Chapter 3

Raising statistical capability: Statistics New Zealand's contribution.

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3.1 Introduction

Statistics New Zealand (http://www.stats.govt.nz/) has increased its investment in both internal and external Statistics training over the last few years. There are a number of reasons for this; to ensure increased general capability in the community to use Statistics resulting in better decision making, to maintain our own capacity to produce high quality official statistics and to ensure government officials provide advice to government that is based on sound statistical analysis. The need for intervention was identified by a lack of capability and recruitment and retention problems in the public sector.

A three-pronged strategy for enhancing statistical capability was developed. This comprises a number of initiatives to increase statistical capability and the majority of these involve some partnership arrangement (either contractual or collaborative) with Statistics educators. This chapter describes the range and type of initiatives that Statistics New Zealand contributes to.

3.2 Identification of need

Over the last few years managers within Statistics New Zealand were getting increasingly concerned that staff in the subject matter (output) areas did not have as high a level of statistical skill as in the past, and that it was becoming more difficult to retain skilled staff. Even in the methodology area there were recruitment and retention problems with more reliance on international recruitment and secondments from other agencies. At the same time a lack of quantitative skill in the state sector agencies generally was established by:

- a Victoria University of Wellington pilot study (Macky & Saffron, April 2004)
- Statistics New Zealand consultation with statisticians and policy managers in 18 agencies.

The areas identified for improvement were:

1. Basic quantitative skills
2. Basic statistical skills and literacy
3. Professional development
4. General statistical knowledge

5. Specialised areas of statistics (e.g. cohort and longitudinal analysis, measures of the economy)

These needs were subsequently endorsed collectively by Chief Executives of state sector agencies.

3.3 Official Statistics

One reason for Statistics New Zealand's investment in raising skills is that there are some fundamental differences between official statistics and other forms of statistics and research involving statistical analysis as given in Table 1.

OFOFFICIAL STATISTICS	'"OTHER" STATISTICS and RESEARCH
Multi-purpose (collect once – use often	Single focus (on research or policy question)
Participation often mandatory (high response rates)	Voluntary participation (lower response rates – potential bias)
Often based on complex sample designs	Often designed experiments
Broad coverage (many variables – often high-level measures)	In-depth studies
Large-scale (provide comparisons between groups)	Usually relatively small scale (experiments or surveys)
Usually repeated regularly (provide long time series)	Mainly cross-sectional (single point of time)
Internationally comparable (agreed standards and classifications)	Relevant to population studied (focused on research or policy question)
Analysis provided by collectors usually simple (single variable or between two variables)	Sophisticated analysis (multivariate analysis methods used)
Provide primary data source	Can involve secondary analysis (of other data sources)
High cost	Generally involve lower costs

Table 1: Differences between official and other types of statistics

Official statistics require balances to be made. For example, between: statistical and administrative needs; continuity (time series) and relevance (new statistics to meet emerging needs); providing access to data and maintaining individual confidentiality; burden on respondents and information needs; and providing objective baseline information and responding to policy demands. Official statistics also need to be 'fit for purpose'. As Athel Cornish-Bowden wrote in an email to Edward Tufte (Dec 18, 2006) when discussing John Tukey's famous 1977 aphorism (*An appropriate answer to the right problem is worth a good deal more than an exact answer to an approximate problem*) stated, "I prefer a slightly longer expression of the same idea that he (Tukey) wrote in 1962: Far better an approximate answer to the right question, which is often vague, than an exact answer to the wrong question, which can always be made precise."

3.4 Strategy for raising statistical skills

Statistics New Zealand reacted to the needs expressed above by developing a strategy for raising statistical capability. The strategy has three distinct parts: raising the skills of staff within Statistics New Zealand (initially called The Power of Numbers); enhancing the skills of other agencies, particularly users and producers of official statistics, in the state sector (Beyond the Numbers) and upskilling the public via communities of interest such as small businesses and schools (Understanding the Numbers). Communities and the general public were included in the strategy as it was acknowledged that '*official statistics are of no use unless they are used*' (Bill McLennan, past Australian and United Kingdom Government Statistician, 2004). Increasing the skills of members of the public in how to use statistics as either an information base or in local community decision making is likely to increase the overall use and, therefore, the value of official statistics.

The implementation of the strategy consisted of a programme of initiatives under each of the three parts. However, two key points needed to be taken into consideration in the construction of a plan of action.

Firstly, Statistics New Zealand is not an education agency and can only facilitate the learning of, rather than actively teach, Statistics. This means that initiatives had to be developed and implemented collaboratively with education agencies and course providers. The range of initiatives that were either already in existence or have commenced since the Statistics Education and Research (SER) team was established are shown below in Figure 1.

