



Statistical Education Research Newsletter

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1. Notes and Comments

A new Northern Hemisphere Summer is fast approaching and we look forward to the many exciting conferences with statistical education contents.

The *IASE Round Table Conference on Training Researchers in the Use of Statistics* (Institute of Statistical Mathematics, Tokyo) is receiving wide interest on the part of statisticians and researchers and many interesting proposals for papers at the Conference were received. After a refereeing process carried out by expert statisticians, statistics educators and professionals, we selected a set of contributions which we hope will stimulate good discussions of the Round Table conference research questions and provide new directions for future research in this area. *IASE* is grateful to the *Japan Statistical Society* and to the *Institute of Statistical Mathematics* for their support in preparing for this conference, as well as to all who will make it a successful event (organisers, authors, discussants, referees and observers), who represent the five continents, as well as developed and developing countries.

Another major event is *ICME 9*, the largest mathematics education conference, which is held only every four years and where *IASE* is organising a Topic Study group *TSG4 The Teaching and Learning of Statistics*, organised by Susan STARKINGS and Michael SHAUGHNESSY is giving a plenary talk on statistics education. We hope that the statistics education work in these conferences, as well as in the Stochastics Discussion Group at the *PME 24*, Hiroshima, will attract attention to statistics education and the *IASE* from Japanese statisticians and educators, as well as from colleagues in other countries in the area. We are now preparing for the *ISI 53d Session* in Korea, 2001, where *IASE* is organising 11 Invited Paper meetings and we hope the Japanese conferences this year will also help increasing the presence of statistical education next year in Korea.

These are just some of the many conferences related to statistical education we are reporting in this issue. Please do not forget to review all this information, and in particular the information about *ICOTS-6*, Durban, South Africa, 2002, where we look forward to receiving your contributions.

All these conferences suggest that statistical education research is quickly increasing and that we need to reflect on what we are doing and where we want to go. In this issue we would like to begin a discussion about what we view to be the important research questions in statistical education. We include a short paper prepared by the editors that we hope will provoke reactions and discussions by our readers. We plan to collect and classify all your comments and prepare a special issue on "Research agendas and problems in statistical education" for January, 2001, where the discussion of this paper by some *IASE* members will also be published. If you want to contribute, please contact one of the editors. We will also be glad to receive short papers (2-4 pages long) about topics of general interest for researchers to be published in the newsletter.

Notes: Throughout the Newsletter, *IASE* members' names are highlighted in capital letters.

The whole Newsletter is located at the web site: <http://www.ugr.es/local/batanero/sergroup.htm>

2. Research in Statistical Education: Some Priority Questions

Carmen BATANERO, Joan B. GARFIELD, M. G. OTTAVIANI, and John TRURAN

A principal aim of the *IASE Statistical Education Research Group* (SERG) is to promote research related to teaching and learning statistics. As described in JOLIFFE (1998), we still need to achieve academic recognition in the different disciplines or programmes where we work. A step towards this goal is to define "What is Research in Statistics Education" and to convince others of its validity as a research discipline.

Some of us work in traditional mathematics or statistics departments, some in education departments, some in other disciplines, such as economics or psychology. Some work in departments with approaches which emphasise elementary data analysis rather than formal statistical analysis, and some make much greater use of student involvement and project work than others. Departments tend to have their own cultures, and are often not fully aware of the value of other cultures. People involved with statistical education often work in several different

cultures, which can make it very difficult to design and conduct high quality research projects. Other difficulties of research in statistical education are that it is often not seen to have general validity or applicability and many potentially valuable findings have not been widely implemented. Understanding why this is so may help us and others to understand more deeply the nature of the work we do.

We must also face the fact that some academics strongly believe that education is not a discipline which has anything to contribute to knowledge, especially to their own academic area. Researchers working within the field of statistical education (whatever they are—statisticians or pedagogists or educational researchers) can find it difficult to have their work on statistics education recognised and valued by statisticians in mathematics and/or statistics departments. It is also important for academics working in education to understand and be understood by people in the community—politicians, leaders in industry and leaders in schools.

The numerous conferences in statistical education (ICOTS, IASE Round Table Conferences, IASE meetings in ISI Sections, stochastics working groups in ICME, PME, PME-NA, etc.), journals, papers published, and internet resources suggest that statistical education has come of age (VERE-JONES, 1997). Some good research question have been posed by SHAUGHNESSY (1992) and SHAUGHNESSY, GARFIELD & Greer (1996). We still need, however, more reflection and discussion to clarify what should be considered as research in statistical education, how we establish the validity of our research findings, what priority questions need to be studied, and what theoretical frameworks and research methods might be recommended to carry out this research.

Other disciplines have faced this same problem. In mathematics education, for example, the *International Commission for Mathematical Instruction* organised a conference in 1993 to clarify the nature of research in mathematics education which led to publication of a book reflecting the discussions (Sierpinska & Kilpatrick, 1997). In this brief article we share with *IASE SERG* members an attempt to pose some questions to encourage reflection on the work we are currently doing and what direction future research might follow. We encourage our readers reflect on these ideas and issues and to send us their comments and reactions.

Foundations of research

Being able to construct good research questions regarding statistical pedagogy depends a great deal on theoretical and methodological questions. Statistical education is a relatively young research field, with researchers being trained in a variety of different disciplines. However, education has been an academic discipline for 100 years now, and has always crossed discipline boundaries to some extent. Statistics education needs to work with all educators across all disciplines and especially mathematics educators, since at the secondary school level, statistics is usually taught by mathematicians. Although we believe that statistics has its own unique characteristics and ways of reasoning, we recognise the need to collaborate with mathematics educators in doing research at the school levels. Statistics education should build on related work in other disciplines and make use of cross-discipline linkages which have already been established. We propose that the following questions are all relevant to an understanding of statistics education, and comment briefly on some of these:

- *What psycho-pedagogic models can help us understand the development of statistical reasoning, and how can these models be used to facilitate this development?*
- *What teaching-learning theories can help us understand and explain the teaching-learning of statistics?*
- *What learning environments and procedures are aligned with different models of learning or cognitive development?*
- *Should we adapt particular theories about teaching-learning to the specific teaching-learning of statistics?*
- *How is the teaching-learning of statistics unique and how is it related to the teaching-learning of mathematics and of other disciplines?*

We sometimes develop models which work well with students only within a particular culture where the models have been developed. One limitation of some research results is that they did not take into account different relevant cultural parameters and this may be critical to acceptance of the research results.

- *How do different cultures affect the transferability of our research results?*

Research methods and philosophies do change over time. This occurs partly because research questions change or because available techniques change. Such changes often cause tensions between people who are working on the same questions in different ways. In our experience it is impossible to argue that either the old or the new methods are always right. We believe that researchers need continually to examine their work and to look for the best way of gathering information to answer their questions.

- *Bearing this diversity of approaches in mind, what are the features of a good research study in statistical education? How might we develop criteria for evaluating what is good research?*

By now there is a considerable amount of experience in the world about conducting research into statistical education. We may now be at a stage where it would be possible to develop some general principles, such as:

- *What background knowledge do we need in order to conduct quality research in statistical education? How might we best train researchers to conduct research in statistical education? Should we try to identify and organise a programme to train researchers in this area?*

Specific research questions

In the area of mathematics education, GODINO & BATANERO (1998) classified research questions into two main categories: a) questions characterising the meaning of mathematical objects in educational institutions (institutional meaning) or for individuals (personal meanings); and b) studying the evolution of these meanings over time; for example, studying the evolution of the students' personal meaning as regards a given concept as a consequence of instruction. This classification may be useful for statistical education, where there are also specific areas where there is a need for research results. Below we suggest some areas that deserve further research.

Statistical thinking. While statistical thinking, reasoning, and literacy are often described as intended outcomes of statistics education, and a recent paper in *International Statistical Review* (WILD, C. J., & PFANNKUCH, M., 1999) presented a model for statistical thinking, there are no agreed-upon meanings or distinctions between these related concepts. Last year a *Research Forum on Statistical Thinking, Reasoning, and Literacy (SRTL1)* was held at Kibbutz Be'eri, in Israel, where a small group of researchers met to share research and to try to clarify meaning of these terms. A feature of this research forum was the use of videotapes of students to demonstrate or provoke discussions on different types of reasoning, thinking, and literacy. Plans are now being made for both a book on this topic as well as a second forum (*SRTL2*) to be held in 2001. The *ICOTS-6* to be held in Durban (SA) 7-12 July 2000, has the theme "Developing a statistically literate society" and special sessions on "Statistical Literacy Day" are planned.

- *What are the differences between statistical literacy, statistical reasoning, and statistical thinking? What are the important goals for students in developing these different types of cognitive processes and how are they best taught and assessed?*

Technology. Today many students are learning statistics with the help of new technology. New software and technological tools are changing the meaning of statistics because they introduce new representations, change the way in which we deal with statistical objects, and change the type of problems the students encounter in the classroom. On the other hand the quick pace of changes in statistical software means that our teaching activities need constant revision. Although there are several studies that examine the teaching of statistics with the help of computers, there is as yet no consensus about what the role of technology should be in teaching and learning statistics.

- *What types of activities, demonstrations, simulations, and explanations (from the teacher, multimedia materials, and/or textbook) help students construct a deep understanding of statistical concepts as opposed to a surface understanding of algorithms and procedures?*
- *What are the effects of technological tools on student learning?*

Inferential reasoning. Most secondary schools now include in their mathematics curriculum data analysis, probability, and statistical inference. However, many of these students, as well as students in introductory college statistics courses, do not have the mathematics background necessary to study formal probability topics and

inferential methods. Many of these students have not studied calculus and very few have basic ideas of probability. There is a need to investigate intuitive methods of introducing the basis of statistical inference to these students; perhaps with the help of computer simulations. We need to explore how to best use these methods and how well students are able to develop the concepts and use the statistical tools in solving problems.

- *How can we enable students who have a poor mathematics background to understand statistical inference?*
- *Given that many of society's decision-makers do not have formal statistical training, are there ways of teaching a pre-formal understanding of statistical inference, which can form a basis for the teaching of formal inference, even to those with limited mathematical skills?*

Training teachers. Modern pedagogical theories about teachers' training distinguish two types of knowledge that teachers should acquire: knowledge about the content (e.g., knowledge about statistics) and didactic knowledge (e.g., knowledge about didactics of statistics). It is not clear how to best teach future teachers statistical content, since the mathematical background of elementary teachers is quite different from the background of secondary mathematics teachers.

Problems also arise in training teachers at the elementary, secondary, and college level in "didactic knowledge". First, we need to determine the components of didactic knowledge, which include pedagogy, psychology, specific knowledge about statistical misconceptions and intuitions, epistemology, curriculum materials, etc. Second, we need to design "didactic situations" that will enable future teachers to acquire this knowledge. If we want teachers to develop constructivist-based teaching methods, we should not use expository teaching for the didactic content.

- *How can teachers become aware of good activities to use in their classes to improve student learning?*
- *How can they learn better to develop a reasonable mix of different activities and still cover the required content?*
- *The increasingly data-driven nature of our society makes it very important to provide skilled teachers of statistics. This means that it is increasingly important to establish effective ways of training current and future teachers of statistics. What are good ways of doing this?*
- *What are teachers' conceptions of probability and statistics?* This question, posed by SHAUGHNESSY in his 1992 chapter has not been sufficiently researched.

