SOME CASE STUDIES ON THE LINKS BETWEEN NATIONAL STATISTICAL OFFICES AND STATISTICAL EDUCATORS: WHAT ARE THE MAIN DEVELOPMENTS?

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It is important for National Statistical Offices to work with statistical educators. Improved statistical literacy will mean that their outputs are used more extensively and with more wisdom. The paper will be based on a series of case studies of what is being done in seven countries around the world to improve the link between National Statistical Offices and statistical educators (or teachers), especially with supporting resources. The focus will be on schools. As well identifying some the most important initiatives, I will try to draw some lessons on the way forward.

INTRODUCTION

This paper is largely based on desk top research of the web sites of seven countries–Australia, South Africa, USA, Finland, United Kingdom, Hongkong and New Zealand. Although these countries are from different parts of the world, my choice was limited because language limitations have forced me to look only at those web sites that are in English. They are not necessarily the most active countries. Other active countries such as Canada, Italy and Portugal are discussed in detail in the ISLP study discussed below.

When I was well advanced in the preparation of this paper, I discovered an e-book published by the ISI's Statistical Literacy Project (ISLP), *Government Statistical offices and Statistical literacy* (available on www.stat.auckland.ac.nz). Having now studied this important resource, whilst there is some overlap, I think this paper largely compliments the ISLP e-book by providing comparative analysis across countries.

What does the ISLP e-book provide? It also covers seven countries–USA, Portugal, New Zealand, Canada, Finland, Italy and Australia. For each country, there is a paper describing the role of the Government Statistical Offices in improving statistical literacy. There is also a direct link to the relevant part of the web site.

There are three reasons why official statistical agencies should support statistical education. First, I believe it is a role of official agencies to encourage students to consider a career in statistics. This is in their long term self-interest. Therefore, providing support to the teaching of statistical concepts is important from this perspective. Second, there are those students who are potential future users of statistics (e.g., economists, environmentalists) and support their understanding and knowledge of statistics is also important. Third, there is a moral responsibility to improve statistical literacy within the country as well as helping to ensure official statistics are used.

There seems to be increasing interest among Government Statistical Offices in this project. As quoted in the ISLP e-book:

> It is a hidden secret that some Government Statistical Offices are doing as much as or more for statistical literacy of their countries than Academics, Departments of Education and Statistical societies.

As implied by this quote, some countries are making efforts to improve the statistical literacy of the general public (e.g., The 'Understanding Statistics' page on the ABS web site). Whilst this is an important activity the focus of this paper is on schools rather than the general public.

The next section outlines provides details of products and services based on these case studies. The final Section draws out some conclusions on how official statistical agencies can work most effectively with schools (teachers and students). I have used both 'educators' and 'teachers' in the paper, reflecting the practices of different countries. They should be interpreted in the same way.

In C. Reading (Ed.), *Data and context in statistics education: Towards an evidence-based society. Proceedings of the Eighth International Conference on Teaching Statistics (ICOTS8, July, 2010), Ljubljana, Slovenia*. Voorburg, The Netherlands: International Statistical Institute. www.stat.auckland.ac.nz/~iase/publications.php

The longer version of the paper provides an analysis of the services provided by each of the seven countries included in the case studies. Space limitations prevent this detail from being provided in this version but the longer version is available on request.

PRODUCTS AND SERVICES PROVIDED BY NATIONAL STATISTICAL OFFICES

This section provides a summary of the different type of products provided by National Statistical Offices based on the seven case studies. Although countries providing each type of product or service have been designated in brackets this has been done primarily for cross-referencing with their websites etc. I may have missed activities undertaken by the countries. It does not include the products and services provided by the American Statistical Association in USA or the Royal Statistical Society in United Kingdom.

The ASA and RSS have the dominant role in the USA and United Kingdom respectively but in all other countries studied the National Statistical Offices have the lead role with the national statistical associations often playing a supporting role.