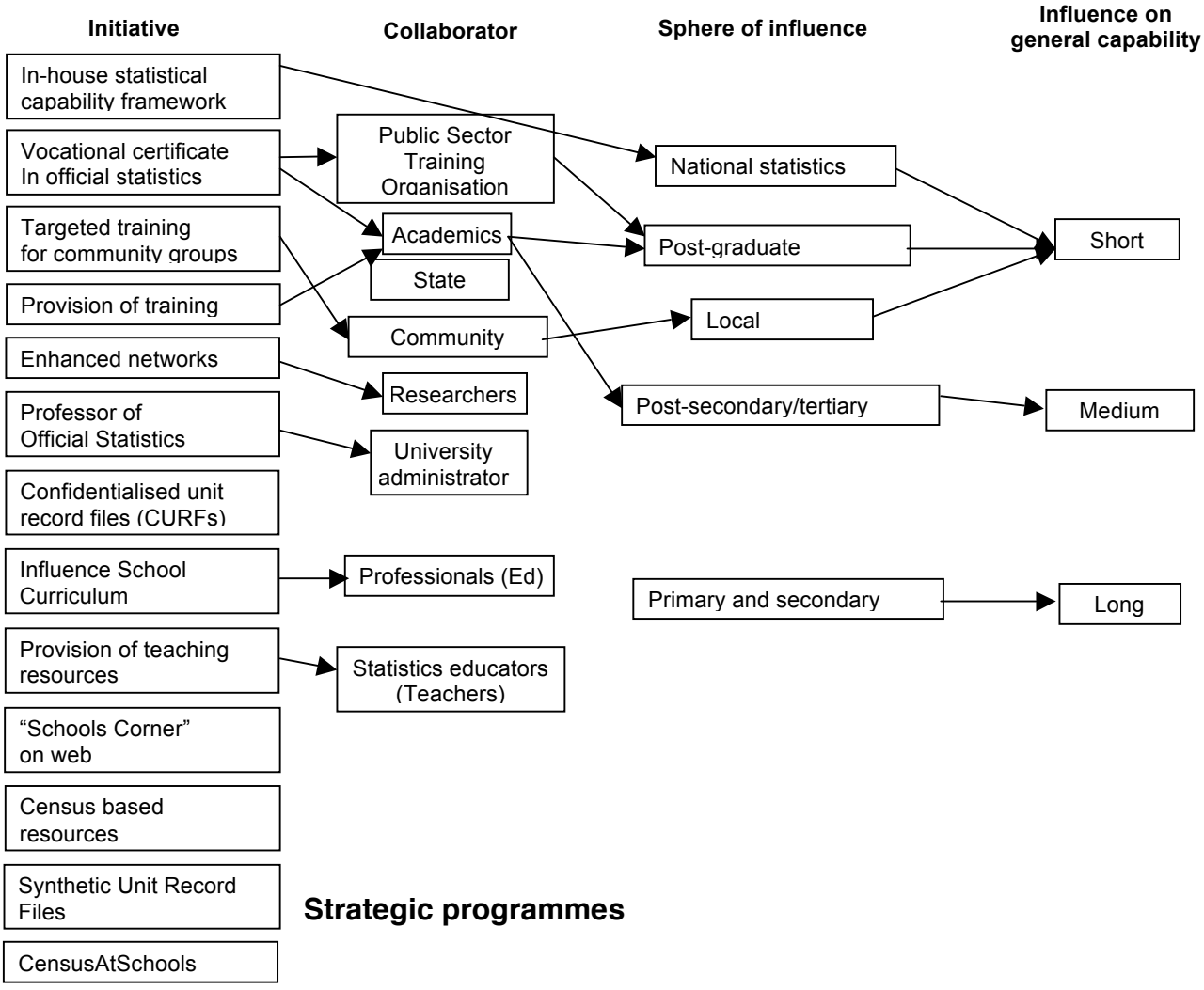

Figure 1: Raising statistical capability initiatives

The majority of the initiatives have resulted from working collaboratively with other state sector agencies or academics and the types of collaborators are given as well as the education level targeted and whether it is expected to have a short, medium or long term influence on statistical capability. For example, short term increases in capability are likely to result from targeting current users and producers of statistics, medium term increases by targeting tertiary students (the next set of employees) and long term increases by targeting the learning done within schools. The arrows in the figure show some of the links between initiative, collaborator, level targeted and influence on capability. Only a sample is shown.

Secondly, one agency alone cannot provide statistical training simultaneously for all community groups. The communities to be targeted annually were determined on the basis of either there being a 'window of opportunity' arising or a particular and critical need being identified. While there were already a few educational initiatives in place, implementing the new strategy involved focusing on and making a substantial investment of resources by Statistics New Zealand into 'Statistics Education and Research'. One of the existing General Managers was assigned to lead a small team (of four staff) in 2006 that was tasked with giving effect to the strategy.

3.4.1 The power of numbers

A challenge for any national statistical office is to maintain a high level of statistical capability within the organisation. Staff vary in their statistical expertise, and confidence, outside of that in their subject matter area, especially if they have a non-statistical background, such as social science, commerce and education.

'Statistical Core Capability' was developed as one part of the learning and development structure for staff: the Statistics New Zealand Capability Framework. This framework operates under a self-directed learning approach where staff, together with their manager, can identify their developmental priorities and learn in a manner that matches their preferred learning style. Statistical Core Capability describes the statistical skill and knowledge all staff should have, irrespective of their role and the business unit they work in. Staff are also expected to be familiar with work outside of their area, its potential impact on what they do and vice versa. The expected depth of skill and knowledge has been broken into levels that reflect the differing levels of statistical expertise expected. Non-statistical staff do not use statistical techniques as part of their work but they are required to have some knowledge about the workings of a national statistical office. This includes an understanding of issues relating to official statistics (e.g. confidentiality) and general statistics (e.g. measures of average, data types and being able to interpret basic graphs). At the other end of the spectrum, experienced statistical analysts are expected to provide statistical leadership: they should think critically about their work and proactively consider quality and ability of methodologies to meet their purpose. This includes an understanding of the analytical techniques used by a variety of subject matter areas. It is expected that Statistics NZ staff will have completed the basic requirements for all staff by July 2008 and will be using the Statistical Core Capability to determine some of their developmental priorities for the next financial year.