Finally there are several other topics where there is little research, such as longitudinal studies of statistical reasoning, the development of students' understanding of variation, etc.

This article is only a first attempt to define some important questions to be researched in statistical education and we hope this document will initiate a wide discussion on this topic. We invite our readers to send their reactions to the editor. We plan to continue this discussion in a forthcoming issue where some invited reactors will contribute brief discussions of this paper along with reactions from our readers will also be included.

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3. IASE Members

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Kaye is teaching biometrics to agricultural and biological science students with the aim of enabling them to efficiently and effectively design experiments and analyse the resulting data. Her broad research focus is on the analysis and interpretation of data collected from large-scale multi-environment plant breeding experiments such as those conducted by the international centres for agricultural research. She leads a team of research associates and post-graduate students investigating multi-way clustering and ordination procedures. Her original interest in these pattern analysis techniques arose from a request from plant breeders for better ways to analyse data than an analysis of variance table that indicated all effects were significant and that hundreds of paired comparisons were needed. By using a pattern analysis approach, scientists are now able to integrate qualitative, quantitative and molecular data to provide both a global and local summary of the interaction and relationships among genotypes, environments and attributes. Her recent book (Basford and Tukey, 1999) presents various graphical approaches to analysing multiresponse data. A suitably constructed picture can aid enormously in the interpretation of data. Good graphics mean that young scientists don't need to have twenty years experience with a particular crop to understand and interpret the data collected from their experiments. Reference is Basford, K.E. and Tukey, J. W. (1999). *Graphical analysis of multiresponse data: illustrated with a plant breeding trial*. London: Chapman & Hall/CRC Press.

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After graduating in psychology (with methodology and statistics as his speciality), Nick started to work on a dissertation that focussed on the methodological problems inherent in questionnaire research. It was during this time that he first began to teach statistics to undergraduates. After obtaining his Ph.D. degree, he worked as a lecturer at various universities, teaching methodology and statistics. Three years ago, he was offered a permanent position as an assistant professor at the department of Methodology and Statistics of Maastricht University. Two years ago, Nick started a line of research that was completely new to him. Broadly, this research focuses on the way that students acquire and organise statistical knowledge, and on techniques for improving the transfer of this knowledge, i.e. on the practice of teaching statistics. Nick has now prepared a paper on the organisation of statistical knowledge, which he will present at the AERA-conference in New Orleans (April 2000).

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Beth CHANCE, Assistant Professor of Statistics at California Polytechnic, San Luis Obispo, received her Ph.D. from Cornell University. Prior to moving to California Polytechnic in fall of 1999, she taught at the University of Pacific for 5 years. Her primary activities include research in determining effective integration of technology into statistics courses and authentic assessment practices, and development of curricular materials and software for teaching statistics. With Joan GARFIELD and Bob delMas, she has developed modules to help students understand the concepts behind sampling distributions, such as confidence intervals, and p-values. These modules (www.gen.umn.edu/faculty_staff/delmas/stat_tools/index.htm) include software, instructions for interacting with the software, and tools for assessing student knowledge gains. An analysis of student learning gains from using these modules was recently published in the *Journal of Statistics Education* (www.amstat.org/publications/jse). Beth has also investigated implementation of authentic assessment practices in statistics. An article based on her UOP course practices was also published in the *JSE*. Most recently, Joan GARFIELD and she published an overview of assessment practices in statistics education to be published in a special issue of *Mathematical Thinking and Learning*. With Allan Rossman, Beth has co-authored the *Workshop Statistics* series of text/workbooks that provide activities leading students to discover and explore fundamental ideas of introductory statistics. Beth, Allan, and Karla Ballman are currently working on a project to extend this active learning approach to a post-calculus level for introductory courses taken by statistics, mathematics, science, and engineering majors.

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Federico is interested in quantitative technology applied to economics and finance. Within this field he has worked in Estimation of densities and regression functions by nonparametric methods, which he has applied to estimating the distribution of Incomes. He is also interested in the generation of distribution families with differential equations and the investment analysis. He has introduced stochastic elements in the typical models of cash discount flow and he has analysed these type of models and the problems related to their application, by introducing subjective information provided by experts. Another field is option assessment and business flexibility assessment. Here he makes an extended use of diffusion processes and Ito's lemma. In fact he has prepared a software based on Visual Basic for Excel, ("Vaflor") for commercial use. Since he is teaching econometric and quantitative methods some of his results can be used in teaching, e.g., the results on independence of random variables that he presented in Brazil this year were obtained in his studies on the generation of distribution families. He is currently interested in the enormous possibilities of the Internet for teaching statistics and in spreadsheets, which are flexible and opened to creative processes and can serve to compute, organise the information, program and experiment new statistical methodologies that are not included in statistical commercial software yet. Some of his materials for teaching are located in his web page <http://www.ugr.es/local/fpalacio>.

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Gabriel is currently following a Doctoral Programme in Mathematics Education at the Cinvestav-IPN en Mexico. His main interest is the development of probabilistic thinking in learning environments and the role of computers in this development. He is presenting a paper at the IASE session in ICME-9 this August.

4. Lennart RÅDE (1925–1999)

As was reported in the last newsletter, Lennart Råde, the former chairman of the *SEFI MWG* and one of the early leaders in statistics education and one of the people who was instrumental in the establishment of the *IASE*, died in December 9th, 1999 after a long illness.

Lennart was born in 1925 in Ramsele, Sweden. He took a Bachelor of Science in Mathematics, Physics, Theoretical Physics and Statistics at Uppsala University and Gothenburg University, and a PhD in Mathematical Statistics at the Gothenburg University in Sweden. His teaching experience included teaching at school levels from 1949–1951 and teaching mathematics and statistics at the Applied Mathematics Department, Gothenburg University from 1952–1990. His research activities and publications included mathematics books for secondary school level, books on probability, statistics and reliability theory for University students, and papers on sampling, inference, combinatorics, applied statistics, stochastic point processes, reliability, probability distributions, mathematics education and statistics education.

Lennart RÅDE promoted some of the very early work in statistics education, at a critical time for the development of our research field at an international level. In 1969 he led a conference on teaching statistics at Southern Illinois University, USA, which may be seen as a pre-cursor of the ICOTS conferences. He was a member of the *International Statistical Institute Education Committee* (1975–1987), Chairman of the *International Statistical Institute Task Force for International Conferences on Teaching Statistics* (1977–1987), Chairman of the *ICOTS I* conference held in Sheffield in 1982, and a member of the program committee for *ICOTS II* in Victoria, British Columbia, Canada, in 1986. Other activities related to statistical education included organising the working group on the teaching of probability and statistics at the *Second International Congress on Mathematics Education*, Exeter, England, 1972, and in Karlsruhe, 1976, and the *ISI Round Table on Teaching Statistics* in Warsaw, Poland, 1975. Lennart provided some modest start-up funding for the *International Study Group on Probability and Statistics Concepts* which Ephraim Fischbein, David Green and others started. This group has continued to work since then and has now developed into our current *IASE Statistical Education Research Group*. He was also involved in many mathematics education activities, at an international level and was member of the editorial board of *Teaching Statistics*, *International Journal of Mathematics Education in Science and Technology* and *Zentralblatt für Didaktik der Mathematik*.

Lennart brought to stochastics teaching a mixture of a well trained academic mind together with an understanding of the need for practical activities, and he was able to develop and demonstrate many suitable activities which might be used by children as well as tertiary students. His disarmingly simple style enabled him to lead students to deeper and deeper understanding. As well as his interest in stochastics teaching he also worked hard to discover ways in which hand calculators could be effectively used in classrooms. Here are two extracts from his 1982 talk to Australian mathematics teachers. They are both still of great importance and illustrate Lennart's concern with seeing mathematics as a whole, a whole to be made alive, and stochastics as being a part of that whole. The bibliography will take both these extracts further, and also give many other examples.

"A good computer problem should not only be suitable from the programming point of view but should also have an interesting content and provide interesting results when run on a computer... A good computer program should also demonstrate the power of the computer".

"Another area which provides very interesting programming is random or stochastic geometry. Here geometric objects are considered as random elements which are generated by some random experiment. For example, a stick is broken at random in two points. Estimate by simulation the probability that a triangle can be formed of the three parts of the stick. ... These problems will also give the students the opportunity to use various theorems and formulas from geometry".

David VERE-JONES, who met Lennart at the *ICME 5* Conference in Australia in 1984 for which Lennart was organising the Statistics Teaching Stream, recalls:

"Three of us from New Zealand went across to talk about the use of projects in the school programme and how they figured in the revisions that were then being introduced into the mathematics programme in the New Zealand upper secondary school. I remember being most impressed by how efficiently and

effectively he organised the somewhat straggling bunch of statisticians seeking to establish their identity among the hordes of mathematics teachers. (Once, when I visited the Department in Gothenberg where Lennart worked, I recall Peter Jagers, the Chairman at the time, making some crack about always letting Lennart do exactly what he wanted, because everything he did was done so exceptionally well. That was certainly the impression I gained of him).

When I got to know Lennart better, and was able to meet him in England and Sweden in more relaxed surroundings, and even to share his passion for walking to some extent, I realised what an exceptionally modest, courteous but also strong-principled person he was. I had somewhat horned in on his territory, but he never seemed to bear any resentment. I was also very much more ignorant of Statistics Education, both at the practical end and in terms of international contacts, than he was, but again he never dwelled on his own achievements - hardly even mentioned them - but only talked about future plans that he was helping us to develop. I found that we also shared a research interest in point processes and their applications, but again he was exceedingly modest about his contributions, despite, I think, being quite proud that he had a professional role as a research statistician in addition to his role as an educator.

Not long after the ICME meeting, I became involved with the ISI Education Committee, and learnt at first hand more about the contributions he had made to Statistical Education at the international level. Lennart had been involved in some of the very early Round Table Meetings sponsored by the ISI, and when Joe Gani became Chairman of the ISI Education Committee in 1979, he persuaded Lennart to take on the role of leader of the Task Force on International Conferences. This was a critical period for the development of Statistical Education at the international level, and Joe and Lennart, backed by their colleagues on the Committee, were the key people moving it forward. It was during this period that the foundation was laid for the ICOTS Conferences, and in particular for the first ICOTS meeting in Sheffield, which was essentially a brainchild of the Sheffield-Gothenburg axis that Joe and Lennart had established.

Through his writings, also exceptionally clear and well-argued, through his energy and organisational skills, and through his dedication over many years to the cause of Statistical Education, Lennart earned himself a respected and well-justified place as one of its true pioneers. He had seemed to me quite imperishable, destined to enjoy a perpetual and well-deserved retirement, so it was a shock as well as a sadness to hear of his recent death."

