THE ROLE OF NATIONAL STATISTICS INSTITUTIONS IN THE USE AND UNDERSTANDING OF OFFICIAL STATISTICS IN THE COMPULSORY EDUCATION SECTOR

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Statistics New Zealand, like many national statistics institutions (NSIs), is charged with increasing the use and understanding of official statistics in the wider community. This seemingly insignificant outcome is driving radical changes in the way NSIs communicate their statistics to their audiences. *One area where NSIs are increasingly working to communicate statistics is the compulsory education sector. Helping primary and secondary school students use and understand statistics is regarded as one of the best ways to promote the long-term use and understanding of official statistics. While there are many ways to build this statistical capability in young people, an emerging policy strand suggests that it is not realistic for NSIs such as Statistics New Zealand to embark on statistical education programmes of their own. Instead, it is argued that they should focus on three planks: encouraging agencies for education policy to place a high value on statistics education; influencing curriculum development (in statistics and other subjects) to include significant official statistics components; and providing targeted official statistics resources to support curricular components. This paper critically examines this approach to achieving the desired relationship between NSIs and the compulsory education sector, from a New Zealand perspective.*

INTRODUCTION

Like many national statistical institutions, Statistics New Zealand is reviewing the way in which it engages with the compulsory education sector. This paper outlines the history of Statistics New Zealand's involvement with the sector and the context within which the review is taking place. It also proposes a possible strategy for interacting with the government agencies, schools, teachers, parents and children involved in primary and secondary education.

A critical examination of the proposed strategy draws on ideas and comments from academics and practitioners in the field. Feedback in response to this paper will help formulate a final compulsory education-sector strategy for Statistics New Zealand.

STATISTICS EDUCATION IN NEW ZEALAND SCHOOLS

Statistics first appeared in the New Zealand school curriculum in 1928. The prescription for Standard 7 (fourteen year olds) included 'Graphical Arithmetic: including thermographs, bar graphs and simple statistical graphs of different kinds'. The introduction of social arithmetic in 1943 involved compiling tables and graphs, and in 1945 the new mathematics syllabus included 'Graphs of Statistics, interpolation' (Roberts, 1999). It was not until the 1970s that significant steps forward were taken in teaching statistics in New Zealand schools. Replacing mechanics with applied mathematics allowed students to choose from three options – statistics, mechanics and computing. Then, in the 1980s, mathematics and applied mathematics were replaced by maths with calculus and maths with statistics, and more upper secondary students began to learn statistics (Begg & Pfannkuch, 2004).

The New Zealand Curriculum Framework Te Anga Marautanga o Aotearoa (1992) (Curriculum Framework) included statistics as part of mathematics for students at all levels. It

emphasised mathematical processes, problem solving, reasoning and communications, as well as numeracy and information skills.

At the same time as the new curriculum was being introduced, New Zealand's national statistical institution was recognising that it had a role in supporting the teaching of statistics. In 1991, Government Statistician Len Cook's paper at the International Conference on Teaching Statistics discussed the role of governmental statistical offices in supporting students and teachers of statistics. The same year, Statistics New Zealand delivered a resource to all schools as part of its communication strategy for the 1991 Census of Population and Dwellings. By 1992, the changing information needs within communities and the need for students to develop skills in understanding statistics were being recognised. Time-series data were made available to schools through the computer package PC/INFOS SCHOOLS and a compendium was developed of relevant extracts from Statistics New Zealand publications.

In 1995, Statistics New Zealand set up an education section to develop a teaching resource for use in schools. The project, as part of the public communication programme for the 1996 Census, was intended to form the basis for a permanent relationship with the New Zealand school sector. Accessible data and statistical advice would be provided to students and teachers, and Statistics New Zealand would have a proactive role in the future direction of statistical learning in primary and secondary schools.

CHANGING CONTEXTS

Early in 2002, Statistics New Zealand published a new strategic document, *Strategic Directions 2002 and Beyond*. The document identified that increasing the use and understanding of official statistics had become a key goal for the organisation. Fledgling developments in broadening the reach of official statistics, such as those with schools, public libraries and community groups, would now become a core part of the organisation's mission.

Subsequent documents described the outcomes this new strategic direction was seeking to achieve in more detail. The *Statement of Intent 2004* articulates the intended outcome: "Governments, businesses, communities and citizens use official statistics on New Zealand's economy, society and environment to inform debate, research and decision-making."

Statistics New Zealand increasingly sees its role as one of empowering individuals and communities to access and understand official statistics, and then to use these statistics when making real-world decisions, whether they are about moving house, casting an informed vote or starting a business. This role goes far beyond the traditional role of providing statistics to government for policy use, and then providing further information to other users if and when possible, and at a cost.

The new approach has had profound implications for the way Statistics New Zealand deals with all its audiences, including schools. To bring clarity to this process, the organisation examined the wide range of potential users of official statistics to put together a picture of the user community. Three broad audiences were identified.