3.4.2 Beyond the Numbers

The aim of this programme of initiatives is to raise capability in state sector agencies (including Statistics New Zealand) and to make policy advisors aware of the power of statistics to provide an evidence base for decision making. There are currently three components:

Certificate in Official Statistics

The Certificate of Official Statistics is a vocational (pre-university) level certificate that provides a recognised qualification in official statistics. It was developed through collaboration with the State Services Commission (agency responsible for cross-departmental state sector issues) and Learning State (the agency responsible for training specific to the state sector). The certificate comprises four compulsory statistics units and some optional general units (project management, further statistics, research report, etc.). A group of academics from statistics departments in different universities agreed to work collectively to deliver the four compulsory units below:

a. *Interpret statistical information to form conclusions for projects in a public sector context* (delivered by the University of Auckland)
b. *Evaluate and use statistical information to make policy recommendations in a public sector context* (delivered by Victoria University of Wellington)
c. *Assess a sample survey and evaluate inferences in a public sector context* (delivered by Auckland University of Technology)
d. *Resolve ethical and legal issues in the collection and use of data in a public sector context* (delivered by Statistics New Zealand and School of Government, Victoria University)

This qualification is assessed on a competency basis with students being able to resit parts or whole units until they meet the required standard. The Auckland University of Technology was contracted to formally assess the units.

The Certificate was run as a pilot in 2007 with 15 candidates, the majority of whom came from within Statistics New Zealand. It is expected that students will take a year to complete the qualification. About half of the pilot intake have completed the compulsory units. Following the success running of the pilot a second cohort of 18 candidates outside Statistics New Zealand was enrolled in April 2008. The candidates are mainly from agencies other than Statistics New Zealand, such as NZ Police and the Department of Labour. Arrangements are already underway for a third cohort to begin in September 2008.

Official Statistics System Seminar and Training Series

The Official Statistics System Seminar Series (OSS Seminar Series) was formalized in 2006 with the creation of the Statistical Education and Research team. The Series is a monthly forum open to producers and users of official statistics with, in general, one speaker presenting on a particular topic. Seminar topics have included "Longitudinal developments at Statistics NZ" and "Ethnic diversity: What does it mean for public policy?"

The Official Statistics System Training Series is an ad-hoc attempt to provide basic to intermediate statistical training for the state sector. In the near future, the Series will

move to a formal structure similar to that of the above Seminar Series. The typical format of the training series is a one-day workshop with, to date, instruction from university statistical lecturers. Workshops have included "Truth, damned truth and statistics (understanding polls and what questions to ask)" and "How I learned to stop worrying and love the survey cycle."

Adjunct Professor of Official Statistics

The establishment of a half-time Adjunct Professor of Official Statistics (mainly funded by Statistics New Zealand was negotiated with Victoria University of Wellington). The professor has a co-ordination and leadership role providing tertiary training and research in official statistics, aimed at state sector employees and users of official statistics. That is to:

- promote official statistics as a career choice
- increase use of official statistics in academic and student research
- improve use of official statistics in the state sector
- enhance statistical capability of state sector.

The professor is located within the School of Government and an appointment was made early in 2007. The success of the professorship depends on the appointee developing personal relationships within Victoria University, across universities and across state sector agencies.

In the first year the teaching programme has been primarily in basic statistics for 'evidence based decision making' in both the Australia and New Zealand School of Government (ANZSOG) and Victoria University's School of Government Master of Public Policy. A course on Data Visualisation is currently being designed. Research activities have included:

- collaboration with a statistics department lecturer on a paper on estimating population size in voluntary organisations
- joint research with Learning State and Statistics New Zealand staff on the relationship between standards based assessment and retention in courses or programmes, with Otago and Auckland University to evaluate the impact on learning on the use of real datasets in school classrooms and with Auckland University on classroom resources for improving statistical literacy
- co-supervision of a PhD student doing methodological research in Official Statistics and supervision of a teacher on a Royal Society Research Fellowship (looking at factors associated with tourism and how these change over time in a small local authority), and
- helping initiative several Official Statistics research projects.

Network of Academics in Official Statistics

Universities have not been instrumental or coordinated in their engagement with the Official Statistics System (OSS) and the state sector has had little influence in setting

the direction of official statistics research and training within universities. Meeting the official statistical needs of the next decade will involve collaboration between New Zealand universities and state sector agencies. The establishment of a Network of Academics in Official Statistics (NAOS) is one step toward improving relationships with major users of official statistics in academia and the state sector. Statisticians from six of New Zealand's universities are currently members and a first collective bid for research funding was made in 2007. The network also provides the delivery of courses in the Certificate of Official Statistics.