Other comments from a number of IASE people who knew Lennart can be found on the web at
<http://www.swin.edu.au/math/iase/lrade.html>

All his friends mention his enthusiasm for the teaching of statistics, his friendly personality, his kindness, integrity and his sense of humour. His colleagues at Chalmers and The University of Gothenburg and at IASE, will all remember him for his deep engagement in mathematics, statistics, teaching mathematics and in statistical education. His death is a sad loss to all of us. Our condolences go to his wife and family.

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5. Brief News

IASE statutes

In a recent survey of IASE members concerning some changes to the IASE statutes, the following have been approved:

1. The number of Vice Presidents have been increased from 4 to 5.
2. The immediate past president will be a member of the Executive Committee.
3. The category of honorary membership was created.

These welcome changes will assist the executive carry out the increasing tasks it has to deal with. The IASE Executive Committee thank those members who supported these proposals.

Statistics Education Activities at the National University of Rio Cuarto (UNRC), Argentina (M. Inés Rodriguez, & Hector Agnelli).

Since the UNRC was started in 1972, the Department of Mathematics at the Faculty of Sciences is in charge of the Bachelor in Mathematics and of the Mathematics Teacher Degree for Secondary Education. They are also responsible for teaching mathematics and statistics in all the different degrees in the Faculty of Sciences and other Faculties. More recently, postgraduate teaching have been organised in this Department in particular the Speciality in Statistics (1996), and the Master's in Mathematics Education (1997). The experience and concern of the Department members as regards mathematics education lead to many activities in this field, including participation in the *XXI Reunión de Educación en Matemática* organised by the *Unión Matemática Argentina* in 1998 in Bariloche, where Hector Agnelli (hagnelli@exa.unrc.edu.ar), and Susana Peparelli (spparelli@exa.unrc.edu.ar) presented a paper on the "Different interpretations of probabilities". Rosa SAENZ (rsainz@unlp.edu.ar) presented a paper on "Some didactic aspects in solving an elementary probability problem" in 1999 at the *XXII Reunión de Educación en Matemática*, organised by the *Unión Matemática Argentina* in La Plata. María Inés Rodríguez (mrodriguez@exa.unrc.edu.ar), Roberto MEYER (rmeyer@fce.unl.edu.ar), Mariela Cravero, and Pamela Martínez attended the *Conferencia Internacional: Experiencias y Perspectivas de la Enseñanza de Estadística in Florianópolis* - Brazil in 1999, where they presented the paper: "Actividad de Educación Estadística en Argentina (1990-1999)". Susana Peparelli is attending the *V Reunión de Didáctica Matemática del Cono Sur*, Santiago de Chile this year, where she will be presenting the paper "Meaning of mathematical objects: the case of probability". A pedagogical project on teaching statistics in Agronomy and related areas with the use of computers is co-ordinated by M. Inés Rodriguez and developed by Gabriela Palacio, Patricia Barberis, Norma Gallardo, and Federico Olivero. The following Masters' theses and monographs are being developed at the Department.

Peparelli, S. *Distintas interpretaciones de la probabilidad: probabilidad subjetiva* [Different interpretations of probability: subjective probability]. Supervisor: Hector Agnelli.

SÁENZ, R. *Aproximación al modelo estadístico: regresión lineal* [Approaching statistical modelling. linear regression]. Supervisor: Hector Agnelli.

Magallanes, A. *Modelo binomial: análisis epistemológico y didáctico* [Binomial model: epistemological and didactical analysis]. Supervisor: Oscar Bustos.

Parnisari, M. *Una propuesta de enseñanza del azar para la EGB* [A proposal for teaching chance concepts in primary education]. Supervisor: Oscar Bustos.

Tartara C. *Introducción al análisis exploratorio de datos con aplicaciones para la EGB* [Introduction to exploratory data analysis with application to primary education] Supervisor: María Inés Rodríguez

Cardelli, J. *El saber estadístico en las carreras de Ciencias Sociales* [Statistics teaching in social sciences].

RSS Statistical Education Centre Initiatives to Publicise Statistics. Peter HOLMES, RSS Centre for Statistical Education, Nottingham Trent University, Nottingham NG1 4BU, UK

There is a major initiative next year in UK on publicising mathematics and statistics to the general public. The Department for Education and Employment has designated this year as Maths Year 2000 and is arranging activities to bring mathematics (including statistics) to a wider audience as well as having major initiatives in schools. On behalf of the RSS Centre for Statistical Education Peter agreed to put in some statistical inputs. One major initiative is a series of 6 MathsFests to take place in different regions of the country. The first were in Oxford on 29 January; and in Plymouth/Exeter (April), with others arranged in Manchester/Liverpool (May), Nottingham (July), York (October) and London (Jan 2001). The aim of these appears to be to give all and sundry an opportunity to do some mathematics and see what mathematics can do (maths in this context includes statistics). They expect anything between one and two thousand people to come to these one-day events, and this will include members of the general public, not just teachers, pupils and those generally connected with education. Peter offered to give input at each of these from the RSS Centre.

Special Issue on Statistics in the Spanish Journal *Blaix*

Vol. 15 (November, 1999) of *Blaix*, a Spanish Journal published in Catalan has focused on statistics and on different topics related to its study. This is the table of contents:

- BATANERO, C. Cap on va l'educació estadística? [Where statistics education is going to?], pp. 2-13.
- Borrell, F., Pol, A., & Saguer, E. L'estadística. La seva presència a la societat actual i al currículum de l'educació secundaria [Statistics. Its place in present society and in the secondary school curriculum], pp. 14-25.
- Gomá, A. Fer estadística: una experiència col·lectiva [Doing statistics: a collective experience], 26-36.
- Monzó del Olmo, O. L'estadística a l'Educació secundaria [Statistics at secondary school level], 60-69.
- Corbalán, F. Estadística aplicada a la vida diària: una enquesta electoral [Statistics applied to everyday life: a voting survey], pp. 70-71.
- Cruset, B., & Fernández, X. Una experiéncia: estadística a cicle mitjà de primaria [An experience: statistics at middle primary school level], pp. 77-79.

Research at Mérida, Venezuela. Christian RIVERA, Universidad de Los Andes, Mérida, Venezuela.

Christian RIVERA is studying the influence of some organisational variables on knowledge's acquisition within an elementary statistical course. Following Kilgore y Pendleton's (1993) model, he assumes that students' achievement depends on a set of variables that might favour or inhibit learning. One such variable is the organisational culture of the teaching centres, which can increase the amount of use of new materials or instructional projects (investigations, lectures, computational software) by students. He started a project at the School of Statistics in his University to assess the influence of these facilities on student's knowledge in introductory course in statistics.

6. Summaries of Publications by IASE Members

BEHAR, R. (1999). One thousand and one dimensions of the learning of statistics. Plenary lecture at the IV Congreso Galego de Estatística e Investigación de Operaciones. Facultad de Medicina, Santiago de Compostela, Spain, November, 1999. Many people, who attend a statistics course, feel anxiety and desperation, because they are unable to grasp the essence of statistical concepts. At the end of the course, the student is unable to face real problems, where statistics is a reasonable aid. After the course students' opinions and attitude towards statistics and its learning are negative. Teachers, on the other hand, feel frustrated by the results of students' assessment, and at best, make unfruitful changes to their lectures. Where is the process failing? In this presentation, the author explores the different elements and

factors affecting the educational process and the learning of statistics, and its relation to some educational strategies. The aim is to provide a starting point to reflect on our current situation in the teaching of statistics.

CALLAERT, H. (1999). Spreadsheets and statistics: the formulas and the words. *Chance*, 12 (2). This text illustrates pitfalls and inaccuracies in statistical ideas as they are explained in some standard statistical software. An example is taken here from Excel, a package widely used by many people who are not professional statisticians but need occasionally to carry out some basic statistical analysis.

CALLAERT, H. (2000). Amazing graphs. *Teaching Statistics*, 22 (1), 25-26. This paper focuses on graphical displays, and in particular on a common mistake made by students, but also sometimes encountered in newspapers, magazines and brochures. By taking some bad habits to an absurd extreme, it tries to serve as an example of how to catch students' attention and make them look critically at any data display they may encounter in future work.

CALLAERT, H. (1999). Nonparametric hypotheses for the two-sample location problem. *Journal of Statistics Education*, 7(2). This paper describes the special attention one needs to pay to the variety and richness of general location models when teaching basic nonparametric methods in a first applied statistics course. The simple Wilcoxon-Mann-Whitney context is used for illustrating the possible change in modelling assumptions when moving from parametric to nonparametric tests.

Lac Prudent, N., & GALLESE, E. Interdisciplinary teaching facing the future challenges. In L. Pereira- Mendoza (Eds.), *Proceedings of the V International Conference on Teaching Statistics*. This paper describes the Argentinean experience of the analysis and discussion of the Current Household Survey of Argentina, addressed to the study of the labour market, income distribution, poverty and to generate labour and living conditions statistics. In this context, a Seminar in Applied Econometrics was implemented, taking special account of the different background of the students of the University of Rosario, Argentina, with the following aims: a) to study the national current economic situation involving the labour market, unemployment, poverty and income distribution; b) to improve interdisciplinary work between economists and statisticians; c) to promote the urgent need of cooperation between statistics producers in national statistical offices, researchers and teachers; d) to encourage the use of scientific magazines and technical reviews as a source of information additional; to arrive to econometric models.

JONES, G. A., Thornton, C. A., Langrall, C., W., & Tarr, J. E., (1999). Understanding students' probabilistic reasoning. In L. V. Stiff, & F. R. Curcio (Eds.), *Developing mathematical reasoning in grades K-12. 1999 Yearbook* (pp. 146-155). Reston, Va: National Council of Teachers of Mathematics. The purpose of this article is to describe and illustrate the range of probabilistic thinking exhibited by elementary and middle school students. The descriptions and illustrations are intended to provide a background that will help teachers understand and foster students' probabilistic reasoning.

Johnson, T., M., JONES, G. A., Thornton, C. A., Langrall, C. W., & Rous, A. (1998). Students' thinking and writing in the context of probability. *Written Communication*, 15(2), 2103-229. This paper explores changes in students' probabilistic thinking and writing during an instructional program that emphasised transactional writing in a problem-solving context.

VALLECILLOS, A. (In press). University students' understanding of the logic of hypothesis testing. *Journal für Mathematik-Didaktik* (Revised English version of a paper published in *Recherches en Didactique des Mathématiques*, 15(3), 53-81, 1995). Significance testing is a very controversial topic within research work (Morrison & Henkel, 1970) and a frequently misunderstood theme in statistics teaching (Brewer, 1986). In this paper, we present the results of a theoretical and experimental study concerning University students' understanding of statistical tests' logic. We discuss epistemological issues concerning Fisher's and Neyman-Pearson's approaches to hypotheses testing and their relationship with the problem of induction in experimental sciences.