The public audience comprises all members of society who are wanting information in a personal capacity. The professional audience consists of professionals in the public, private and educational sectors who use and analyse statistics in policy-making and other high-level endeavours. The technical audience is made up of expert data users and professional and academic statisticians working in the area of statistical methodology.

Figure 1 represents the key concepts supporting this audience model, and is the most popular representation of the model within Statistics New Zealand. It shows that while the public audience is the largest potential audience in terms of number of people, each member of that audience requires only a small and uncomplicated set of data. As you work down the model, the size of each audience gets smaller, but the amount and complexity of the data required by users grows significantly.

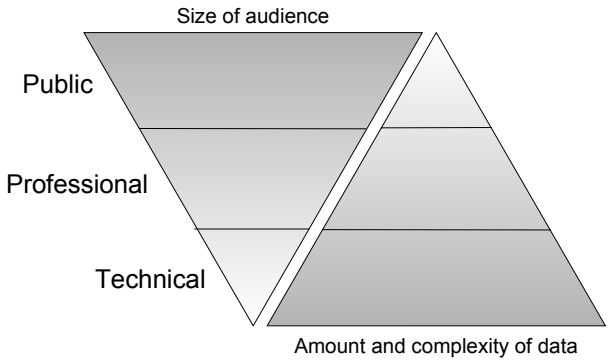

Figure 1. Statistics New Zealand's audience model.

Students within the compulsory education sector form a large part of the public audience. Others within the audience include community groups, ethnic communities and individual citizens. All these groups share broad characteristics in terms of statistical literacy, access to technology and interest in and awareness of official statistics.

Statistics New Zealand's change in strategic direction was echoed in the compulsory education sector. The Curriculum Stocktake Report to the Minister of Education (2002) recommended the curriculum framework and supporting curriculum documents be modified. Begg and Pfannkuch (2004) suggest that 'thinking' should be the major curriculum focus for the 21st century. Statistical, along with mathematical thinking will form a core part of the new curriculum. Changes will build on the 1992 curriculum, which focused on the 'doing' and the content, with the next step involving greater emphasis on statistical thinking. It is acknowledged that statistics play a significant part in other curriculum areas, particularly in science and social science. The new curriculum needs to link the aims of other subjects so that statistics taught within these areas are aligned with the approaches taken to statistics taught with maths.

A POSSIBLE STRATEGY IN RESPONSE TO THE CHANGING ENVIRONMENT

Statistics New Zealand's response to changing contexts has been to re-evaluate its strategy for engaging with the compulsory education sector. It is proposed that the organisation focus on encouraging education policy agencies to make statistics education a high priority; on influencing curriculum development (in statistics and other subjects) to include significant official statistics components; and on providing targeted official statistics resources to support curriculum components.

"Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write" (HG Wells, 1886-1946). A national statistical institution's role is to provide official statistics to allow government, businesses, communities and individuals to make informed, evidence-based decisions. To do this, people need to be statistically literate. Begg and Pfannkuch (2004) talk of the need for more emphasis to be placed on statistical literacy in the curriculum, as well as a new approach to defining the essential skills and abilities that a statistically literate citizen needs to participate in society. If people are to become active and critical citizens, NSIs need to influence education policy agencies to ensure that statistics education has a prominent place in the curriculum.

Madden and Crust (1989) say that "the analysis of real data which is of some personal significance can be much more rewarding for students than the completion of exercises containing second hand data". The GAISE Group (2004) recommended that "pupils use real datasets, that active learning is fostered, and that technology is used to develop conceptual understanding and analyse data". NSIs can provide rich datasets and access to associated reports addressing topics of social relevance which engage and motivate students. They can work with curriculum developers to ensure students – the present and future users of official statistics – are exposed to official statistics through

the curriculum. The use of official statistics in the curriculum will result in students becoming familiar with the data and competent to use it for ongoing decision making.

Ben-Zvi and Gal (2004) report that NSIs can play a unique role in helping improve the statistical literacy and knowledge of a range of users, including students, because they have the ability to support learners in examining and interpreting statistical data in meaningful contexts related to diverse thematic areas. Through their knowledge of the data, NSIs are able to develop targeted resources to support the teaching in the curriculum. Their standard product development processes enable them to deliver resources appropriate to the needs of users.

A CRITICAL LOOK AT THE PROPOSED STRATEGY

Like many NSIs, Statistics New Zealand has a culture of testing the assumptions that underpin proposed strategies. As part of this process, this section of this paper takes a critical look at the proposed strategy outlined above. For each of the three strategic planks of the proposal, the validity of this path is examined, and the supporting arguments exposed. Additional possible strategies are also offered and analysed.

The first key strategy is influencing curriculum policy to include a significant and identified statistical component. Why should NSIs play a role in influencing the structure of the compulsory education curriculum? A government's educational expertise generally lies within its education ministry, whose core business is to ensure the education system delivers skilled and knowledgeable citizens who can contribute to a nation's economy and society.

Increasingly, these educational experts are placing a high value on statistics education, and creating a place for it within curriculum structures. What value can an NSI get from preaching to those who are, effectively, converts?