It is probably not possible, or a wise use of resources, to provide the full range of possible products and services to support statistical education. Priority decisions have to be made. Priorities depend on the circumstances within the country such as the strength of the national statistical society and the resources it can devote to statistical education, the resources NSOs can devote to statistical education, the extent of NSO association with curriculum development and the level of statistical literacy within the country.

The main activities on the case studies are:

a) Designing special products (e.g., books, e-products) to support curriculum. This may include subjects such as economics and environmental statistics, not just mathematics and statistics. (Australia, US, Finland, UK, New Zealand).
b) The promotion of existing publications and other NSO services with schools and making them more easily available (e.g., through libraries). (Australia, US, Hongkong, New Zealand).
c) Assisting those preparing curriculum material with official statistical data to include in this material. (Australia, South Africa, New Zealand).
d) Census@Schools (Australia, South Africa, New Zealand).
e) Special education web pages on the NSO website. (Australia, US, Finland, Hongkong, New Zealand).
f) Newsletters aimed at teachers. (Australia, Finland, New Zealand)
g) The preparation of lesson plans and supporting data sets based on official statistical data. These have to be aligned with the curriculum to be useful. In addition Statistics New Zealand provides a unique microdata service based on actual household surveys. (Australia, US, Finland, UK, New Zealand).
h) On-line ‘learning’ games (Australia, US, New Zealand).
i) Support of professional development programs for teachers. (Australia, South Africa, New Zealand).
j) Explaining prominent official statistics such as the Consumer Price Index. This could be done through e-courses (eg Finland) or talks (eg Hongkong). (Australia, Finland, Hongkong, New Zealand). These services can also be important for the general public.
k) Assistance with curriculum development on statistical education. (Australia, South Africa, New Zealand).
l) Competitions for students to promote statistical learning. (South Africa, Hongkong).
m) Educational visit by teachers to the NSO. (Finland).

In my view the most important services are (a) with (c) and (g); (d); (e); (i) and (l).

CONCLUSION

What have we learnt from the case studies?

a) Census@Schools

This is a very worthwhile program well regarded by those countries that have instituted the program. It should be seriously considered by all countries. There are a number of attractions. Statistical surveys are an increasingly important source of data in the information age. Census@Schools provides a practical application of a survey from the design of the questionnaire through data collection to data processing and analysis. It becomes more meaningful because students can choose at least some of the topics to be included in the data collection.

There is also an international network with international conferences, workshops, etc to discuss a range of issues of interest. This supports development of the service as well as allowing countries to learn off each other. The RSS is at the centre of this international collaboration.

There have been moves to have at least some of the questions common across countries. When this data is loaded to an international data base it allows students to make comparisons across countries. This has been an objective of the program but there has been some drift away from this objective as countries have tended to do their 'own thing'. I think it is important that this objective is reaffirmed as it is a very useful way of providing students knowledge of differences between countries and increasing their level of interest in the data analysis.

There is another important lesson that has been learnt. The program has to be conducted on an annual basis not just in Population Census years. Otherwise, there is a significant loss in momentum because teachers can't utilize the program as part of their annual teaching cycle. The restart costs can be quite considerable. Even when running on an annual basis, the administrative costs to teachers in registration etc have to be kept to a minimum or they will lose interest.

b) Link to curriculum

Statistical education products and services are likely to be far more useful and relevant if they are linked to the curriculum. Engagement with those responsible for implementing the curriculum should be fundamental step before designing and producing education materials. It is unlikely that resources will be used to any great extent unless they are linked to the curriculum.

This is not just the mathematics curriculum of course. Education resources based on official statistics could be very useful for economics, environmental studies, geography and social studies.

Some countries are being provided opportunities to contribute to the development of curriculum and this can be a very worthwhile long term investment in the statistical literacy of students and subsequently the public.

c) Use teachers to help prepare materials

Teachers and students have special needs. Products and services should be designed with these needs in mind. Teachers are often best equipped to provide the necessary advice. They are familiar with how classrooms work in a contemporary setting. The ABS, for example, has hosted teachers who have been seconded to work for the ABS for a period of time. Their assistance has proven invaluable in design, promotion and providing access to teacher networks.