WILD, C. J., & PFANNKUCH, M. (1999). Statistical thinking in empirical enquiry. *International Statistical Review*, 67(3), 238-265. With discussion by T. M. F. Smith; D. S. MOORE, N. E. Breslow; R. D. Snee; and R. BIEHLER and response by the authors. This paper discusses the thought processes involved in statistical problem solving in the broad sense from problem formulation to conclusions. It draws on the literature an

in-depth interviews with statistics students and practising statisticians aimed at uncovering their statistical reasoning processes. From these interviews, a four dimensional framework has been identified for statistical thinking in empirical enquiry. It included an investigative cycle, an interrogative cycle, types of thinking and dispositions. We have begun to characterise these processes through models that can be used as a basis for thinking tools or frameworks for the enhancement of problem-solving. Tools of this form would complement the mathematical models used in analysis and address areas of the process of statistical investigation that the mathematical models do not, particularly areas requiring the synthesis of problem, contextual and statistical understanding. The central element of published definitions of statistical thinking is "variation". We further discuss the role of variation in the statistical conception of real-world problems, including the search for causes.

7. Recent Dissertations

READING, C. (1996). *An investigation into students' understanding of statistics*. Ph.D. University of New England, Armidale, NSW, Australia. Supervisor: John Pegg.

This thesis is an investigation, both qualitative and quantitative, of students' understanding of statistics. Early investigations into the study of levels of understanding were directed at course content, but more recently the search has focused on student responses. This present study describes and analyses levels of statistical understanding identified in secondary students' responses.

Students were given open-format questions concerning four basic areas of statistics, namely, data collection, data tabulation and representation, data reduction, and interpretation and inference. Their responses were grouped according to the degree of statistical sophistication exhibited and these groupings were further refined to develop an hierarchy of levels of understanding in each of the four areas. The framework of the SOLO Taxonomy (Biggs and Collis, 1991) was used to describe the hierarchy. The responses fell into two modes, the iconic and the concrete-symbolic and features of each level within these modes were described.

The influence of a number of factors on these levels was investigated, quantitatively. The coding were found to increase in level with increasing academic year. Mathematical ability was also found to be an influencing factor on the level but gender had far less influence. By presenting data in raw form and as graphs, it was determined that in some instances the form of presentation of the data influences the level of understanding. During coding, responses were found to diverge into two distinct paths and a students' tendency to process simultaneously (Luria, 1966) was found to have some influence on this tendency. QUEST software was used to apply the Rasch model to the data to estimate overall statistical understanding for each student. From this analysis, at and threshold values were used to provide quantitative evidence that the coding of the responses fell into two distinct cycles in the concrete-symbolic mode.

The longitudinal aspect was also investigated by retesting the same students twelve months later. The identified hierarchy proved sufficient to code the responses and analysis of the results substantiated most results observed in the previous year. The increase in understanding was not significant over the twelve months. This supported the earlier findings of little significant difference in understanding between successive academic years. Interviewing of a small sample of students showed that prompting usually provided more information in the response but often at the same level. Probing allowed some students to increase their level but if pressured some students reverted to lower levels for support, thus exhibiting multi-modal functioning. Level descriptions and the cycles identified in this study are consistent with recent findings by other researchers in the field of statistical understanding.

8. Bibliography on Activity Theory and Related Research in Education

Sue Gordon, The University of Sydney, <sueg@mail.usyd.edu.au>

Comment by Editors

Sue Gordon is working in a Mathematics Support Centre in a large city university. Her principal job involves facing the reality of students who have difficulty in learning mathematics and statistics. Her thesis grew out of a desire to improve the quality of her very difficult job. To do this effectively she had to go back to theoretical principles. Her bibliography provides a valuable example of just how complex good statistics education research and teaching really are.

Abstract

Who was that said: "There is nothing as practical as a good theory"? The following bibliography serves to introduce the ideas of activity theory and, more broadly, learning in context. I have found activity theory to be useful for researching students' statistical learning and so for trying to improve my teaching of statistics. Activity theory was developed by a Russian psychologist, Leont'ev, and owes much to the far reaching and insightful ideas of Vygotsky, whose brief life and career took place in the former Soviet Union (Leont'ev, 1981; Vygotsky, 1978). It offers a model for understanding learning which relates students' goals and actions and the context surrounding and organising learning.

There are two aspects of activity theory that I have found useful for research in statistics education. Firstly this theoretical perspective highlights the importance of students' goals and actions. This shifts the emphasis in statistics education from what we as teachers are doing, our "knowledge craft" (Becker, 1996) to a focus on what students are doing — their perspectives. Students' engagement with the process of learning determines the quality of their emerging statistical knowledge. As one student explained, statistics is what students make of it: "It can be artistic, practical, creative or routine". Secondly, research based on activity theory stresses that the social and cultural context is integral to learning; the ways students learn statistics are inseparable from a complex web of personal, institutional and cultural factors. Leont'ev's framework suggests that in order to teach statistics effectively, we must first understand the learners—their goals, perceptions and evaluations of the statistics they are studying. Teachers usually try to emphasise the usefulness of statistics as a tool for gaining insight into our complex world. However, no one can persuade a student of the power of a tool. This discovery depends on the student's experiences.

The bibliography is divided into different sections, Each section relates to a broad aspect of student learning within the activity framework. Section 1 lists English translations and interpretations of the work of Leont'ev and Vygotsky. These are classic educational references and I include them for the sake of researchers interested in this area though they may be esoteric for many in the group. Section 2 introduces references pertaining to the historical setting of activity theory and contemporary explanations and development of activity theory and Vygotskian perspectives. Section 3 extends the area to references relating to learning in context or sociocultural perspectives on learning. These pertain to diverse settings and learning tasks. In section 4, I introduce literature which investigates students' activities; studies on students' goals and approaches to learning.

My aim in preparing this bibliography is to forge links between research and theory in general education and statistics education. The bibliography is introductory and lists references I have found useful. I invite researchers and statistics educators to expand this bibliography for the benefit of our group by sharing references which will increase our understanding of student learning and help us engage students in statistics education.

Doctoral thesis and earlier related papers applying activity theory

Author's works

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Section 2: Historical Setting And Critiques Of Theory

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Section 3: Learning, Society And Culture

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3.2 Learning In Context

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Section 4: Students' Goals and Approaches To Learning

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9. SERN Bibliographies

Now that this newsletter is an official *IASE* publication. We publish below a list of the bibliographies which were in the old *International Study Group Newsletter* for the benefit of new *IASE* readers and as a reminder to old readers. We hope that these lists may help old and new researchers to enter more quickly into a new topic, and we hope too that they will help to break down barriers between research across countries and linguistic traditions. All copies are available on the Web via the *SERN* web-site.

Vol.	10	No	2	Apr	97	Statistical Testing
	10		3	Jul	97	Statistical Testing
						Subjective Perceptions of Randomness
	10		4	Oct	97	Epistemological Analysis of Randomness
	11		1	Jan	98	Combinatorial Reasoning
	11		2	Apr	98	Children's Strategies in Comparing Probabilities
	11		4	Oct	98	Bayesian Statistics
						The Works of Efraim Fischbein
	12		1	Jan	99	Historical Aspects of Stochastics Education
	12		2	Apr	99	Association
	12		3	Sep	99	Averages
	N1		1	Jan	00	Textbooks Analysis

If you have a bibliography (perhaps from a recent dissertation) which you think might be of interest and use to others, please contact the Associate Editor, John TRURAN, <jtruran@arts.adelaide.edu.au>.

10. Other Publications of Interest

- Albert, J. (2000). Using a sample survey project to assess the teaching of statistical inference. *The Journal of Statistical Education*, 8 (1). This article describes the evaluation of the teaching of statistical inference in a first statistics class. A sample survey project is described as a means of assessing the effectiveness of a Bayesian approach in communicating the basic tenets of inference. The success of the survey project is evaluated, and changes to the structure of the project are described that facilitate the interaction of the instructor with the students.
- Bryc, W. (1999). Decoding a scrambled text: a hands-on project to illustrate sampling and variability. *Journal of Statistics Education*, 7(2). Students crack a simple substitution code using character frequencies in texts sampled from web pages. Frequencies are tabulated by a web-based character counter. This quick and simple project reinforces notions of sampling variability and emphasises the need to complement statistical techniques with intuition.
- Lazaridis, E. N. (1999). Constructionism and reductionism: two approaches to problem-solving and their implications for reform of statistics and mathematics curricula *Journal of Statistics Education*, 7(2). The First International Conference on the Teaching of Mathematics was held in Samos, Greece, in July 1998. Presentations by the attendees reflected a recent debate on reforms of the mathematics curriculum and related pedagogy. Chief among these was a greater emphasis on connecting the mathematics curriculum with applications, to make courses in mathematics more "relevant" to students. This manuscript notes that mathematicians tend to teach students to approach data analysis in a constructive manner, proceeding from an understanding of the basic science, while statisticians concentrate on reductive approaches, whereby models are generated upon consideration of the data themselves. It is suggested that departments of mathematics and statistics will need to adopt a new spirit of Cupertino, and partner with colleagues in application areas, if curricular enhancements in either domain are to have a reasonable chance at success.
- Love, T. A. (2000). A different approach to project assessment. *The Journal of Statistical Education*, 8 (1). An approach used to assess project team work in a condensed (half-term) elective course is discussed. The scheme described encourages student groups to prepare presentations that will be attractive to people who will evaluate their work in the real world. A report on the projects (and comments) completed by Masters of Business Administration (MBA) students at a mid western school of management is provided, along with the inventory used to assess each team's work.
- Ojeda A. M. (1998). Presentación de problemas y razonamiento probabilístico [Format of problems and probabilistic reasoning]. In F. Hitt (Ed.), *Investigaciones en matemática educativa II* (pp. 381-394). México: Departamento de Matemática Educativa del Centro de Investigaciones y Estudios Avanzados. Stochastics education research faces the difficulty of including chance elements, apart from other common difficulties that students meet in mathematical problems. On one hand one must be aware of the role of chance in the problem presented; on the other hand, he should approach the chance idea - where there is a latent indetermination- by using mathematical models that determine degrees of certainty about possible outcomes. The analysis of both the observation data and the situation presented is crucial for the researcher being able to interpret the information obtained in term of cognitive processes and of the understanding of the concepts.
- Peard, R. (1998). The understanding of mathematical expectation in gambling situations. In P. Galbraith, W. Blum, G. Booker, I. D. Huntley (Eds.), *Mathematical modelling. Teaching and assessment in a technology-rich world* (pp. 149-157). Chichester, UK: Horwood. Australian society has an acceptance of gambling and

the main purpose in entertainment rather than an expectation of long term winning. This paper examines research by the author which has shown that social gamblers involved in track betting often have an intuitive knowledge of the concept of mathematical expectation that those involved in Casino betting do not.

Sahai, H. (1999). Teaching Biostatistics to medical students and professionals: problems and solutions. *International Journal of Mathematical Education in Science and Technology*, 30(2), 187-196. The problems and challenges encountered in teaching biostatistics to medical students and professionals are considered. Some suggestions and tips which may help to overcome some of these problems are presented.

Single, R. M. (2000). Using the National Health Interview Survey and the 2000 Census to introduce statistical sampling and weights. *The Journal of Statistical Education*, 8 (1). In this paper, basic ideas from survey design are introduced using the 2000 Census as an example, in order to capitalise on the recent media attention. Then, these same concepts are applied to the National Health Interview Survey (NHIS). The methods of statistical sampling and the structure of a national survey have a variety of applications in the classroom, depending on the level of the course being taught. This paper discusses some of these applications and how to access and use these data as an effective teaching tool.