3.4.3 Understanding the numbers

Statistics New Zealand has traditionally provided some training for community groups but this has been mainly reactive. However, there have been some targeted interventions. Examples include a pilot project done with three Maori (indigenous New Zealanders) tribal authorities and ongoing development of classroom resources for schools from official statistics. The primary community group targeted from 2006 to 2008 was schools as a 'window of opportunity and need' was seen with the introduction of a new *Mathematics and Statistics* national curriculum (Ministry of Education, 2008). However, several other groups were also targeted (as given below). A number of these focus on academics and indirectly provide support for the Professor of Official Statistics.

Academics

(a) *Official Statistics Research Fund*
A fund of NZ$500,000 annually has been available to enable state sector agencies to contract academics for methodological research in official statistics. It is required that projects are joint so that staff within the agency learn from the academic and that an implementation plan for successful projects be presented. To date, 32 projects have been funded in topics ranging from an investigation of user needs, creating synthetic data, regional spatial indices and small area estimates to improving methods for selective editing, confidentiality and estimating disclosure risk. Final reports are disseminated through Statistics NZ's on-line publication: *Official Statistics Research Series* and lead researchers also provide presentations at the Official Statistics System Seminar Series.

(b) Confidentialised Unit Record Files
An agreement signed in August 2007 between Statistics New Zealand and the New Zealand Vice Chancellors' Committee resulted in a statistical data package being supplied to New Zealand Universities. This was modeled on a similar agreement in Australia. Included in the package was access to microdata including basic Confidentialised Unit Record Files (CURFS). CURFs are unit record data that has been modified to protect the confidentiality of respondents while also maintaining the integrity of the data. Modification of the dataset involves methods such as top or bottom coding (giving all of a set of extreme points their mean value), capping (excluding extreme

values), data swapping, and collapsing categories to create a unit record dataset that can be made available. Researchers need to be approved then a basic CURF is made available on a CD-ROM and may be used for statistical, research or teaching purposes. An alternative product option is the "expanded CURF" that includes more detailed information such as a higher number of variables, or more detailed classifications. Approved researchers submit code by remote access (from their own desktop via the Government Logon Service (GLS) to Statistics NZ) for processing and return of the checked (for confidentiality breaches) statistical output. Information about the CURFs is currently being promulgated in the universities and interest has been expressed from geographers, social scientists and statisticians.

Small Businesses

Go Stats! commenced as a pilot programme in mid 2006 specifically for small and medium sized businesses. It was seen as an opportunity to

(i) return something of value back to the business community in recognition of their contribution to survey collections

(ii) create awareness of the range of official statistics available for business planning and / or increasing business efficiency, and

(iii) help build capability in this sector.

The pilot programme was successful and a wider series of slightly refined presentations, jointly hosted by Chambers of Commerce, were held across New Zealand during 2007. This resulted in further demand for presentations during 2008. Statistics NZ is currently working with Business Mentors NZ to increase their knowledge and understanding as they are key people working with and supporting the small business community.

Media

Statistics NZ has had minor involvement in media statistical upskilling in the past but saw the need to improve the numeracy skills and statistical thinking of journalists. In 2007 help was given to the NZ Journalism Training Organisation to create a compulsory statistics unit in their qualification aimed at improving (in the medium term) the media's use of numerical data in news stories. A Statistics NZ prize wasawarded to the student journalistwho wrote the best published article using appropriate official statistics. The first of these was presented at the end of 2007 at a dinner hosted by Statistics NZ and well attended by senior journalists. A Statistics NZ presentation explaining the importance of properly articulating the "story" behind the number and showing how graphs and percentages can add to an article was also given to the national conference of Journalism Educators of NZ.

Schools

Statistics New Zealand has traditionally supported schools by providing classroom resources usually focused on, and in part to promote, Census activities. The advent of a new draft national curriculum in schools (Ministry of Education (2007)) that, for the first

time, contained a stream on *Mathematics and Statistics* rather than *Mathematics* was seen as an opportunity to increase our support for teachers and ensure that they had access to data and teaching resources to support the new national curriculum. This is currently the major investment in community upskilling.

The new national curriculum consists of eight levels of learning across the entire school system, from new entrant to year 13 students. At each level students should learn in '*meaningful contexts'* **Statistical investigations (**using the statistical enquiry cycle), **Statistical literacy (**interpreting statistical and probability statements made by others), and **Probability.** The content in each of these gets more sophisticated as the level increases. For example in Statistical Investigations students at Level 1 should pose and answer questions, gather, sort, count and display category data and discuss the results whereas students at Level 8 should: conduct experiments using experimental design principles, conducting surveys, and using existing data sets; find, use, and assess appropriate models (including linear regression for bivariate data and additive models for time-series data), seek explanations, and make predictions using informed contextual knowledge, exploratory data analysis, and statistical inference; communicate findings and evaluate all stages of the statistics enquiry cycle; make inferences from surveys and experiments; determine estimates and confidence intervals for means, proportions, and differences, recognising the relevance of the central limit theorem and use methods such as resampling or randomisation to assess the strength of evidence (Ministry of Education, 2008).

In general classroom resources are developed using statistical literacy concepts (D. Ben-Zvi & J. Garfield, 2004) and based on the Wild and Pfannkuch PPDAC model (1999). As shown in figure 2 this comprises: problem specification (statement of research questions); plan (the procedures used to carry out the study); data (the data collection process); analysis (summaries and analyses used to answer the questions posed); conclusions (statements about what has been learned with respect to the research questions).

