# TIGHTROPE WALKING, EDUCATIONAL ISSUES AND STATISTICAL SOCIETIES

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*Diversity can be both the beauty and the beast for the statistical profession: diversity of problems, of areas of interaction, of workplaces and of jobs. Statistical societies play the dual role of representing and servicing their variety of members, while simultaneously representing the statistical profession and statistical sciences in the wider community, where statistical issues can arise in everything from education to data analysis issues to government enquiries. In education, issues can range from accreditation, all levels of school and post-school education, national standards, interaction with business and industry, government and public policy, but all involve education in the broad sense that includes outreach, and all involve balance for the profession and its societies. Brief visits to a number of recent challenges in Australia, illustrate key issues for statistical societies.*

## STATISTICAL SOCIETIES

By the nature of the discipline, all of statistics, no matter how theoretical or applied, is motivated by, and interacts with, applications to at least some extent, and the applications range over just about all fields of human enquiry and investigation. Thus statistics and its professionals can become involved in an amazing variety of areas and workplaces, many of which include outreach in all its forms. As a Society *is* its members, so it is to be hoped that statistical societies are able to represent this variety as much as possible, but such representation must therefore involve balance and compromise in some way. Often the representation is the feedback and networking of members pursuing their aspects of work and commitment to their profession, with the feedback and networking through the Society providing the support for the members. Sometimes the Society entrusts individuals to act as they see best in representing the profession and the Society. And sometimes the Society acts as the body representing its members, pulling together as best it can the diversity that is inherent in the discipline and profession of statistics. This all sounds smooth, but in practice it can feel like a balancing act on a tightrope, and it is a tribute to the profession when its societies achieve a balanced representation. Perhaps it is the need for statisticians in their work to be communicators, interacters and balancers, that enables them also to successfully cooperate in their societies and makes their societies vital contributors to the whole profession.

## CONTINUING EDUCATION.

Some think of continuing education *for* statisticians, and some, *by*, and there are some exciting aspects in which the two coalesce. Continuing education for statisticians is much more than updating of skills; a major component is and must be, renewal and awareness of motivation and applications. The introduction of accreditation for statisticians has increased discussion of how and to what extent statistical societies should provide “continuing education” for their members. “Updating of skills” is a delicate issue, not only because of the immense time pressures currently manifest in professional workplaces, but also because of the implications of judgement of which skills to update and how. Often in professional areas, individual updating can be the most efficient. However, like other professionals, statisticians appreciate efficient and effective help where it is needed, and the most successful updating mechanisms seem to lie within special interest sections of a society, where more closely allied interests and workplaces give rise to more clearly identified needs and means of meeting those needs. That is, which skills to update and how, should come from members. The renewal of motivation, and the awareness of developments and applications, are, of course, essential aspects of conferences, symposia, meetings, journals, newsletters, and networking, and the lasting value of these activities cannot be emphasized enough. It was the need for networking and support that was a prime motivation in the formation of the Young Statisticians’ Section of the Statistical Society of Australia (SSAI) after a Young Statisticians’ Professional Development Workshop in Canberra in 1993. Such workshops had been held as joint efforts of two or three Branches of the SSAI, but the 1993 meeting had a national flavour, and was the precursor of what has become the annual WAYS - Workshop for Australian Young Statisticians.

Continuing education by statisticians of workers in other areas is a relatively newer activity of statistical societies, being more commonly activities of institutions, and not only the universities. However, the needs of school teachers, some specific other areas, and generally in business and industry, are influencing considerations, and this is an area in which statistical societies can play at least a networking and supporting role, particularly in view of scarce resources, especially human and time. In Australia over the last six to eight years, a number of very successful workshops held specifically for industry by the Industrial Statistics Section, gave rise recently to three-day Australian Conferences on Industrial Statistics, bringing industry and statisticians together. It is of great interest to note that, in only the second of these, held in September 1997, statistical

education made its way into discussion. There is some similarity already in these conferences to the Mathematics-in-Industry Study Group, which was started by mathematicians in CSIRO in 1984, to bring together mathematicians and problems from industry in an annual three-day concentrated brainstorming session. Such direct interaction of industry and professionals is a coalescence of continuing education for and by both parties.

## ACCREDITATION

In most countries where accreditation of statisticians is underway or in the pipeline, the emphasis is on the practice of statistics, with the challenge of the appropriate balance of education and experience, and the compromise of neither too tough nor too low criteria. The recently introduced Australian model, like the UK model, allows that there can be individuals whose natural ability and experience far outweigh lack of formal training, but there is also emphasis on the importance in general of sufficient and appropriate statistical education. Accreditation always raises the issue of whether courses should be accredited. The Australian model puts the emphasis on accrediting individuals, including their educational background. Although there will be thus some de facto accrediting of courses in the education component of the criteria, this recognises that courses constantly change, that statistical education tends to involve more choice on the student's part than the "professional" courses with fairly prescribed structures, and that statistics groups are usually part of other groups. The Institute of Actuaries has a similar attitude when considering exemption requests for some of their papers; that is, the details of the actual subjects studied by the student are regarded as important. It is of interest to note the increasing demand by employers for honours graduates in areas such as mathematics and statistics. Employers quote the demonstration by honours graduates of increased depth, commitment, staying power and problem-tackling abilities, beyond what one would expect for just one more year. The Australian accreditation model reflects the employment value of an honours (or equivalent) degree.