Tappin, L. A. (2000). Statistics in a nutshell?. *The Journal of Statistical Education*, 8 (1). The paper reports on a two-year investigation into the feasibility of allocating three weeks of an undergraduate calculus-based probability course to statistics. Statistical inference is based on probability, and statistical inference could be presented as an application of probability. Besides introducing some statistical concepts, it was hoped to enhance understanding of probability by highlighting this connection. However, it was not possible for the students to learn anything meaningful about statistical science in three weeks. In addition, any enhancements to the learning of probability were not significant enough to warrant the omission of material from that course.

Taur, Y., & McCulloch, C. E. (1999). A Teaching tool for nonlinear regression: visual fit *Journal of Statistics Education*, 7(2). We describe a Java applet that allows users to see and learn the fitting of regression models in a manner that is both visual and interactive, as well as consonant for linear and nonlinear models. In addition, this program familiarises users with the fact that many different parameterisations exist for a single function, and it provides insight about the relationship between these models. Called Visual Fit, this program draws scatter plots of data and allows users to fit various nonlinear models to the data. The program can also provide least squares estimates or true population parameters for comparison with the estimates made by the user. Visual Fit is available at:

<http://www.amstat.org/publications/jse/secure/v7n2/visualfit.html>

Taylor, S. A., Hopfe, M. W., & Hebert, T. E. Computer testing for a data analysis course. *The Journal of Statistical Education*, 8 (1). Given the emphasis on utilising the computer in many statistics courses, we discuss how we have implemented microcomputer task based testing in our courses. Background information is provided about a required, undergraduate, multiple section course, and why we believe computer-based testing is an effective evaluation instrument. Issues of examination design, administration, and evaluation are presented. Examples of problems used in computer-based exams are also included.

11. Complementary Short References

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12. Internet Resources of Interest

Cileda COUTINHO (Cileda.Coutinho@imag.fr) is sending the following web sites that may interest our readers:

- An online statistical textbook: <http://sunsite.univie.ac.at/textbooks/statistics/stathome.html>
- Cabri forum at Jose Antonio Mora's page : <http://teleline.terra.es/personal/joseantm/>

Internet Projects For Elementary Statistics <http://hepg.awl.com/weiss/e_iprojects/>. Projects designed to help students understand statistics by analysing real data and interacting with graphical demonstrations of statistical concepts. Each Web chapter provides a set of simulations, demonstrations, and other activities to supplement *Elementary Statistics*, a textbook by Neil Weiss published by Addison Wesley Longman: that introduces statistics through a streamlined approach to probability designed to prepare students for more advanced topics.

A New Web Site of the PME Stochastics Teaching and Learning Discussion Group. It is a pleasure to announce the launching of a new Web site of the PME Stochastics Teaching and Learning Discussion Group: (<http://www.beeri.org.il/stochastics/>). The site serves as a meeting place for members of the group and anyone who is interested in the teaching and learning of statistics and probability. The site includes the group's current and past newsletters, member's information, and a useful list of statistics resources on the World Wide Web. We hope you will find the site useful and enjoyable, and consider becoming a member of the group.

From the early research into stochastic thinking, notably the seminal investigation into probability understanding by Piaget and Inhelder two major strands of research have developed, which have gradually expanded to include statistics and combinatorics. One has been concerned mainly with psychological aspects, particularly decision-making in an uncertain environment, the other mainly with pedagogical aspects.

The PME Stochastics Working Group was established in 1997 (currently, *the PME Stochastics Discussion Group*) with the specific aim to link these two research streams and to bring to PME researchers in statistical education in areas such as Psychology, Education and Statistics. Its aim is to serve as a focus for members interested in the psychology of the teaching and learning of probability, statistics and combinatorics. It maintains an informal network between PME Conferences by means of an electronically distributed newsletter and Web site. It particularly seeks to bring together interested people from all language groups, and does its best to provide translation facilities as appropriate.

Co-ordinators: Dani Ben-Zvi, Weizmann Institute of Science, Israel <dani.ben-zvi@weizmann.ac.il>; Brian Greer, Queen's University, Belfast Northern Ireland <b.greer@qub.ac.uk>, John Truran, University of Adelaide, Australia <truranjk@camtech.net.au>, Kath Truran, University of South Australia, Australia <kath.truran@unisa.edu.au>.

13. Information on Past Conferences

13.1. Efraim Fischbein Memorial Preceding PME 23

Information provided by the speakers at the Memorial and collected by Henrietta Fischbein

On July 22nd, 1999, a year since Efraim Fischbein left us, a memorial was held in Tel Aviv. Colleagues and students from many parts of the world attended the ceremony. These included most of the participants at an *International Research Forum on Statistical Reasoning, Thinking and Literacy*, being held at Kibbutz Be'eri, Israel, at the time, and also many others on their way to PME 23 in Haifa. Efraim's contributions to the field of Mathematics Education and Statistics Education were remembered by six of his colleagues from different countries. Most of the speakers were long-time colleagues and friends. Professor Shlomo Vinner (University of Beer-Sheva) presided over the ceremony and in his opening speech dedicated the event to the study of Fischbein's work.

- **Gerard Vergnaud** (Renée Descartes University of Paris) entitled his paper: "From a Piagetian Perspective to the Definition of a New Field of Research".

Gerard underlined only some of Efraim's contributions to the field of Mathematics Education, of which the creation of PME in Karlsruhe in 1976 was the most important factor for the development of the Psychology of Mathematics Education. It answered a need for psychological knowledge by a growing number of people engaged in mathematics education. Nicolas Herskovitz is remembered as an enthusiastic supporter for the creation of this group. Alan Bell and Ludwig Meisner, together with Gerard, wrote a constitution which was adopted unanimously in Berkeley in 1980. Gerard's presentation covered three main aspects of Efraim's work : a) his research conducted in Bucharest; b) his concept of intuition; c) his epistemological and methodological message in *Cahier de psychologie cognitive*, 1982.

Efraim's research conducted in Romania was marked by the influence of Piaget's work, but it also showed his need to go further than Piaget concerning the relationship between cognitive development and learning at school. While he was a Piagetian, he was not a fideist of the theory of stages at a time when most people were. Gerard stated that "*Efraim contributed to some important changes to the theoretical framework constructed by Geneva School.*"

Many of Efraim's researches in Bucharest were aimed at understanding children's ideas of probability, statistics, multiplication of ratios, combinatorics, etc., and how their primary intuitions could be improved or replaced by new ones. It is important to stress that he introduced a component of teaching/learning to check if children's primary intuitions were changed or improved by knowledge. He was also interested in the problem of logic and used to design electric devices to check whether adolescents supposedly at the formal level were able to generate a set of combinations. Efraim was also interested in physics, mechanics and space—his works cast some doubts on the non-empirical status of mathematics.

Intuition was Efraim's main challenge. He presented in his book *Intuition in Science and Mathematics* a theory of intuition. Gerard read a passage about Intuition of Space to illustrate the deep theoretical understanding of the phenomenon of intuition of space, one which is not static, but also action: "*It is this highly complex system of expectations and programs of actions related to the movements of our body and its parts which constitutes the intuition of space*" (p. 88). "*An intuition is more than a system of automated reactions, more than a skill or a system of skills, it is a theory, it is a system of beliefs of apparently autonomous expectations*".

In 1982, in an article published in *Cahier de psychologie cognitive*, Efraim replied to an article by Jacques Leplat about research on the working sites and inspirations for research in the laboratories. He wrote: "*Education, engineering, therapy are not only sources for problems and hypotheses, they are, and must be the essential reservoir for the conceptual structure itself.*" What currently represents the main sources of theoretical concept in psychology is the everyday life experiences of the psychologist himself. The main reasons for the gap between investigation in the laboratory and on the working sites is due to the constraints imposed on the investigation in the laboratory, and the large number of varieties of conditions of psychological phenomena in education and work.

Gerard concluded his presentation with an expression of his friendship for Efraim and his family.

- **Joan GARFIELD** (USA), on behalf the IASE, expressed her opinions and those of her colleagues on the extraordinary contributions to the statistics education community made by Efraim Fischbein.

Joan first met Efraim at the *First International Conference on Teaching Statistics* held in Sheffield in 1982, when the idea for an international network of researchers emerged. David Green (UK) and Efraim gathered a group to begin this network. The original name was *The International Study Group for Probability and Statistics Concepts and Learning*. In 1987, Joan became the chair and secretary of the group which kept growing over the years. Carmen Batanero (Granada, Spain) is the current secretary and chair of this group which, after some other changes of name, has in 2000 become the *IASE Statistical Education Research Group*.

Joan's talk was partly based on what had been written soon after Efraim's death by John Truran (Adelaide, Australia) in the Study Group Newsletter. John had written that there were three giants in mathematics education during the last 50 years, Piaget (genetic epistemology), Freudenthal (mathematics), Fischbein (psychology). All three were experts in fields beyond statistics education, and their broader vision sharpened their contribution to mathematics education and made a significant contribution to statistics teaching and learning.

Efraim was a prolific researcher and writer. The lists of his stochastics publications prepared by Henrietta for PME News and by Carmen for the Study Group Newsletter give a good idea of the range of his interests within mathematics education. His primary interests were in mental models and forms of reasoning. He was concerned with both young children and adolescents and like Freudenthal, but unlike Piaget, he was also concerned with the relevance of his work to the teaching of mathematics. His book, *The Intuitive Sources of Probabilistic Thinking in Children* was published in 1975, the same year that Piaget & Inhelder's *The Origin of Chance in Children* was translated into English.

So it was during the period when the wider development of serious studies of probability occurred that researchers were challenged with two conflicting points of view. Piaget & Inhelder had argued for a stage-related development, which required the understanding of combinatorial operations as a prerequisite for full understanding. Fischbein argued for a much earlier understanding of the idea based on a more holistic approach, which he saw as one manifestation of intuitive thinking.

Joan mentioned Efraim's Cupertino with people throughout the world, his kindness and encouragement to young researchers. She quoted a note by Marie-Paule Lecoutre (Rouen, France): "*I was very sad to learn that Professor Efraim Fischbein died last July. His death is really a very great loss for the scientific community.*" Marie-Paule had recently published a paper with Efraim describing research that investigated the evolution with age, of probabilistic, intuitively-based misconceptions. Joan also quoted Mike Shaughnessy (Portland State University, USA) who first met Efraim in Sheffield, and whenever they met subsequently, he was asked "*Shaughnessy, are you doing some more work on probability?*" Efraim always took the time to talk to young people, to new ones just starting out. He set a great example for all researchers.

In July, 1997, Efraim presented one of his last papers—on children's intuitive understanding of factorial numbers—at the PME meeting in Finland, showing that he was still interested in ideas he had first addressed thirty years previously. Quoting John Truran, Joan concluded by saying "*His breadth of interests, profundity of thought, and continued enthusiasm for research into the last years of his life have been an inspiration for us all.*"

- **Alessandra Mariotti** (University of Pisa), a former doctoral student of Efraim Fischbein, remembered her first encounter with Efraim, who was then a visiting professor in Pisa.

