

IASE *matters*

February, 1993

The International Association for Statistical Education is now well and truly established. It has over 260 members, drawn from more than 50 countries. In Perugia, this summer, IASE held its first Scientific Meeting, attended by about 150 delegates, representing 36 nations and including 30 Italian school teachers. In addition to a very busy and interesting programme of presentations, an open Forum was held on future directions, activities and priorities for IASE. Suggestions culled from this meeting, and from contacts with other IASE members, were taken forward to the IASE General Assembly at the International Statistical Institute's 49th Session in Florence. The new Executive Committee has planned an exciting programme of initiatives and activities. IASE members should by now have received a copy of "IASE Review" which is full of information about IASE and about what it has to offer to its members.

Regular readers will notice that this IASE supplement has been given a face-lift. This coincides with the decision gradually to move its emphasis towards "IASE Matters", i.e. short articles, reviews, and conference and research reports. Most calendar notes and other news items will in future be published in the "IASE Newsletter". This is contained in the "International Statistical Information Newsletter", which all IASE members receive free of charge.

Contributions to any of these IASE publications are welcomed. These should be sent to Anne Hawkins, 64 Bedford Court Mansions, Bedford Avenue, Bloomsbury, London, WC1B 3AD, UK [Tel/Fax: 071-636-0058, E-mail: teexash@ioe.ac.uk]

STOP PRESS! "Teaching Data Analysis in Schools; Who should teach it and how?" edited by Lionel Pereira-Mendoza is now available from ISI Permanent Office. (See address at foot of page.)

ASA'S STATISTICAL EDUCATION SESSIONS

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The programme sponsored by the American Statistical Association's Section on Statistical Education at the Joint Statistical Meetings in San Francisco this August focused on issues in statistics education and on current activities and projects. The programme opened with a Special Invited Lecture given by David Moore in a session organised by ASA's President, Stuart Hunter. David's theme, *Statistics: Education Fin de Siecle*, focused on some internal and external factors that have bearing on changes in the teaching of statistics in colleges and universities. He posed several provocative questions about the relationship of technology and the teaching of statistics (will professors continue to be needed?) the revolution in the ways we teach statistics (can we afford it?); and the external pressures on higher education (will statistics departments survive?). Responses to these questions, provided by three discussants, George Cobb, Joan Garfield and William Meeker, led to some lively debate.

Written and Oral Communication in Statistics Education was the topic of the next invited session organised by Noreen Radke-Sharpe of Bowdoin College. Lincoln Moses began the session by discussing the need for clear and lucid written, tabular and graphical presentations. Judith Singer and John Willett presented a paradigm for teaching based on research that suggests learning occurs most effectively when learners engage in "authentic" apprenticeship with community members. They discussed some "authentic" statistical activities they have used in their classes. Finally, Tori Haring-Smith shared her expertise as founder of the Writing Fellows Program at Brown University, giving many ideas on how to use writing in the statistics classroom.

International Association for Statistical Education

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Assessment Issues Related to Teaching and Learning Statistics, organised by Joan Garfield of the University of Minnesota, provided an opportunity to hear from colleagues who study how students learn statistics. Joan Garfield addressed the question of what we should assess. She described several dimensions of statistical learning and offered a framework to guide the development of appropriate assessment methods. In the next paper, Iddo Gal and Lynda Ginsburg discussed the role that beliefs and attitudes play in learning statistics. They argued that non-cognitive factors can impede the learning of statistics and also hinder the extent to which students can develop useful statistical intuitions. Next, Clifford Konold addressed the assessment of students' conceptual understanding of probability and statistics. He also described items currently under development for assessing conceptual understanding before and after instruction. Finally, George Cobb discussed these papers, providing insightful comments that initiated much discussion from the audience.

The Section also co-sponsored sessions with two outside organisations, *Mu Sigma Rho* and *NCTM*. Both these sessions focused on current activities and projects in statistics education. The *Mu Sigma Rho* session, *Introductory Statistics Courses - New Projects*, was organised by Jeff Witmer of Oberlin College. This session featured four speakers who are involved with NSF funded projects to improve the teaching of undergraduate introductory statistics. Mrudulla Gnanadesikan described the *Activity Based Statistics* project she is working on, which is developing hands-on activities for instructors to use with their students. John Spurrier told of the *Elementary Statistics Laboratory*, a set of experiments and activities he and others have developed at the University of South Carolina. Laurie Snell gave an overview of the course he teaches at Dartmouth College called *Chance*. In this course, students investigate topics that are in the news, and develop statistical tools needed to understand them. Dennis Pearl presented a sample of the *Electronic Encyclopedia of Examples and Exercises*, a HyperCard-based program he and others at Ohio State University are developing.