Specifically, the ABS has also found that these teachers can also be very useful in marketing the developed products and services. They have the right contacts and have knowledge on the best media for attracting the attention of teachers.

d) Make it easy for teachers – lesson plans, data sets

It is stating the obvious but statistical education products and services are much more likely to be used if it is easy for teachers to use them. Lesson plans based on the available products and services are possibly the most useful way. These will often involve some analysis or interpretation of data. Supporting data sets can also be a useful way of making it easier for teachers.

e) Need to train teachers

Many teachers of statistics do not have formal training in statistics. Many in fact may not even have advanced training in mathematics. It is not surprising that many are reluctant to teach statistics. The ABS is involved in a longitudinal study looking at the impacts in the training of teachers. Whilst the study is still in its early stages it is already showing the advantages of teacher training especially when linked with the use of resources that aid teaching of particular statistical concepts. As well as lesson plans, data sets, etc to aid teaching, National Statistical Offices should consider training of teachers when releasing statistical education products and services. This is not always easy given the large number of teachers involved and has to be arranged in collaboration with Departments of Education, Conferences of Teachers, etc. There has to be heavy reliance on on-line training resources. The best way to support inquiries from teachers also has to be considered.

Without some effort put into training, there is a high chance that statistical education resources will be underutilised. Recently retired teachers might be able to be used to assist with training and other tasks. This approach was used by Statistics Canada for example.

f) Electronic products

In a modern teaching environment, the focus must be on electronic products. They also have to be designed in a way that they are stimulating and useable for both teachers and students. The internet can be a great way of accessing services or providing data bases that might support education resources.

The NSO web page is a great way of supporting education resources and keeping them up to date. Teachers are now also more willing to use web based resources. However, it is important to have a special education page that is clearly visible.

g) Resources including data sets, must be topical and relevant to real life and fun

This almost goes without saying. However, traditionally the teaching of statistics in schools has been theoretical and a real turn off for most students. The exceptions are those that enjoy algebra and the more conceptual aspects of mathematics. However, the most important need for most students at schools is to teach statistical thinking or statistical concepts without going deeply into the mathematics that underpin these concepts. Furthermore, these concepts are much easier to understand if they can be illustrated by real life examples that are relevant and meaningful to them. The resources provided by National Statistical Offices should be designed with this in mind.

If the statistical applications involve real life data, where students have been involved in the design and collection of data sets, the applications become much more meaningful and interesting for students. This is one of the advantages of Census@Schools. It is also possible to set up experiments to achieve a similar objective.

h) Need to promote use of official statistical data in text books and elsewhere

If resources are to be used, they need to be promoted. A multi-pronged approach will need to be used. It is generally not sufficient to rely on one promotion channel. They also must be vehicles used by teachers. Possibilities are:

- Electronic Newsletters (assuming an up to date email list exist)
- 'Teachers Corner' on NSO websites (although this needs to be promoted as well)
- Newsletters produced by Departments of Education, Teacher's Associations, etc perhaps with links to more detailed information on the NSO website
- Conference of teachers – presentations, workshops or booths.

Teachers are bombarded with information. If promotional material can be distributed or disseminated by those who already have good access to teachers, then it is more likely that the material will be read.

Conferences can be most important because the environment at Conferences is such that teachers are wanting to understand new developments. When they can be arranged, workshops can be extremely useful way of talking directly to teachers.

i) Staying aware of teacher needs

As with other statistical products and services, user feedback is important. This is probably best targeted at teachers who will generally be able to speak on behalf of their students. Again a multi-pronged approach may need to be taken.

- User surveys can be used but there are often difficulties getting good response rates. Teachers can change schools quite frequently so it can be difficult to obtain an up to date website.
- Focus groups of teachers
- Allowing for feedback on the website.
- Encouraging feedback when participating in Conferences.

FINAL REMARKS

In conclusion, support for statistical education is an increasingly important role for NSOs. Modern technology makes this more viable. Although there is still a lot that can be learnt from exchanging national experiences ICOTS can play a valuable role in this exchange of information.