She tried to express her feelings and emotions when being received by him as a doctoral student. She stressed his gift of communication and the fact that he had the art of creating a symbiotic relationship with his audience. The first time Efraim visited Pisa, Alessandra was interested in geometry and in visualisation, and was impressed and encouraged by the interest he showed for her work.

Coming to Israel and working with him, she felt the interest and passion Efraim had for his work and the fact that this could be transmitted to his students. She came to know that Efraim's interest in her geometry investigation was not an accident because he had done research and published articles on this theme earlier, and in 1963 the Romanian Academy Publishing House published *The Figural Concepts*, which was received as Efraim's doctoral thesis.

A figural concept is a mental entity controlled by a concept but which preserves its spatiality. The objects of investigation and manipulation in geometrical reasoning are the mental entities called figural concepts, which reflect spatial properties and at the same time possess conceptual qualities like ideality, abstractness, generality, perfection. "*Geometrical reasoning is characterized by a dialectical tension between the two components, conceptual and figural.*" After presenting the example of two points intersected by a different number of lines, and the questions asked by researcher, Alessandra underlined that such questions could be asked only by a psychologist. No mathematician would have thought of such types of questions. But they were exactly the kind of questions which permit us to have a better understanding of what is behind the geometrical notion of point.

For a better understanding of the rupture which could exist between the figural and conceptual notion, Alessandra mentioned her very recent research, choosing an example from three-dimensional geometry—the problem of the shape of a cross-section in a cylinder and cone, and how it has been dealt with throughout the centuries. These examples helped the speaker to stress the importance of figural concepts and the wealth of

theoretical ideas Efraim had left the research community to work on. "This is the way he will always be with us and to make his ideas living will be a great consolation for all of us."

- **Kathleen Hart** was, until relatively recently, Director of the Shell Center and before that, a member of the staff of King's College in England. She began her speech by saying that she knew most of the people attending the ceremony because Efraim and PME.

Kath considered that one of the main contributions of Efraim to the whole world in Mathematics Education, was his communication. He was interested in talking to people, in expressing his views and listening to other people's ideas. She too had been a former president of PME and a participant of the meeting in Karlsruhe in 1976. What was obvious in Karlsruhe was the desire to understand each other. She recalled how touching it was there when people tried to express the same ideas in French, German and English. Someone was talking about errors that children made in the study of electricity and "turned on a tap" explaining in English, then another person came along and turned on the tap explaining in French and then in German. At the time, it did not appear to be ridiculous. Their only desire was to make everyone present understand the ideas of the speaker, to communicate with one-another. PME has gone a long way since then, and people try to express themselves in English and it is supposed, she said, that they really understand each others' ideas.

Soon after Karlsruhe, Efraim went to the States to NCTM. He asked the Americans to join PME. One of the participants said that they were far too busy and Europe is too far away for them, but PME-NA was born and it is a strong organisation, and in 1999 they held their meeting in Mexico. Kath considers that it is quite extraordinary how people can manage to work together, fitting in with each other.

Kath noted that Efraim worked in different countries with all kinds of people. He was always considered to be a man of integrity and wisdom. Whenever he was asked to talk to students, he readily accepted because he enjoyed the intercourse with young people from all over the world. "*He was a man who looked forward and I think equally I look forward.*"

Kath talked about her work with doctoral students in South Africa, the problems to be faced and the discrepancy between the expectations which people have for the performance of their children and the real surrounding conditions. She is now conducting an investigation in the teaching of mathematics in Sri Lanka, former British Colony which has 95% literacy. The state provides uniforms, books and teachers for all the children. What she has observed so far is the fact that teachers of mathematics consider the amount of time spent in a classroom as being important for high efficiency. In her concluding words, Kath said that she would always remember Efraim with affection.

- **Shlomo Vinner** (University of Beer Sheva, Israel) talked about *Satisfying the Need for Certitude—Intuition*. Some extracts from his address are quoted here verbatim.

Quite often the loss of a person brings us back to his work. We read it again and discover some aspects we had not been aware of before. This is because of the development we have undergone as readers, and also because we had been exposed to new approaches and points of view.

Attempts have been made to explain human behaviour by means of the principles taken from the theory of evolution. The explanation is made on the assumption that there is some mechanism in our brain which makes us act the way we act in given circumstances. The existence of this mechanism in our brain is due to the evolutionary advantage given us in the course of animal evolution in general and human evolution specifically. According to this approach, the psychologist identifies a certain need existing in the animal or human being which is assumed to be produced by a certain psychological mechanism. The psychologists try to explain the evolutionary advantages given to those who possessed it.

For Freud these were: the drive for sex and for aggression. For Maslow they were the need for high self-evaluation of one's self and also for self-fulfilment. For modern approaches, physiological needs have physiological explanations, but psychological needs do not yet have any satisfactory explanations, or do not have any explanation at all, except the general saying that everything is bio-chemistry.

Assuming that there is a bio-chemical mechanism, which form a certain psychological need, the psychologists try to explain that a normal mental behaviour can be reached only by relying automatically on a number of acceptable data. Fischbein considered the need for certitude as a necessary condition for normal functioning of the thought process. Lack of certitude can paralyse this process. The question to be asked is how this need is satisfied. Fischbein said that in order to assure the continuity and fluency of our mental behaviour, we feel the need to rely on certain ideas which would appear to us indubitable, self-consistent and self-evident.

Intuition expresses the fundamental need of human beings to avoid uncertainty. Intuitions are specifically those cognitions in which overconfidence plays an essential role. It does not mean that overconfidence is an automatic product of ignorance or incompleteness of information. *"Overconfidence is attained by a selection activity which is aimed to preserve, automatically, those data which seem to support a certain conception and at the same time, to ignore those contradicting it."*

The term "intuition" has multiple meanings in Western culture. Descartes, Spinoza, Kant, Bergson, used intuition as a key term in the epistemology. Fischbein explained the concept mainly because he has to tell the reader in what sense he used it. Intuition is immediacy. Intuitive knowledge is immediate knowledge. Intuition is seen as a primary phenomenon which may be described, but which is not reducible to more elementary components. Intuition has its roots in the syncretic type of thinking of the child and of human beings in the early stages of civilisation. But it does not survive in adults and in highly developed cultures only like a residuum.

The history of science and mathematics is an important source for understanding the dramatic struggle of the scientific mind against intuitive biases. Fischbein ties intuition to the need for certitude. Intuition is our absolute need for absolutely reliable landmarks. The use of the word organic in Fischbein's theory is a clear evidence that intuition has a biological origin. It is considered coherent to tie Fischbein's theory of intuition to brain studies, the aim of which being to explain mental processes.

Fischbein distinguishes between intuition about statements and intuition about concepts. He dealt mainly with intuition about statements. In an article which was published in 1999 *"The Mathematical Concept of Set and the 'Collection' Model"* (Fischbein & Madlen Baltsam), Fischbein dealt with intuition about concepts. One may consider the theory of intuition presented in *"Intuition in Science and Mathematics"* an expression of the evolutionary approach.

Intuitive reactions are very often the result of analogy or generalisation. Fischbein believed that the need for certitude is the explanation of the persistent use of the term intuition in many fields. We feel the fundamental need to see with our minds. In order to survive, we have to act in accordance with a given, credible reality. Education is supposed to develop reflective ability and critical thinking. The thinking process cannot be free of mistakes, but it is possible to overcome these mistakes by means of the control stages which should be added to any thinking process. Even by these statements, Fischbein is joining the current tendency in psychology and education.

We have discussed some aspects of Fischbein's theory from the point of view of psychology of the human beings. Goldeman in his book *"Emotional Intelligence"* gives some suggestions about the use of our emotions. He writes that the feeling of sadness is to help someone to adjust to some significant loss. But we cannot adjust to the loss of Fischbein, here we are grieving for him. We miss him. We find some consolation in his writings, by these we can still talk to him. His ideas have become tools for our daily thought processes about thinking. Thus, in a way, people continue to live beyond their physical existence.

- Professor **Albrecht Abele** (Heidelberg University, Germany) began by expressing his gratitude for the friendship and scientific co-operation he had with Efraim.

"Efraim Fischbein's personality, his scientific contributions, his kind courteous nature, his clear train of thought, his simple language, his ability to fill young pupils and students with enthusiasm, to make them curious and knowledge-thirsty— all these have been appreciated repeatedly today and in the PME Newsletter."

Albrecht mentioned his first meeting with Zoltan Dienes in Heidelberg where Dienes talked about his games, very artificial games with symbols and concrete materials which were used as carriers for symbols. In 1970, in Budapest, Albrecht met Efraim, whose co-operation with the Dienes group shows his turning to

questions of the primary school mathematics. The co-operation and friendship between Efraim and Albrecht started then. Efraim *"enriched decisively the work of the Dienes group with his ideas."* It was a very fruitful contribution to the work of the Dienes group.

In his speech Albrecht mentioned the conference in Trento in 1980, when Efraim gave two lectures: "*Le concret et l'abstrait dans l'enseignement de mathématiques élémentaires*" [The concrete and the abstract in the teaching of elementary mathematics] and "*L'enseignement de probabilités dans les classes élémentaires*" [Teaching probability in elementary school classes].

Albrecht also mentioned the creation of PME in 1976, within the framework of ICME-3. Efraim was the chairman of the working group on "Psychology of Mathematics Education", Albrecht was the secretary and Colette Hug and Robert Karplus assisted in the organisation. Three main topics were discussed during the working group sessions: Image and Concept in Learning Mathematics (Fischbein); Reflective and Intuitive Intelligence in Learning Mathematics (Fischbein); Intellectual Structures and Mathematical Structures (introduction by Abele).

The Karlsruhe workshop showed a model of Efraim's typical working methods: stimulating the discussion by questions, searching for a theoretical background for empirical studies and findings, giving answers on the basis of a wide knowledge and consistent/firm rigour of thinking. At the end of the session participants suggested meeting every year. Efraim suggested establishing the group as a permanent group affiliated to ICME, passing a constitution, electing an international committee with a president as head. The major goals of the new group were formulated: promotion of international contacts, exchange of scientific information in psychology and mathematical education in general, exchange of information about specific problems of teaching and learning mathematics.

Albrecht said: "*I was deeply impressed by Efraim's clarity of thinking and the strict logic of his argumentation. Many suggestions offered by him in our discussions helped me in my own research and teaching activities.*" Efraim paid several visits to the University of Education at Heidelberg, giving talks, seminars or discussing with colleagues. In 1989 he was a visiting professor for some months. Through his lectures, the teacher students gained an impression of his view and understanding of didactical topics from the point of view of a psychologist who had begun very early, 1953, publishing papers and books on these topics.

Albrecht concluded his talk with memories of Efraim and his wife, while they visited his family in Schriesheim. These were memories dear to him, to his wife and his two sons. He remembered Efraim's contribution to his retirement and concluded by quoting Efraim—"A good didactical model should be a generative one, that is, it should be able to inspire the creation of other models adequate to related problems" and "A good model has to be true in itself."