The different types of investments made in developing resources for schools are detailed below.

Schools Corner

Schools' Corner was introduced in the mid 1990s as a dedicated part of the Statistics New Zealand website (http://www.stats.govt.nz/schools-corner) for teachers and students. It contains background information to official statistics, tables, links and activities directly related to the curriculum including ideas and class resources using currently available official statistics (e.g. sheep and cattle numbers, migration figures, a sample class survey form in both English and Maori languages) that can be printed and used in the classroom. (New Zealand) Royal Society Teaching Fellows assisted with the design and production of resources for classroom use. Originally the site targeted both students and teachers, however in recent years the target has primarily been teachers.

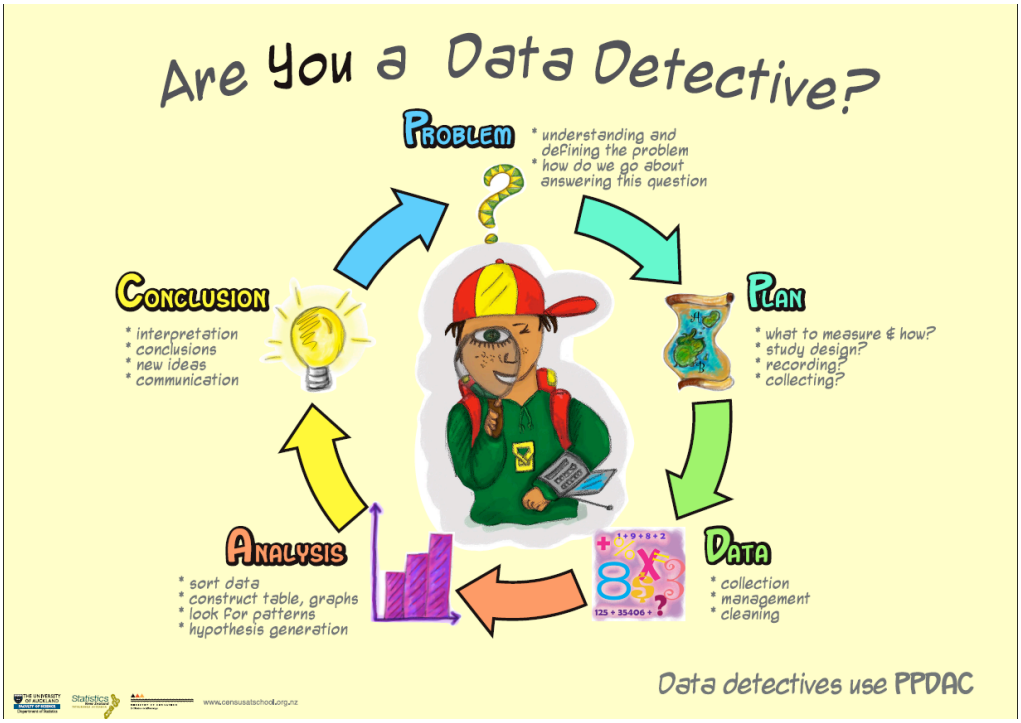

Figure 2 :The PPDAC model.

Included on the site are teachers pages that enable teachers to develop activities further and explore other relevant parts of the Statistics New Zealand website relevant to the curriculum. Other school resources such as the *2006 Census Education Resource* and *SURF for Schools* are available on the site to augment the hardcopy editions. A newsletter *StatZing!* containing activities built on Schools Corner is also sent out to schools three times a year. The site currently draws around 5000 unique visitors a month and is viewed as a key way to reach the schools audience and achieve greater statistical literacy. As the trend for the education sector to use more web-based products continues, Statistics New Zealand will continue to exploit the opportunities facilitated by new technologies and new avenues to reach the schools audience.

CensusAtSchools

CensusAtSchools is an internet based survey of school students begun in 2000 by the Royal Society Centre for Statistical Education in the United Kingdom (http://www.CensusAtSchool.ntu.ac.uk) but based on a New Zealand project done in conjunction with the third International Conference on Statistics (ICOTS III) in 1990 ('*A Children's Census*', Forbes, 1996). It was designed to provide students with experience in participating in a survey and access to a large, meaningful multivariate data set. The

CensusAtSchool was first run in New Zealand in 2003, then in 2005 and 2007 (by the University of Auckland under contract). Funding is currently provided jointly by the Ministry of Education and Statistics New Zealand. At present it is run in a number of other countries (United Kingdom, South Africa, Australia, Canada, Singapore and the United States of America) and a set of common variables was agreed to in 2007 to allow international comparisons to be made. Students enter their own survey data via the internet. A random sampler provides access to samples of 255 CensusAtSchool participants and a table-maker allows users to create univariate and bivariate tables which may be viewed graphically. Classroom activities are suggested (available in the 2005 report and also on the CensusAtSchool website (http://www.censusatschool.org.nz/). CensusAtSchool is targeted at, but not restricted to, primary and early secondary school learners.

