



January, 1995

This issue contains Peter Holmes' notes on the deliberations and recommendations of one of the working groups on curriculum issues at the 4th International Conference on Teaching Statistics (ICOTS-4) held in Morocco, July 1994. The next issue will contain the reports of the Spanish- and Arabic-speaking working groups.

THE STATISTICS CURRICULUM TOWARDS THE YEAR 2000

ENGLISH-SPEAKING GROUP

More details about the availability of the full report may be obtained from Peter Holmes, Centre for Statistical Education, Probability & Statistics, University of Sheffield, Sheffield, S3 7RH [Tel: 0742-768555 ext 4117, Fax: 0742-824292, E-mail: p.holmes@sheffield.ac.uk]

The statistics curriculum must be appropriate both for educating students who will become lay users of statistics and also for preparing the ground for those who will become professional users. It may not be possible or desirable, given the existence of different cultures, to reach an international consensus.

It is difficult to motivate the students and their teachers. Problems are encountered in incorporating everyday events into teaching, and in training teachers. There is a need for more statistical specialists to be teaching in schools. Teaching resources, such as data banks and projects that work, must be developed. Increasing use must be made of technology, but keeping up with change is hard.

Traditional curriculum content has been typified by: graphs and averages for primary schools; formula-based content, set-based probability and hypothesis testing at secondary level. It should be changed to introduce the language of chance and experimental based probability in the primary school; to develop data collection, making inferences, and EDA in secondary school; probability models and confidence intervals in upper secondary. The communication of ideas and results must be included, and more of statistics should be covered by teaching across other subjects. Students need to learn how to choose and use appropriate tools such as calculators and appropriate computer programs.

Statistics is what statisticians do, rather than what they know. We should move towards an emphasis on process skills, linking content and approach in statistics with scientific method. For students of all ages, probability and statistics need to be integrated to form a coherent course for statistical literacy. Australia shows the way by having a strand called Chance and Data, in contrast to other countries' emphasis on data-handling. Simulations can be used to integrate probability and statistics. Even some official data are samples rather than complete surveys so are subject to random error. Newspaper articles often have many references to probability as well as statistics. Probability also integrates with statistics in the realm of decision-making (even at an informal level).

The statistician has a responsibility to educate and teach beyond the narrow bounds of a sanitised statistics. Even EDA is not content free. Can we make visible the preconceptions we bring to data analysis?

International Association for Statistical Education

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The traditional approach is characterised by 'represent data, compute average', is textbook centred and is formula-based. Instead, the emphasis should be on using data to draw conclusions; understanding concepts, e.g. average as balance; linking probability and statistics; on applications that use real data, and on examples from the media; Students need experience of projects and investigations, of interpreting data; and of seeing statistics used across the curriculum.

We need to look at how learners learn, and base our teaching on their prior experience. Concepts tend to build rather than come as a whole. The curriculum approach should be cyclical to build up in this natural way. Students should be given opportunities to discuss ideas and to be challenged by new ones. Exploratory approaches to data analysis should be encouraged, giving students more time to think. They must be helped to learn to reason with uncertainty. Problem-solving should be an integral part of any course in statistics.

Our forms of assessment influence what we teach and what pupils and teachers see as important. We need to change our assessment procedures to match our aims, to encourage good content and good balanced learning. Teachers should be more involved in the assessment process.

We need to develop good assessment tasks to encourage good teaching. Projects that are assessed are more valued, but more time is needed for this.

Usually there is less emphasis on assessment in the primary and early secondary schools so here is the place to build good teaching and learning before the distorting effect of inadequate assessment procedures takes hold.

Statisticians as well as teachers can influence assessment. We should encourage a variety of assessment forms to cover all aspects of learning statistics. We should also assess the effectiveness of different types of teaching to determine which enable students to gain greater understanding.

Calculators and computers are tools of the statistician's trade. Our courses should enable students to use them appropriately. They can also be used to help learning.

Graphic calculators, spreadsheets and statistical packages all have their role.

Using computers increases the importance of information handling, databases and simulation. The fact that they can do the calculations means more emphasis can, and should, be on principles and process rather than on techniques.

Many teachers do not want to know about technology changes. Teachers lack the time to prepare for and to manage change. They also lack confidence in teaching statistics at the school level. Many still feel they lack competence. In some places, they avoid teaching it if they can. Current teacher training courses do not prepare teachers for teaching statistics. Most innovations are brought in without sufficient forward planning. Initial and in-service courses are needed to prepare teachers for change.