Data analysis is a key component of the changes that are beginning to sweep the United States in the way mathematics is perceived and taught in schools. These changes formed the focus of the *NCTM* session, *Statistics: Motivation for Change in k-12 Math and Science*, organised by Richard Scheaffer of the University of Florida. Carey Bolster, a driving force behind *ASA's Quantitative Literacy* project for elementary teachers, reported on a project designed to help elementary school teachers incorporate data analysis into their

classes. Miriam Clifford, one of the leaders of *ASA's* project on the *Data-Driven Curriculum*, discussed the vital role that data analysis can play throughout high school mathematics. Finally Jeff Witmer reported on a project, *SEAQL (Science Education and Quantitative Literacy)* to promote the sound use of statistics in science laboratories. For a while, the convention room was transformed into a science lab while members of the audience counted how many drops of water they could deposit on the surface of a coin without it spilling over.

All of these invited sessions were well attended with a typical audience size of well over a hundred. The sessions reported on progress being made across a wide variety of ventures in statistics education. They represent excellent beginnings, but they are only beginnings. Real lasting changes in the way in which we teach statistics will only happen if many more people get involved.

These and other papers from the conference will be published as the American Statistical Association 1993 Proceedings of the Section on Statistical Education.

THE TRAC APPROACH TO CROSS-FACULTY TEACHING

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The TRAC approach has been used in Brisbane, Australia, for teaching statistics to postgraduate students who wish to use statistics in their research. All the students were from Faculties other than the School of Mathematics. A special course was created to overcome the problems associated with such students visiting statistics staff on an *ad hoc* basis, seeking advice and help with the statistical aspects of their research. These (unpaid) consultations had become increasingly numerous, and thus more of a burden, as the emphasis had switched towards quantitative rather than qualitative research in fields where previously the quantitative aspects had not been prevalent. The existence of the service course also provided the statisticians with a means of encouraging the correct use of statistics in the wider research community; preventing incorrect or incomplete analyses from being published, preventing the transmission of errors by publication of literature, and preventing the spread of incorrect methods by those researchers who trust the methods used by others without checking their relevance.

The students came with a variety of different needs. All had different backgrounds and different goals as to what they wished to achieve from this subject. Some wanted sophisticated procedures; others to achieve confidence with their investigation plans; and others simply wanted to know what techniques they could apply to their situation and if the data to be collected would be suitable for researching their chosen topic. An additional difficulty for the teacher was the pressure to make the subject a success, because this was a service subject.

The subject consisted of 3 hours of class contact time per week; a one hour lecture, a one hour tutorial, and a one hour discussion. Group work was encouraged. The statistical techniques were taught by giving an overview of how the results were obtained, without working through the mechanics of the calculations involved, because these could readily be achieved by using a computer package. The emphasis was on the validity of the techniques, on where they could be applied, and on their interpretation. The students wished to be users of statistics and would be using computers to obtain their results. They therefore needed to know whether they were entering good quality data (to ensure that their results would be meaningful), and how to explain their results. To help the students achieve this, the examples used were data either from the students' own projects, or from those of past students, or from consulting jobs, i.e. real data with real flaws. These provided a meaningful and effective teaching resource. At all stages, the students were encouraged to think critically about their investigations and to appreciate when they should visit a statistician to seek further help.

Students were assessed on two assignments; one relating to experimental design and the other relating to multiple regression. Each assignment consisted of several questions covering the different application areas of the students. From these, the students had to choose one question to answer. The other two pieces of assessment comprised a statistical critique of a journal article relating to their discipline or research interests, and a short presentation and submission on a specialised statistical technique needed or used in their area. This assessment strategy captured the diversity of the subject and incorporated sufficient flexibility to suit the students' other commitments.

The TRAC approach (*Teaching, Reflection, Action Research, and Collaboration*) was adopted so that the teacher who was responsible for the course received regular feedback on which to base improvements to the teaching. This approach aims to improve the quality of student learning by improving teaching practice through reflection and collaboration.

Its purpose is to encourage the teacher to articulate his or her teaching intentions, to have a third party observe and collect information about aspects of the teaching, and then to examine the implications of that information.

The method forces teachers to be more reflective about their teaching - something that most of us have tried to be, albeit on an *ad hoc* basis - in order that the process of self evaluation is no longer left to chance. To formalise the reflection process, the teacher is encouraged to keep a journal on how they are teaching the subject, and how they feel the students are progressing. This journal is then used to identify areas of concern. It is the focus of the clinical supervision phase, which centres on discussions between the teacher and a trusted colleague before and after the lesson.