Synthetic Unit Record Files (SURFs)

It was assumed that teachers of statistics would find real datasets a useful teaching resource for the new curriculum but National Statistics Agencies need to keep the information provided by both individuals and businesses confidential. In order to give teachers 'real' data that could be used to generate examples and resources to meet all the requirements of the new curriculum for both the primary and secondary school, including those listed above for Level 8, Statistics NZ staff with recent experience as secondary school teachers created a Synthetic Unit Record File (SURF) from the 2004 Income Supplement to the Household Labour Force data set. The records were not from real people, but were generated to have the same characteristics as the respondents to the survey (for the applications likely to be used by teachers). The SURF dataset has 200 respondents and seven variables (Age [15-44], Sex, Usual gross weekly wages and/or salary [$0-$2000], Hours worked per week in the first job [0-79], Highest qualification gained [none, school, vocational, degree], Marital status [married, never, previously, other] and Ethnicity [European, Maori, Other]). The variables were chosen so the dataset could be used for a range of statistical activities (from construction of tables and graphs through to simple regression).

29,000 people were involved in the June 2004 Household Labour Force Survey. Of these, 27,800 responded to the Income Supplement and 14,500 were aged between 15 and 44. From this supplement a Confidentialised Unit Record File (CURF) intended for use by researchers and tertiary students had been created. This age range defined the sub-population of the CURF used to generate most of the variables contained in the SURF (sex and ethnicity were generated from Census 2001 demographics). Figure 1 demonstrates how the original survey dataset, the CURF and the SURF are related.

The validity of the SURF was assessed for the results that learners would get using it (as compared to using the CURF). There were only minor differences for the univariate and bivariate analyses that the students would be exposed to (however, this may not be

the case if multivariate analyses were done using the SURF). Classroom teaching resources were also developed, two of which follow.

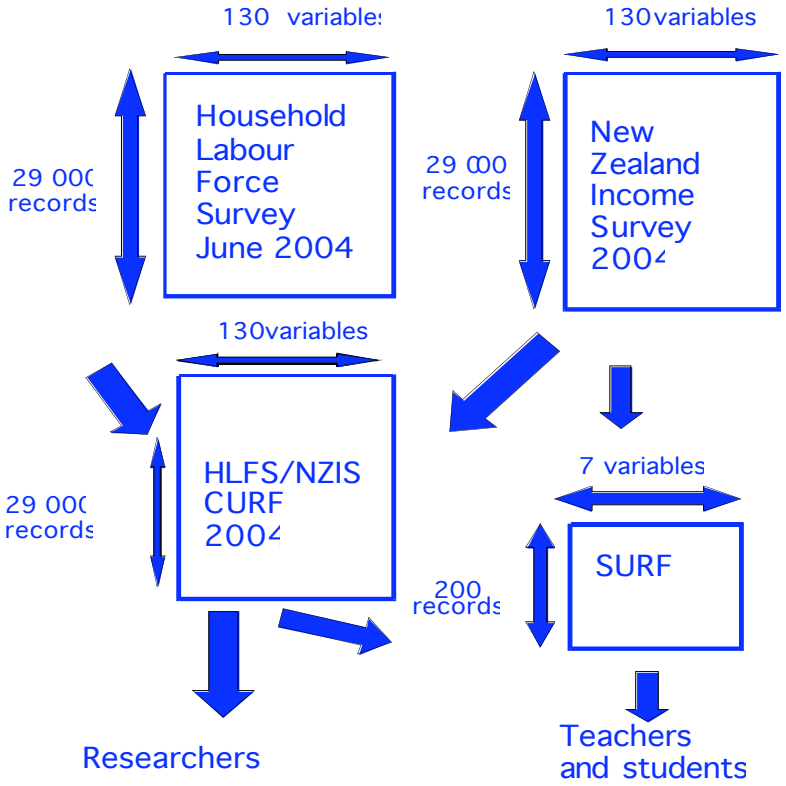

Figure 3: Relationship between the Household Labour Force Survey, the NZ Income Survey, the CURF and the SURF

Example 1: Am I Average?

- Plan: Working in groups, you are going to investigate what defines the average person by using the information collected for the SURF for Schools dataset.
- Data and Analysis: The group needs to:
    - Construct a frequency table for each variable in the dataset. Remember that some variables will need to be grouped.
    - Draw a different type of graph for each variable on the dataset. You must draw at least one histogram, one bar graph and one pie graph.
    - Do at least one calculation for each variable. Choose from: mean, median, mode, proportion and range.
- Conclusion: Write a sentence about what you have discovered for each variable. Design a poster which shows the characteristics of the average person from the dataset.

Example Two: Reducing company employee costs?

- Problem: A company is concerned that it has too many employees who do not work at least a 40-hour week. You have been hired by the company to investigate the working patterns of its employees. The SURF dataset can be thought of as representing the company's employees.

There are three main types of question that can be posed to help answer this problem; *summary*, *comparison*, and *relationship*. The type of question depends on the students' statistical knowledge and teachers need to be aware of their role in facilitating discussion on posing questions and not neglect this aspect of an investigation (Arnold, in press).