Footnote

The Study Group obituary and bibliography referred to in Joan GARFIELD's talk will be found in the *Newsletter of the International Study Group for Research on Learning Probability and Statistics* 11(4), October 1998. Further mémoires, including one by Henrietta, will be found in *PME News*, May 1999

13.2. ISOSS Sessions On Education Statistics Pakistan, 27th-31st August,1999

Dr. Munir Ahmad, President ISOSS, Lahore, Pakistan.

The ISOSS organised ICCS-VI at Lahore, Pakistan on 27th-31st August, 1999 in collaboration with PSA, UNFPA, ISESCO and the University of the Punjab, (Pakistan). There were ten invited papers sessions and 35 contributed papers sessions on various aspects of the conference. The theme of the conference was "3rd Millennium Challenges". About 146 papers were presented in the sessions. Two sessions on statistical education were arranged where 3 invited papers and 6 contributed papers were presented on various aspects of statistical education.

Invited papers:

Ahmad, M. On 50 years of statistical education in Pakistan.

HABIBULLAH, S. N. Kinnaird inter-collegiate. statistical competition "guided level": an innovative endeavour to train Pakistani teachers of statistics regarding the conduct of sample surveys within colleges.

OTTAVIANI, M. G. & BATANERO, C. The role of IASE in developing statistical education.

Contributed papers:

1. Khattak, S.. Blunders in the merit list of NWFP medical and dental colleges in the sessions 1996-97 and 1997-98.
2. Ahmad, M. Role of ISESCO in the development of statistics, mathematics and computer science in the Islamic world.
3. Jamil Butt, M. Development of computer educational material to promote literacy in Pakistan.
4. Pervez, K., & Memon, A. Z. Teachers' ethical attitudes (A case study based on postgraduate education).
5. Sabazwari, M. A. Educational ideology of Pakistan and its related aspects.
6. Faizan Haider, S., & Intikhab Alam Zaidi, S. IPNG/IVP6 A break through in it.

The paper of Dr. OTTAVIANI and Dr BATANERO was presented by Miss Saleha NAGHMI HABIBULLAH of Kinnaird College on the express permission from the authors. Some full length papers will be published in the conference proceedings, whereas other papers will be abstracted. ISOSS arranged an official meeting of the official representatives from different countries. The following persons attended the meeting: Mr. Fazalullah Qureshi, Secretary, Statistics Division, Government of Pakistan, Islamabad (Pakistan). Dr. N.M. Larik, Director General, Federal Bureau of Statistics, Islamabad (Pakistan). Dr. M. Rashid Salaria, Deputy Director General, Statistics Division, Islamabad (Pakistan). Mr. Mohammad Ali Mehdizadgan, SCI Expert in Household Economic Statistics, Statistical Centre, Tehran (Iran). Mr. Mohamed Ali Baghat, CAPMAS, President Office, Nasr City, Cairo (Egypt). Mr. Mohamed Rida Ahmed Abdullah, CAPMAS, President Office, Nasr City, Cairo (Egypt). Mr. Magdy Mohamed Abdel Halim Zawied, CAPMAS, President Office, Nasr City, Cairo (Egypt). Mr. Canden Baysan, SESRTCIC, Attar Sokak No.4, Ankara (Turkey). ix Ms. Binttwatie Soedhwa, Chief Population Statistics, Kromme Effeboogstrant Parmaribo, Suriname.

The Secretary of the Statistics Division welcomed the official delegates on behalf of the Government of Pakistan, and ISOSS. Dr. Munir Ahmad, President of ISOSS who arranged the meeting welcomed the delegates and explained the purpose of the meeting. Each of the delegates expressed his views on the occasion and extended his whole hearted co-operation in organising projects of mutual interest and rendered the possible assistance in co-ordinating the government activities. The meeting ended with a vote of thanks to the chair with remarks that such meetings should be held in ISOSS conferences in the future. ISOSS has also decided to make statistical education and official statistics regular features of the ISOSS and *Pakistan Statistical Association Conferences*.

13.3. Jornadas ASEPELT sobre Nuevas Tecnologías para la Enseñanza de Economía Aplicada, November, 1999, Alcalá de Henares, Madrid, Spain

The first ASEPELT Conference on *New Technologies for Teaching Applied Economics* was organised by ASEPELT and the Department of Applied Economics, University of Oviedo, Spain. The aim of the *European Scientific Association of Applied Economy, Spanish Section* (ASEPELT, Barcelona, Avda. Diagonal 508, 1er. piso) is to organise, promote and improve original research work in applied economics. To reach these goals the following activities are carried out: a) Exchanging information related to research and work projects among

members; b) Publishing selected papers or collective works; c) Publishing a scientific journal; and d) Organising seminars, conferences and meetings.

The conference was aimed at discussing the possibilities of new technologies in University teaching and to invite all the association members to contribute with their experiences in training with the help of new technologies.

Papers related to statistical education

- Amo Saus, N. E., & GarcíaPérez, M. E. Nuevas tecnologías para la enseñanza de las Matemáticas en Economía Aplicada [New technologies for teaching mathematics in applied economics].
- Areitio, B., Aldaz, L., Odriozola, G. Experiencia y posibilidades de docencia distribuida y virtual [Experiences and possibilities of distributed and virtual teaching].
- Arias Martín, C., Caro Ruiz, J. M., Márquez de la Plata, M. Pajares Ruiz, A. Pérez Díez, J. L., & Pérez Villalta, R. Propiedades numéricas de la regresión lineal mínimo cuadrática [Numerical properties of the linear regression line].
- Barkhas, J. La educación en una sociedad informatizada [Education in a computerised society].
- Beyaert, A., & González, M. I. Clases de econometría aplicada y nuevas tecnologías: aprendizaje cooperativo en el aula de informática e Internet [Applied econometrics and new technology: co-operative learning in the computer lab and the Internet].
- Calderón Montero, S., & González Pareja, A. Integración de Internet en la enseñanza de las Matemáticas en la Economía [Integration of the Internet in mathematics teaching for economists].
- Fernández, A. Tecnologías para la enseñanza virtual por Internet [Technology for virtual teaching on the Internet].
- López, A. J. Una experiencia docente enlared. Análisis de datos económicos [A teaching experience in the web. Economic Data Analysis].
- López Delgado, P. Integración de Internet dentro de la enseñanza de la estadística para economistas [Integration of the Internet in statistics teaching for economists].
- Martínez Filgueira, M., García-Carro, B., Peña, C., & Sánchez, S. Nuevas perspectivas en la enseñanza de la Estadística [New perspectives on the teaching of statistics].
- Pérez, R. Experiencia virtual de formación universitaria. Proyecto aullaste, una metodología [A virtual experience of University teaching. Project aullaste. One methodology].
- Rincón, J. M., Vega, A., & Areitio, B. Ruptura dela intersección espacio temporal en la enseñanza universitaria [A break in the space-time intersection of University teaching].
- PALACIOS, F. Nuevas tecnologías para la enseñanza de técnicas cuantitativas. Aplicación de Office en combinación con una página WEB: una experiencia para el curso 1999-2000 [New technologies in the teaching of quantitative methods in economy with a web page. An experience for the course 1999-2000].
- More information is available from <http://www.aulanet.uniovi.es/asepelt/>

13.4. Encontro sobre Ensino e Aprendizagem da Estatística, Lisbon, Portugal February, 3-4, 2000

This meeting was held since February 3rd to 4th, 2000 at the Faculty of Sciences, University of Lisbon, Portugal. It has been recognised that statistics is a matter of high relevance in the education of citizens, although in Portugal has not still received the deserved attention in primary and secondary school curricula. The meeting gathered more than 600 participants, primary and secondary school teachers, and University lecturers from Portugal, Spain, Brazil, Argentina, Cuba and Mexico. This meeting was the consequence of a joint initiative from

the Portuguese Statistical Society, Association of Teachers of Mathematics, and the *Departments of Education and Statistics & Operational Research* of the Faculty of Education, University of Lisbon. Carmen BATANERO, University of Granada, Spain and Peter HOLMES, Nottingham Trent University, England, were invited to present main international development in the area. Teachers and researchers presented teaching experiences and research reports on students' learning, and there was a debate on the curricular content and the training of teachers to teach statistics. The Head of the *Departments of Primary Education and Secondary Education* from the Ministry of Education attended the closing session.

The conference works showed that statistics has a limited role, in particular in primary school curricula, where main ideas, such as measures of spread, sampling, or global features of data are not considered, and new methods of data analysis are not valued. Moreover, there is a strong computational tendency, that do not allow students to appreciate the role of statistics in the processes of designing and carrying out research projects and in making inferences. It also was shown that students often bring incorrect ideas to this field, that produce with a frequency greater than expected wrong responses, even to questions related to simple measures of central tendency. Students sometimes lack flexibility to select the representation of a statistical concept that is more suited to a particular situation. Students' difficulties include the own general notion of what is statistics, that for many of them is only a chapter of mathematics that serve to "compute averages and produce graphs".

A final point discussed in the meeting was the training of teachers, which, in Portugal, tend to be not interested in the topic that is frequently the first theme to be suppressed when it is needed to reduce the courses content. Since learning fundamental notions of statistics and its role in the research process very important for the training of citizens, it is urgent to promote a positive attitude in relation to this area among teachers. This poses a main challenge to educational authorities, teaching institutions, professional association and what is more important , to teachers themselves.

Plenary lectures.

BATANERO, C. Dificultades de los estudiantes en los conceptos estadísticos elementales: el caso de las medidas de posición central [Students' difficulties with basic statistical concepts: the case of averages].

BRANCO, J. Estatística no secundário: O ensino e seus problemas [Statistics at secondary school level: Its teaching and its problems].

Viana, J. P. Divertimentos e assuntos sérios na estatística [Funny and serious matters in statistics].

HOLMES, P. What sort of statistics should be taught in schools and why?.

Round Tables:

A estatística no currículo [Statistics in the curriculum]. A. Porralho, F. Nunes, Joana Porfirio, Joao Pedro Faria, & Paulo Alberga.

A estatística na formação inicial de professores [Statistics in the initial training of teachers]. Isabel Rocha, Joana Castro, Joao Filipe Matos, & Nazaré Lopes,

Papers:

Barceló, S., CAPILLA, C., & Zúnica, L. Experiencia y desarrollo de la asignatura de estadística en los planes de estudio de ingeniería en informática [Experiences and development of statistics in the training of computer scientists].

Barrios, M., Cosculluela, A., Freixa, M., Guardia, J., Peró, M., & Turbany, J. La transición entre el bachillerato y la asignatura de estadística en la Facultad de Psicología de la Universidad de Barcelona [The transition from secondary school to the introductory statistics course at the Faculty of Psychology in the University of Barcelona].

Marinelli, C., Torcida, S., & Cepeda, R. Sobre una propuesta de enseñanza de la asignatura de probabilidades y estadística para alumnos de ingeniería en sistemas [A proposal for teaching probability and statistics to students of systems engineering].

TAUBER, L., & Sánchez, V. Comprensión de la distribución normal en estudiantes universitarios [University students' understanding of normal distributions].

Oliveira Ferreira, M. J. Algumas experiências de ensino das probabilidades e estatística com recurso à simulação [Some experiences of teaching probability and statistics with the help of simulation].

Papolla, A. L. Aplicação da probabilidade condicionada aos testes de diagnóstico [An application of conditional probability to diagnostic tests].