A central objective of accreditation of statisticians is education of the community, a public declaration that there is a statistical profession, the good practice of which is not acquired lightly. Publicising this is a challenge, particularly as it is not a case of a one-off,

but rather a continuing, publicity drive. Associated with this is the need to provide career information that represents the diversity of statistical jobs, workplaces and people, but that is readily updateable. Paper linking to electronic forms together with linking to institutional information, seem to offer the best options for ongoing and effective career information. Again, societies play vital roles here, but again the linking with the work of individuals and institutions is a key issue.

GOVERNMENT POLICIES AND PUBLIC RECOGNITION.

It is amazing how unaware some areas of government (and the media) seem to be of the existence of a statistical profession, let alone such an organisation as a statistical society. For example, in 1997, an official national government enquiry of a statistical nature was brought to the attention of the Council of the Statistical Society of Australia by a Society member. When it was brought to the attention of the enquiry that perhaps the enquiry should have contacted the Society, the news of the Society's existence seemed to be a revelation to those conducting the enquiry, with considerable consequent consultation. The most amusing aspect was the astonished reaction to the information that the Society was actually represented on the Australian Statistical Advisory Council. A national radio interview of the Society's president during the 1994 national conference elicited the revealing comment from the interviewer that he "had no idea there was such a body as the Statistical Society of Australia, let alone that there were over 300 delegates at a week-long statistical conference! How do you fill a week?" In matters of raising government and media awareness of statistics, it is important to link in some way with other mathematical, scientific and technological areas, and it is clear that it is the scientific areas other than life sciences that in particular need their profile raised. It seems to be extraordinarily difficult in Australia to persuade a mostly humanities-educated media that a significant portion of the population, particularly amongst young people, is interested in science and technology. The Federation of Australian Scientific and Technological Societies, including the Australian Mathematical Sciences Council, of which the Statistical Society of Australia is a member, is a political lobby group which after slow beginnings, appears to be making some headway. The Australian Mathematical Sciences Council has also become involved in much more than profile-raising, particularly in educational matters. Its member societies include mathematics, applied and

industrial mathematics, mathematical education groups, and operations research, with the Australian Institute of Engineers holding enthusiastic observer status.

## SCHOOL EDUCATIONAL MATTERS

Although statisticians have often expressed concern about the lack of, or the nature of, statistical education in schools, the key for statistics in school considerations is to work closely with mathematics for a number of reasons. Statistics is part of mathematics at school level, and further education in statistics, whether for users or mainstream, depends crucially on sound quantitative confidence and development of problem-tackling skills, that is, mathematics in its broad sense. At the school level mathematics is separated from science; recognition of this separation is necessary to both mathematics and statistics. It is also important for statisticians to influence the teaching of mathematics at school level, not because of including specifics about statistics but because of influencing the broader quantitative issues of modelling, problem-tackling and applications. Finally and possibly most importantly, it is a constant battle to get authorities and governments to involve and take note of those at the cutting edge and the receiving end of educational matters - the practising teachers, the professional mathematicians/statisticians, and the students - and it is a battle best fought in unison.

School matters of interest do not just start at the secondary school level. Statisticians, as in all quantitative areas, are ultimately dependent on the quality of “mathematics” in its broad sense, at primary school as well as secondary school, and the politics of primary and lower secondary school education is a minefield. For example, in recent years, attention and furore about national statements and national profiles demonstrated to mathematical, statistical and scientific professionals, just how much influence had players who should be peripheral or supportive. Currently the Australian government is pursuing “benchmarks” in literacy and numeracy, but their use of the word benchmarks is inconsistent with most international usage, being remedial criteria rather than aims for the majority of selected age groups. Initial attention is at primary school level, but the input of experienced mathematical educationalists was ignored more than once. Intense political lobbying brought educationalists and mathematical/statistical representatives together but it is yet to be seen whether any notice will be taken of their work. However it was very clear that the primary school educationalists and the

mathematical and statistical professions had a great deal in common compared with other players, and that mathematical/statistical involvement is valuable at all school levels.

At the high school level, this input is even more valuable because of the very great importance of more direct interaction between the professional and the educational worlds, and between university and school teachers, particularly in such a developmental-dependent area such as mathematics. This is a need for direct input on statistical education at the senior school level, but still the key is working with mathematics. Statisticians with sound communication and educational experience are increasingly valued by teachers and secondary school authorities, particularly at the senior school level. Their mathematical and educational input is valued as much as their statistical; preparedness to help teachers understand statistics and connect with real world problems, is greeted with gratitude and delight. Statisticians' input on technical matters of moderation, scaling, testing, and assessment modelling and data handling, is also becoming more recognised and valued. This again is an area in which statistical societies do best by support and networking of individuals' work, with care to emphasize constantly cooperation of all "teachers".

## POST-SCHOOL

The ongoing challenges of statistical education at the tertiary level are:

- the balance and integration of development in practice and theory in mainstream courses (i.e. ones that ultimately lead to professionals);
- the coordination of mainstream and service courses;
- meeting the current and future needs of students in other areas under the quadruple pressures of little course time, increasing needs of other areas, decreasing quantitative backgrounds, and significant decrease in resources with insufficient support for the mathematical and statistical sciences; and
- the ongoing problems caused by statistically-unqualified teaching in other areas, in which crimes against statistics are committed on students with the least defences. Other areas might like to "own" a statistician, but such staff need links and networking with other statisticians.

Despite resource pressures, there is exciting work being done in the first three

areas above, with the key again being interaction: with influence of real applications, with problem-tackling and holistic approaches, with linking with schools as input and business and industry as output. This is again an area in which statistical societies facilitate the sharing and networking, and hopefully can move to the stage of coordinating experiences and resources for the information and benefit of all members and the profession.