Examples of questions are:

1. What proportion of employees work less than 40 hours per week? *(Summary)*
2. Are these proportions different for males and females? (*Comparison between two category variables)*
3. Do males work more hours per week, on average, than females? (*Comparison*)
4. What is the relationship between hours worked and income? *(Relationship between two continuous variables)*

- Plan: use SURF data to calculate appropriate summary statistics and graphs that can be used to answer the questions posed above and identify the key factors associated with the number of hours worked.
- Data: A random sample of 35 records is drawn from the SURF.
- Analysis: Summary statistics and graphs can be used to answer these questions. Histograms, dot plots and / or box plots could be used to demonstrate the differences between males and females in hours worked per week and a scatterplot with a best-fitting (regression line) can be used to look at the relationship between hours worked and income.
- Conclusion: Report to the company answering whether their concern is valid.

Sample results: Table 2 gives summary statistics that can be used to answer questions 1), 2) and 3). The boxplot given in Figure 4 can also be used to answer 3) and the scatterplot in Figure 5 to answer question 4).

The summary statistics indicate that at least 50% of both the total sample and the total population (SURF) work 40 or more hours per week. In fact 66% of the sample work 40 or more hours and 34% work less than 40 hours per week. The sample summary statistics for the sample indicate that: more than 75% of the males work 40 or more hours per week; between 25% and 50% of females work 40 or more hours; the lower quartile for males is higher than the median for females and the mean number of hours worked is higher for males (45.5) than for females (26.4).

	Total sample	Sample by gender		Total SURF	SURF by gender	
(Records)	**(35)**	**Male(17)**	**Female(18)**	**(200)**	**Male(93)**	**Female(107)**
Mean	40.0	45.5	34.7	33.7	42.1	26.4
Standard deviation	11.9	8.4	12.6	16.2	13.2	14.9
Minimum	6	38	6	2	5	2
Lower quartile	38	40	27	20	39	14
Median	40	40	38.5	40	40	25
Upper Quartile	45	45	42	45	50	40
Maximum	65	65	50	70	70	60

Table 2: Summary statistics of Hours Worked by Gender

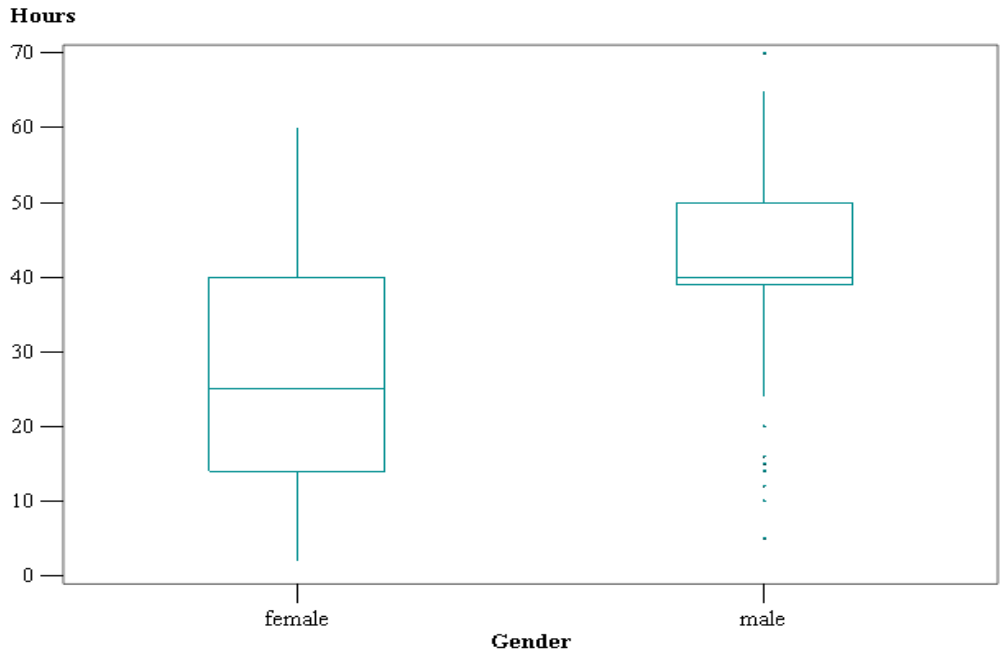

Figure 4: Boxplots of Hours worked per week by gender (for the total SURF

The box plots also show that the median hours worked for males is higher than that for females and most males work 40 or more hours per week but most females work less than 40 hours. There is a greater spread of values in the female data. Both data sets are skewed to the right (most values are small but there are a few quite large ones). In this case the mean will be greater than the median as is shown in the summary statistics.

A scatterplot for the total SURF (Figure 11) shows that there is a: range of incomes earned by employees working the same number of hours weekly, clump of employees working 40 hours weekly and a strong positive relationship between Hours Worked and Weekly Income (a tendency for income to rise as the number of hours worked rises). Students can fit by 'eye' the line that best fits their sample data and then calculate the formula for this. The 'best-fitting' line for the total SURF given on the scatterplot below is y=0.35+17x.