The responses to these criticisms lie in the processes undertaken by the education sector to develop curriculum structures and programmes. In New Zealand, the curriculum is required to be connected to real-world practices, and to access this knowledge through consultation. In many instances, NSIs are key players in the statistics sector. These organisations have a critical mass of statistical professionals and a highly developed understanding of the role statistics play in government, business and community life.

In many instances, professional input by the statistics industry is actively sought by statistical educationalists engaged in curriculum development. Views expressed by Statistics New Zealand have a real influence on curriculum development outcomes, particularly in the crucial area of how the outcomes of the statistics curriculum meet current and emerging real-world needs for statistical literacy. Begg and Pfannkuch (2004) reinforce this when they suggest the voices of both academic and professional statisticians need to be considered at various stages in the curriculum development process.

Also instructive is what has happened in education sectors where educationalists have led the drive to show statistical education leadership. Initial, promising developments have foundered when pressure from third-party institutions has waned. A level of complacency in stakeholders such as NSIs has resulted in statistical curriculum development stagnating. Examples of this can be seen in parts of the tertiary sector in New Zealand, Australia and the UK.

The second plank involves influencing educators to include the study of official statistics in all relevant curriculum areas. Many of the arguments explored above, both for and against, apply equally to this strategy.

There is a risk of NSIs crossing the line between influencing curriculum development and directing the delivery of a particular statistical education programme. NSIs are generally not equipped or resourced to do the latter – it is the core business of the education sector. It could be argued that NSIs could best avoid wading into the core business of educators by keeping curriculum developments at arm’s length.

In practice, great value can be obtained for students, teachers and official statistics systems when NSIs promote the study of official statistics across the school curriculum. Students who

understand the value of official statistics and the role they play within a nation's economy and society are better equipped to assess the relevance, quality and independence of statistics when making decisions based on quantitative data.

Further, teachers are not always aware of the role official statistics play, as this strengthening concept has not yet penetrated professional circles widely. Gitlin and Magonis (1995) discuss the difficulties that arise when curriculum development has an uncomfortable fit with teacher knowledge. Influencing curriculum developers to find a place for official statistics across the curriculum will help overcome this experience gap and ensure that official statistics ideas are learnt by students.

The third plank of the strategy requires NSIs to provide resource material on official statistics for use within the classroom. But why should NSIs put resources into this work? Surely, if the curriculum requires official statistics to be taught, educators will develop the required resources themselves?

In reality, educators must always balance resource development priorities against time, money and skill restraints. The considerable data knowledge required to create teaching resources for official statistics provides a real barrier to investment in resource development, whereas Statistics New Zealand has extensive institutional knowledge of official statistical data. It can offer teachers and students access to resources based on up-to-date data that has been collected through explicit and credible methodologies. The data available to statistical agencies cover a very wide range of topics that reach far beyond what students can collect through their own, classroom-based efforts (Ben-Zvi and Gal, 2004). This, allied with mature product development processes, allows NSIs like Statistics New Zealand to create educational resources at a comparatively low marginal cost by repurposing existing products for other audiences to match curriculum needs, or by creating new products to meet educational needs and then using these as a basis for products for a wider audience.

One barrier NSIs face is lack of practical classroom experience. Statistics New Zealand has found that this barrier is easily overcome by collaborating with classroom teachers in producing educational resources. Currently, two teachers have fellowships to work within Statistics New Zealand's product development business unit, allowing them to access the product development and data expertise the organisation offers. It is envisaged that this will lead to the development of resources that use best practice processes and are relevant to classroom teaching. Such resources have the best chance of being both useful and effective.

While there are some good counter-arguments to criticisms of the three planks of Statistics New Zealand's proposed strategy for engaging with the compulsory education sector, it is important to acknowledge that alternative strategies are available to NSIs.

One option is for the NSI to become a direct provider of educational services to school-aged children. Such a strategy is most attractive when attempts to promote statistics as part of the school curriculum fail. It is unlikely, however, that an NSI would ever command the resources required to effectively deliver such an education programme. This approach would also fail to effectively utilise the best resource in delivering statistical education - teachers. As educational experts who have access to the nation’s students, teachers should be central to any education strategy involving official statistics.

Another option is to supplement compulsory education channels by teaching school-aged children during their extra-curricular activities. There is little opportunity for such an approach in New Zealand. Most organised extra-curricular activity revolves around sporting, artistic, cultural and religious activities, and is generally not appropriate for educating about official statistics. Few organised activities revolve around social sciences and statistics, as these subject areas get high quality and quantity exposure through compulsory education channels. Such a strategy may be appropriate in countries that struggle to provide universal primary and secondary education, but in New Zealand, which has compulsory education to age 16, such an approach would have marginal benefit.

TESTING THE STRATEGY

Statistics New Zealand is undertaking projects that actively test its proposed three-pronged strategy to build statistics education. This paper is one such project. It places the strategy firmly in the critical gaze of many of the world's foremost statistical educators. The feedback and discussion elicited by this paper will help Statistics Zealand refine and consolidate this crucial strand in its objective to increase the use and understanding of official statistics.

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