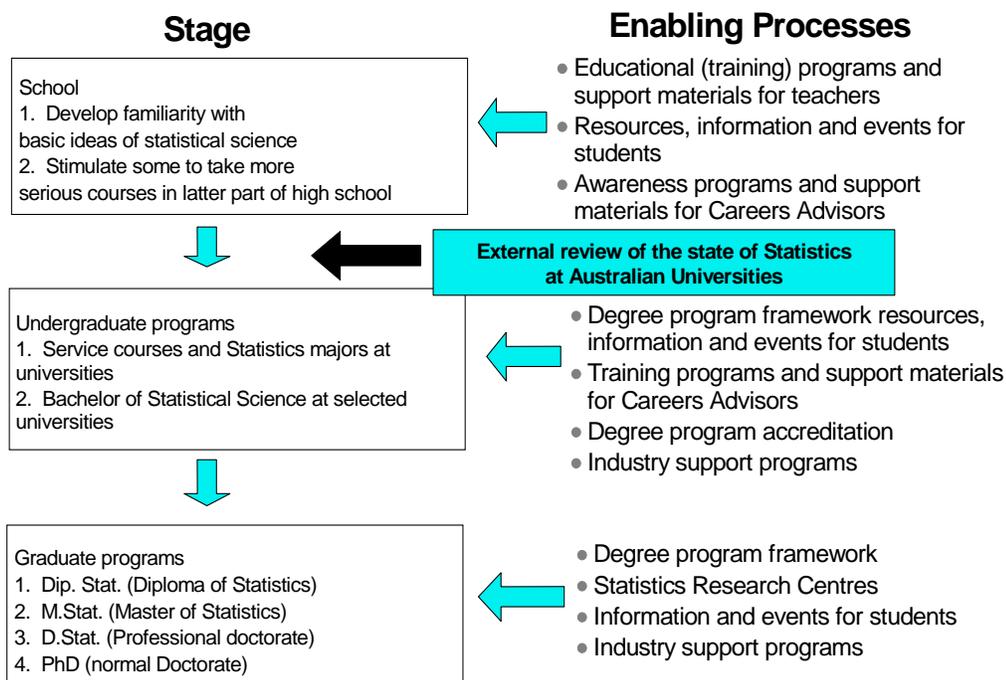


Figure 2: The main processes required to make ASES function appropriately.

These include educational and training programs for teachers and careers advisers, a one-off external review of university Statistics, to ascertain the current status, and Statistics Research Centres, supported by all interested parties, to provide advanced capabilities for teaching and research.

6. Conclusion

The ABS regards statistical literacy as important. It is a life skill that all people should have. Furthermore, the more statistically the population, the more likely they are to use the NSOs statistical products and services. This can only be good for the national statistical office.

Summary of Education Services Web Page Content

Lesson Plans

[Australia Now curriculum activities](#) - A series of lesson plans which utilise current data and information on this website and cover a range of Key Learning Areas and levels.

[Census Lesson Plans](#) - 17 Lesson plans based around the 2001 Census covering Society and Environment, Mathematics, English and the Arts from Prep to Year 10.

[Measuring Australia's Economy curriculum activities](#) - A series of nine units of work which conceptualise content in the national curriculum documents into the two key concepts of internal and external stability. The lesson plans focus on some of the main economic indicators highlighted in [Measuring Australia's Economy](#).

[Census KeyData Education Toolkit activities](#) - Classroom activities developed around the Census KeyData Education Toolkit.

[Australia's Environment curriculum activities](#) - A series of lesson plans based on the ABS publication [Australia's Environment, Issues and Trends, 2001](#).

Student Activities

[On-line Water Project](#) - participate in this interactive project and explore the issues surrounding water use and conservation in Australia. Developed by the ABS Education Services Unit in collaboration with myinternet Ltd.

[Website Indigenous Statistics Education](#) - WISE is an interactive classroom activity containing the most recent population information about Indigenous Australians.

[STATSERCISE](#) - A monthly student activity sheet containing information, quick classroom activities and puzzles.

[A Tale of Two Worlds](#) - An award winning interactive educational CD ROM designed to educate students about the Census. **A Tale of Two Worlds** will help students to develop an understanding of the processes involved in conducting a Census and the associated benefits which accrue to communities.

Statistical Concepts Resources

[Statistics A Powerful Edge!](#) - An on-line resource written for Australian students and teachers of InfoTech and Maths Stats. It contains easy to use information on all aspects of data collection and analysis with student activities.

[Key Steps in Running a Survey](#)

[Conducting a Research Project](#)

[Introduction to Classifications](#) - A simplified guide to statistical classifications.

Other Information

[STATPAK On-line](#) is a catalogue containing a range of ABS products and publications selected for their particular relevance to the curriculum, and sorted into key learning areas.

[TRIP](#) page. Each year the unit employs full time teachers from government and independent schools through the Teacher Release to Industry Program (TRIP) and other programs.

[Education News](#) details the latest information about the Education Unit's recent activities, upcoming events and conferences, and relevant new products and releases.

[Conference program](#) The Education Services Unit attends National and State based teacher conferences to demonstrate to teachers how to use statistics in the classroom.

[Projects page](#) Much Education Unit's work takes the form of project work that aims to increase understanding of various aspects of statistics for teachers and their students.