The clinical supervision process is cyclic consisting of four steps, similar to a quality cycle:

1. *The pre-observation conference.* Here the teacher sets out what is to occur in the lesson and establishes precisely what the colleague can expect to observe; for example, the effect of some new approach or teaching skill. This stage provides a unique opportunity for the teacher to rehearse or to share plans for the lesson with a receptive colleague. For cross-Faculty teaching, where success cannot be left to chance, this opportunity is particularly useful.

2. *The observation stage.* The colleague records his or her observations, listing what happened in the class either by hand, audio-tape or video. The colleague is not to participate in the class but rather is intended to be a 'fly on the wall'. This provides data to be discussed in the following stages.

3. *The analysis stage.* This is personal reflection time, where both teacher and colleague separately try to discern patterns and interpret their observations about what took place. This procedure ensures an independent perspective as to what actually happened in the class.

4. *The post-observation conference.* This includes a discussion of each party's reflections and thoughts about what might be implemented next time. It is essential that the colleague avoids being judgmental. Rather, the effectiveness of the chosen teaching strategy should be discussed.

When I was teaching by this method in Brisbane, I kept a personal weekly journal. After 4 weeks (during which I allowed both the students and myself to settle), I wrote to each student, asking them to comment on whether

they felt that the pace was appropriate; whether they were finding the level of coverage suitable; whether the topics covered their areas of interest; whether there were any other topics that they wanted to be covered; and whether they had any suggestions to improve my teaching and their learning of applied statistics. I also asked if the course so far was measuring up to their expectations. So that the students would not have to identify themselves, replies were requested *via* the internal mail. The students responded very favourably. They were surveyed again at the end of the course by personal letter, at which time they again provided constructive comments.

I chose as my critical friend another member of staff who was also teaching a statistics unit at first year undergraduate level to a customer Faculty. I asked my peer to sit in on my lessons about two thirds of the way through the course, after discussing with her the feedback that I had obtained from the students at the end of week 4. The discussions with my peer proved to be very fruitful and they provided me with many suggestions for possibly facilitating my students' learning processes.

Successful cross-Faculty teaching has several key elements; the content of the subject, the use of relevant examples for different discipline groups, the use of computers, the emphasis on the quality of the data and its interpretation. These elements were dealt with more effectively through the use of the TRAC approach. The support gained from using the TRAC process ensured that I felt free enough to break away from the more traditional teaching attitude which expects that the students will adjust to the level of the lecturing statistician. By using the TRAC techniques to improve the teaching of such a diverse class, I had continual feedback. This made it easier for me to assess whether I was pitching my lessons at an appropriate level. The use of group work, and different examples for each application area, helped me overcome the difficulties that may be encountered when teaching a group of students drawn from a variety of disciplines and backgrounds.

This report has outlined a project which implemented TRAC techniques in a most difficult situation, albeit one that is frequently encountered by teachers of statistics, whatever the level of their students. It illustrates how TRAC collaboration procedures can give teachers the support and confidence that they need to help them to monitor and to improve their teaching performance, and to take on board and use student feedback. I thoroughly recommend the use of TRAC techniques for all teachers; not just those teaching service subjects but also those who have been allocated to teach a subject that they have not taught previously.

Further information and references on TRAC and on the teaching of this course are available from the author.

CALL FOR ICOTS-4 CONTRIBUTIONS

The Fourth International Conference on Teaching Statistics will be held July 25-30, 1994 in the modern Congress Centre in Marrakech, Morocco. Contributions to the following sessions and working groups are still being invited;

- Statistical literacy of citizens and the public's view of statistics
- Integrating statistical topics throughout the school curriculum
- Data analysis for the elementary curriculum
- Hands-on and project-based teaching
- Research on teaching and learning statistics and probabilistic concepts
- Statistical training for and by consultancy
- Teacher training
- Computing and software in statistical teaching
- Learning statistics at a distance
- Use of video and multimedia technology for teaching
- Teaching statistics for future statisticians
- Teaching statistics for economic statisticians
- Statistics for employees of a statistical office
- Teaching statistics for future engineers
- Statistics for social scientists
- Statistics in continuing education for employees in industry
- Initial and continuing education for statistics in agriculture
- History of statistical teaching
- Statistical projects and competitions
- The statistics curriculum towards the year 2000
- Development of educational software in statistics
- Activities of professional societies in education and public awareness of statistics

If you are interested in attending or in presenting at ICOTS-4 but have not yet received an information bulletin you should immediately contact the head of the local organising committee;

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