Some training can be done by having teacher and student working together on a project. It may be that teachers learn best in the way we would have them teach - through active participation. When treated in the right way, as colleagues rather than recalcitrant recipients, teachers can be very flexible and learn to adapt very quickly.

Teachers, as well as their students, have problems with anything new, which may include statistics. There is also resentment with a curriculum thrust on them from above. People bring their own mind sets with them. Any curriculum change needs to address these needs.

The division of the curriculum into different subject areas hinders cross-curricula work. Students themselves keep things in compartments and do not integrate across subjects. Mathematics teachers are often reluctant to discuss the social and ethical problems raised by looking at real data.

Different cultures interpret priorities in statistical education differently. This is one implication of saying that the aim is to prepare students for their society. It is therefore not possible to come up with fully identical recommendations for all cultures.

Are our courses in statistical education reflecting the views held by the community - especially those represented by parents, by governing bodies of schools, etc.? We

should not be too far out of step, and therefore we will have to educate the public as well as our students.

Some aspects of statistics can be a real challenge to faith or to the political process in some countries. Such cultures and countries will need to face this challenge.

Is statistics part of mathematics or should mathematics let it go? Statistics makes mathematics more interesting. Within mathematics, statistics can still be compartmentalised. Statistics is not as black and white as much of mathematics, and so it sits uneasily within it. Even so, mathematics is still the place for numeracy, so responsibility may continue to lie there. Nevertheless, we should be aware of the dangers inherent in this.

For specialist statisticians, a tension was detected between mathematical statistics and data analysis. The traditional training of preparing, analysing and presenting data is supplemented with different techniques and emphases for different specialisations.

The impact of computers on teaching and learning statistics was discussed. The present situation, of disorganised and fragmented software, of continuous upgrading of packages, of in-house software that is largely unknown and only locally tested, is not satisfactory. Spreadsheets are still young and untested. Software to teach experimental design is lacking. New improved packages tend to be more interesting to staff than to students.

Computers are revolutionising statistics; they are starting also to revolutionise learning. Interactive software is better than electronic textbooks, which tend only to duplicate traditional books. It may be syllabus course-driven, problem-driven or assessment-driven.

We want many things from our software - to keep our jobs, to raise public perceptions and to reach our target audience.

For some students it is acceptable for the computer to be a 'black box' that does the work - but insight into what is being done still needs developing. Other students need to know in detail the statistical process being carried out by the computer.

Service courses pose different problems. There are diverse expectations between the statistics and other departments. There must be good communications between them, with actual examples being used in the teaching.

Many countries are experiencing either a growth in the number of students or a growth in the number of those with poor mathematics. There, the challenge of teaching statistical concepts without the mathematics must be met.

If we are to develop our courses we must get feedback from our students. Total Quality Management sees them as our customers - are we meeting their needs? One way of getting feedback is to use minute papers at the end of a teaching session. Certainly, interaction between staff and student is important and needs to be developed. The lecture is not the best way of teaching statistics. More interactive methods, such as group discussions should be encouraged. Specialist students need more training in communicating and consultancy. One possibility is to use group consultancy projects.

NEWS AND ANNOUNCEMENTS

IASE Executive Committee Election

There will shortly be an election for members of the next IASE Executive Committee. The Nominating Committee is composed of Andrej Blejec (Slovenia), Andy Begg (New Zealand), Lionel Pereira Mendoza (Canada, but currently in Singapore), Mary Rouncefield (UK), and chairperson, Annie Morin, IRISA, 15 rue Gutenberg, 35000 Rennes, France [Tel: 33-99-847222, Fax: 33-99-383832, E-mail: Annie.Morin@irisa.fr], to whom all suggested nominations should be sent.

50th Session of the International Statistical Institute, Beijing, 21-29 August 1995

Statistical Education sessions include: The Relative Roles of Universities and Employers in Training Professional Statisticians; Networking Innovations and Resources - the Internet as Toolbox; Teaching Statistics in Asia; Teaching Statistics in Geographical Courses - Links with GIS (Geographical Information Systems); Statistics at School Level; Training Statistical Staff and Continuing Education in Developing Countries; Statistical Literacy in Educational Programmes; Statistics Service Courses at Higher Education level. Contact *Executive Secretariat of the 50th ISI Session, c/o State Statistical Bureau, No.38 Yuetan*

Nanjie, Sanlihe, Beijing 100826, Republic of China [Tel +86-1-38-10965/10051 Fax +86-1-3810035; E-mail: wangjl@bepc2.ihep.ac.cn]

IASE Round-table, 23-26 July 1996, Granada, Spain

Research into the Role of Technology in Teaching and Learning Statistics. Contact *Joan Garfield, General College, University of Minnesota, 140 Appleby Hall, 128 Pleasant St S E, Minneapolis, MN 55455* [E-mail: jbg@vx.cis.umn.edu].