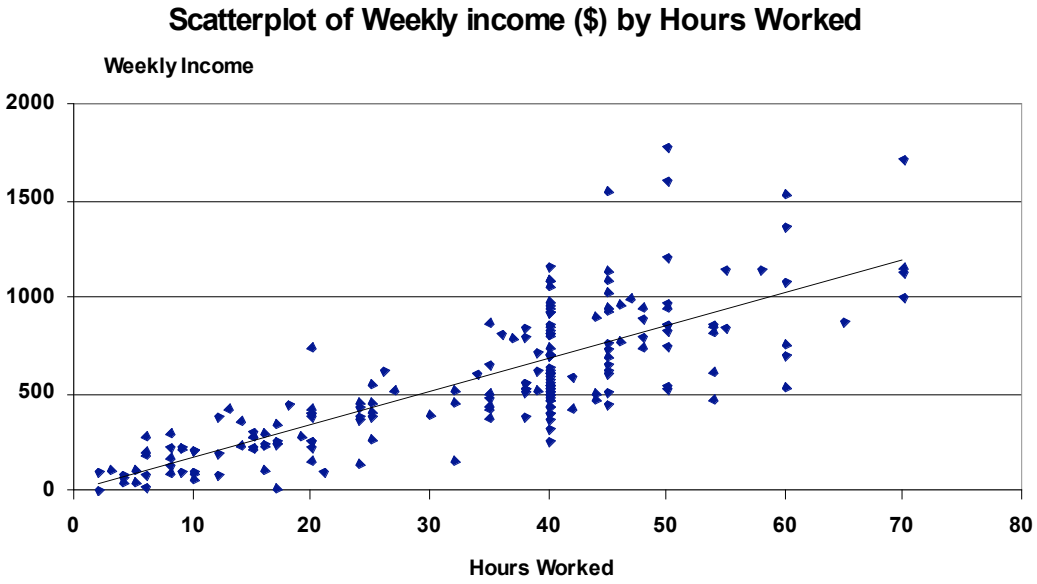

Figure 5

Sample conclusion: As roughly three-quarters of employees work 40 hours or more per week, this may not be as major a problem as the company thinks. However, there is a big difference between males and females with males working, on average, more hours per week than females so the company should consider the reasons why most of the women work part-time and look at policies that may enable them to work longer hours. As one would expect, in general, the more hours worked per week the higher the weekly income earned so there is a monetary incentive to work more hours.

This first SURF can be used to investigate resampling methods but obviously not time series as it only contains cross-sectional data (but other Statistics New Zealand data can, such as from the Household Labour Force Survey which can be downloaded in aggregate form from the website using Tablebuilder). The SURF has also been used to create examples for a chapter written for a book on Secondary School Mathematics for Statistics for teacher trainees (Forbes & Pfannkuch, in press). In this chapter a set of questions are posed for students such as: How do the sample statistics compare with those for the whole SURF?; Are sample sizes of 17 and 18 adequate? and 'points for teachers to ponder' given such as: Do tables or graphs give students a better sense of

the data?; Has any information been lost by summarizing the data; What does the 'best-fitting' line tell students about relationships between variables?

As a result of the demand for the first SURF a second one has just been approved by the Government Statistician using the Household Saving Survey. It has 300 records and 12 variables (Age, Partner status (lives with a partner or not), Age of partner, Sex, Ethnicity, Highest qualification, Labour force status, Annual wages/salary, Annual Total Income, Total debt and Total net worth).

3.5 Evaluation: Does the strategy make a difference

The steady intakes for the Certificate of Official Statistics and competition for research funding under the Official Statistics Research programme indicate that these are at least meeting a demand. Several research projects have been implemented in the methods used by Statistics New Zealand. The number of schools or teachers accessing a dataset can be viewed as a basic indicator of a datasets usefulness. In 2006 there were 2049 primary schools, 142 composite schools and 335 secondary schools in New Zealand (Ministry of Education, 2006). The total number of school students was 760,761; 482,769 in years 1-8 (approximate ages 5 – 12 years respectively) and 277,992 in years 9 and above (approximate ages 13 years and over). Table 3 gives the numbers of SURF datasets distributed to teachers and of the number of schools and students participating in CensusAtSchool.

Table 3: Uptake of datasets

Data collection	Number distributed/ participating
Statistics NZ SURF - requested via the internet - distributed at conferences, etc. - downloaded from the web - visits to the SURF main page	 85 approximately 350 181 734
CensusAtSchool 2003 -schools - students	400 Over 18000
CensusAtSchool 2005 -schools - students - downloaded data files	725 33205 8437 (as at 3 Jan 06)
CensusAtSchool 2007 –schools - students	505 25048 (as at 30 Sept 07)

Teachers can, of course, use more than one type of dataset and data is not readily available on the exact number of classes being taught statistics (as this becomes optional in the senior secondary school) so the proportions of statistics classes using

each resource cannot be calculated. The numbers above are very crude measures. Although there is some overlap, each type of dataset was targeted at different groups of students and they may each be accessed by different teachers and serve different learning purposes. There does seem to be a reasonable level of access to the datasets (for example 20% of all schools and 30% of all students in 2007 accessed the CensusAtSchool) which could imply that either New Zealand teachers find them useful or that they have few other statistical resources available for use in their classrooms. Another (subjective) measure of the usefulness of these datasets can be obtained by surveying teachers directly but to determine the actual impact on student's learning would require pre- and post-testing of students at a minimum (Forbes et al, 2008]). However, it is debatable whether or not detailed research would be a good investment of funds that could be used to create new projects for raising statistical capability.

3.6 Conclusion

Statistics New Zealand has invested in a wide range of projects to increase statistical skills within the department, in state sector agencies and in community groups in the general public. It is too early to determine the effectiveness of these interventions but the level of uptake and interest in these does suggest that they are meeting a demand.

3.7 References

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