There will also be Statistical Education sessions at **ICME-8**, (8th International Congress on Mathematical Education) **Summer 1996, Seville, Spain**.

5th International Conference on Teaching Statistics (ICOTS-5)

This will be held during the summer of 1998 in Singapore.

RSS95 - Theme Conference on Statistical Education

This Royal Statistical Society will be held at the University of Wolverhampton, 12-14 July 1995. It is likely to be of interest to teachers of statistics in schools, colleges and universities, and to anyone concerned with quantitative literacy. The plenary speakers will be Tin Brighthouse, *Communicating Statistics - the user's perspective*, David Moore, *Communicating Statistics - concepts and methods*, and Adrian Smith, *Raising the Profile of Statistics*. Short courses will be given before the conference by Mary Rouncefield, *New Statistics Topics at A-level*, Chris Chatfield, *Problem solving and consulting*, and Neville Hunt, *Teaching Statistics with Spreadsheets*. More details can be obtained from *The RSS95 Conference Secretary, 25 Enford Street, London, W1H 2BH* [rss@bristol.ac.uk]. The deadline for receipt of titles and abstracts for contributed papers is 1 February 1995.

Special Education Issue of the International Statistical Review

The first 1995 issue of this ISI flagship journal, which all IASE members receive, includes a special part-issue on statistical education edited by IASE president David Moore. The articles are; *How Students Learn Statistics*, by Joan Garfield, *The Coming of Age of Statistical Education*, by David Vere-Jones, *Continuous Quality Improvement in Higher Education*, by Robert V & Mary C Hogg, *Continuous Improvement of Teaching: A Case Study in a Large Statistics Course*, by C J Wild.

Journal of Statistics Education

Volume 2(2) is now available. To retrieve a list of contents and instructions for retrieving articles, send the following one-line e-mail message to archive@jse.stat.ncsu.edu;

send jse/v2n2/contents

JSE will continue to maintain its current information service to accommodate users at different levels of technological ability. However,

the JSE is also now available in hypertext form on the World Wide Web (WWW). This development means that the journal will be able to publish formatted, searchable text documents as well as full-colour images, sound and video. If you have available the *Mosaic* client software, you can now view the JSE at this URL ('homepage' being all one word!):

<http://www2.ncsu.edu/ncsu/pams/stat/info/jse/homepage.html>

FREE!! Proceedings of 1st Scientific Meeting of IASE, Perugia 1993

Order from the *International Statistical Institute, 428 Prinses Beatrixlaan, PO Box 950, 2270 AZ Voorburg, The Netherlands* [Tel: +31 70-3375737, Fax: +31 70-3860025, E-mail: isi@cs.vu.nl] Postage cost of \$US 5 payable.

Statistical Education Section of the American Statistical Association

The first issue of the Statistical Education Section newsletter has been produced, and contains a miscellany of reports by well-known figures covering a wide range of specialities within Statistical Education.

IASE Institute Membership Concessions

New, reduced rate, membership dues have just been confirmed for institutions in developing and transition countries. They also include major concessions on the purchase of IASE publications. Details are available from the *International Statistical Institute, Voorburg* (see above).

ISI-TES Joint Seminar

The International Statistical Institute and Training of European Statisticians (TES) are holding a joint "Briefing Seminar on International Statistics for Chief Statisticians of National Statistical Institutes" in the ISI premises in Voorburg from 28 to 30 March 1995. The seminar is aimed at relatively newly appointed Chief Statisticians and aims to provide them with an inside look at the complex system of international statistical organisations and arrangements. It will cover, in particular, the following themes:

- Two Levels of Information about International Statistics;
- Developing International Statistical Relations in a Country;
- The Institutional and Legal Framework of International Statistical Activities;
- Major Types of International Statistical Activities;
- Relations to International Users of National Data;
- Technical Aspects of International Statistical Contacts.

Applications from all countries are welcome. The deadline for registration with the International Statistical Institute, Voorburg (see above) is 28 February 1995.