Freiras, J. O. Calculadoras gráficas no ensino da estatística sem perder o rigor científico [Graphic calculators in teaching of statistics without losing scientific rigour].

Canavarro, A. Estatística e calculadoras gráficas [Statistics and graphic calculators]

Santos, C., & Pedro, C. Programs de geometría dinámica ao servicio da estatística [Application of dynamic geometry programs to statistics].

Ponte, J. P., & Fonseca, H. A estatística no currículo do ensino básico e secundário [Statistics at the primary and secondary school curricula]

Ricardo, B., & da Silva, C. Introdução de noções de probabilidade e estatística nas séries de 1º e 2º graus [Introducing some ideas of probability and statistics at 1st and 2nd primary levels].

Barreto de Bern, A., & Coelho, J. Estimando daretas no ensino fundamental [Direct estimation in fundamental teaching].

da Graça E. A estatística no 1º ciclo [Statistics at primary level].

Pereira, C., & Sabugueriro, S. Os alunos também fazem estatística [Students also do statistics].

Pereira, P., & Rafael, I. Pólos comerciais de Lisboa: um projecto de investigação estatística [Business centres in Lisbon: a statistical investigation project].

14. IASE Round Table Conference on Training Researchers in the Use of Statistics

The Institute of Statistical Mathematics, Tokyo, Japan, August 7-11, 2000



Scientific Committee

Carmen BATANERO, Spain, Chair
Theodore CHADJIPADELIS, Greece
Joan B. GARFIELD, USA
Yuki Miura, Japan
David OSPINA, Colombia
Brian PHILLIPS, Australia

Local Organising Committee

Yuki Miura, Surugadai University, Chair
Kensei ARAYA, Fukushima University
Masakatsu Murakami, The Institute of Statistical Mathematics
Toshiro Shimada, Professor Emeritus, Meiji University

IASE Round Table Conferences

Since 1968, a number of *Round Table Conferences* have been organised on statistical educational topics, initially by the *Education Committee of the International Statistical Institute* and, since 1988, by *IASE* (the *International Association for Statistical Education*). It has been usual for these conferences to be held as satellite meetings to each *ICME* (*International Congress on Mathematics Education*).

This year the *IASE* is organising a Round Table Conference on the Training of Researchers. After a Call for Papers and a process of refereeing, 22 papers have been accepted and will be presented and discussed at the conference. The conference programme, and preliminary papers will be located in a few days at the conference web page: <http://www.ugr.es/~batanero/iasert.htm> and in our next Newsletter we will include a summary of all the presentations and discussions.

The goal of the *Round Table Conferences* is to bring together a small number of experts, representing as many different countries as possible, to confront one another's views and approaches on a given topic area. The round table meetings provide opportunities for developing better mutual understanding of common problems,

and for making recommendations concerning the topic area under discussion. A main outcome is a monograph containing a set of refereed papers, which have been prepared for, and discussed during, the conference. This monograph will be published after the conference to present a global overview of the conference subject, to serve as starting point for further research on the selected theme. Below we are including the document that served to define the theme of the conference.

Training Researchers in the Use of Statistics

Researchers in different sciences need to collect and analyse data about the phenomena which they study. Conducting empirical research is an exercise that requires conceptual, practical, and also applied statistical skills. The arrival of computers has led to diffusion and intensive use of new statistical techniques, and their application to the analysis of progressively more diverse data sets in a growing number of disciplines. As a result, statistics has become a fundamental tool for experimental researchers, many of whom lack the necessary training in statistics.

Researchers frequently bring statisticians into their research teams. This has two advantages. It helps to ensure that complex data are correctly analysed. It also enables the researcher to learn of new developments in statistical procedures and software tools. However, experimental data analysis and solving practical problems cannot be considered to be solely the responsibility of statisticians. Some fundamental research design issues, and decisions within the data analysis process, as well as the final interpretation of results, require a knowledge of the specific discipline area that is generally deeper than that which a statistician is able to contribute.

Inappropriate attitudes or lack of knowledge on the part of researchers about the central role that statistics can play in research may affect the communication and collaboration between statisticians and researchers in other fields. Psychological heuristics and biases also affect the processes of decision taking and interpreting of random experiment results. Researchers, for example, sometimes overestimate the power of their research methods, or attribute too much confidence to the reliability (replicability) of their findings.

As a consequence, statistics courses can be seen to be a crucial part of the general training received by new researchers. Within many masters and doctoral programmes in other disciplines, courses on data analysis concepts and procedures and, more generally, on statistical reasoning and research methodology are included. Therefore, the study of difficulties and obstacles that new researchers face when learning the contents of these courses should be of fundamental concern to statistical educators. Key issues are the existing concepts and attitudes that the researchers bring to these courses, as well as the methods by which they are expected to develop their statistical understanding.

That there are inadequacies in such training programmes may be inferred from the degree of controversy that exists within some research communities about the use of statistical tests and other statistical procedures. This controversy has increased in recent years within some professional research organisations. Important shifts have been proposed, and in some cases implemented, in editorial policies regarding the publication of statistical analysis results. However, there is still a great deal of evidence that researchers do not have the necessary understanding of statistical concepts and processes to appreciate what methods are really appropriate to their needs. It is therefore crucial that statistical educators consider empirical findings about researchers' uses and misuses of statistics from a didactic perspective, so that they can contribute significantly to the development of appropriate training programmes for researchers.

IASE, the International Association for Statistical Education, is convening a Research Round Table on this topic. It is hoped that statistical educators across the world will wish to contribute to the international discussion and thereby extend understanding about the problems of training researchers in the use of statistics.

Some research questions

The overall intention is to study the problem of training researchers in the use of statistics, in all its many dimensions. One aspect of this relates to the considerable variation that pertains in the statistical methods that the trainee researchers require, dependent upon which scientific context they will be working in. A wide-ranging discussion is needed within the statistical education community itself in order to identify prevailing views on how researchers may be optimally trained.

There is, however, also a need to develop mutual understanding of the problems by encouraging dialogue between statistical educators and representatives of other scientific disciplines. The following broad areas are expected to form the main structure of the Round Table programme and its deliberations.

What are the specific statistical competencies that researchers in different disciplines should acquire in their postgraduate training?

Statistics is an important component in the training of new researchers within masters and doctorate courses. There are a number of reasons for including a statistical component in such training. Scientists need: a basic knowledge of statistics to carry out simple statistical tasks themselves, a level of understanding that allows them to identify statistical errors in research literature, and the ability to recognise situations where they should seek a statistician's help.

What are the particular needs and problems in the statistical training of researchers in specific fields? Of what good examples of successful teaching experiments in specific fields do we know?

Many domains of scientific knowledge have become highly specialised. Scientists in different disciplines, have different needs and opportunities to apply statistics. Their views about statistics may differ, according to their previous statistical and mathematical training and research backgrounds. This may be reflected in their having different training needs. Analysis of these issues, and examples of course design and evaluation could provide examples for future developments.

What are the main learning problems, misconceptions and errors concerning particular advanced statistical concepts?

Research into the learning of advanced statistics is starting to emerge. Students' difficulties on topics such as hypothesis testing, estimation, correlation, the normal distribution, are now starting to receive attention from researchers in statistical education. However, much more research on these problems, and on students' difficulties in other advanced statistics topics, is needed. It is also important to communicate the outcomes of such research to statistical educators, so that they can be taken into account in the design of research training courses.

How should we design/evaluate courses for training researchers in particular statistical topics? What good examples do we have of successful teaching experiments in advanced statistics?

Because of the speed at which statistical techniques develop and diversify, researchers frequently need to update their understanding of specific procedures or learn about new techniques that they should be employing in their research projects. One main problem is the design and evaluation of courses on topics such as multivariate analysis, bayesian inference, sampling design, categorical data analysis, experimental design, quality control, etc., directed at new and senior researchers.

What are the effects of technology on the statistical training of researchers?

Research on the Role of Technology in Teaching and Learning Statistics was the theme of the previous Round Table Conference held in Granada in 1996. The conference demonstrated that educational technology does afford us with a large variety of strategies for teaching statistics. However, a number of problems were also identified, e.g. inadequate preparation of teachers, inappropriate curriculum content and structure, or lack of appropriate assessment methods. The extent to which these possibilities and problems could affect the training of researchers in the use of statistical software, as well as the training needs of researchers, will be addressed.

What errors are frequent in the use of statistics by researchers?

Because the logic of statistical inference is difficult to grasp, its use and interpretation is not always adequate. It is important for the scientific community to be made aware of common errors and misinterpretations in the use of statistics.

How the researchers attitudes towards statistics affect the current role of data analysis in experimental research?

The role of statistics in research is sometimes conditioned by researchers' views of statistics and the utility of statistics, including overestimating the power of data analysis, considering statistics as a mechanistic process,

or complete rejection of the quantitative approach to research. The task of assessing the role of statistical methods in empirical research is also complicated by the facts that; (a) researchers use different research methods to achieve the same goals, (b) the theoretical, practical and statistical constraints on researchers differ when the researchers have different objectives, and (c) the relationship between the substantive and statistical hypotheses is often oversimplified by researchers.

Could we compare consultation to a teaching/ learning process? Are there problems of communication in the collaborations between statisticians and experts in different disciplines?

Statisticians who frequently collaborate with researchers need to understand enough about their colleagues' discipline areas as well. They must also learn to communicate statistical issues and results effectively to researchers. Problems can arise because of differences between statistical, technical scientific and everyday use of language. Statistical educators can, and should, be involved in improving the learning processes underlying the skills associated with providing statistical consultation.

What statistical concepts and procedures are informally learned from reading research literature?

Statistical language and statistical reasoning allow a specific way of communicating information and reaching conclusions. The way in which this resource is used in research literature to support researchers' results, and the learning processes involved in reading published research studies, need to be examined from the perspective of statistical education. A related topic is the need to develop criteria that can be used by researchers to evaluate the statistical methods found in research reports.

The Institute of Statistical Mathematics

Since its foundation as the one and only national institute of statistics in Japan, the Institute of Statistical Mathematics has continued to exert a distinguished influence on the study and research of statistical science. The ever-increasing needs for statistical methods and ideas in various fields of science and technology led the Institute to reorganise itself in 1985 as an inter-university research institute which puts a major emphasis on research collaboration with all disciplines of science. In 1997, in the prospect of fostering collaborative research projects even more effectively and intensifying the impact of statistical science over academia, industry, and government, the Institute has restructured its two attached centres and established positions for foreign researchers as visiting professors.

At present, the Institute consists of four departments, two centres, two councils, and a committee. The four departments: Fundamental Statistical Theory, Statistical Methodology, Prediction and Control, and Interdisciplinary Statistics form the active core of the Institute with its 55 academic staff, carrying out research either on statistical theory or on its application to other fields of science and industry. The Department of Fundamental Statistical Theory and its four divisions address the fundamental aspects of theoretical statistics. In the six divisions of the Department of Statistical Methodology, efforts are concentrated on improving statistical methods and creating new techniques for analysis. The seven divisions in the Department of Prediction and Control are specifically concerned with development of innovative approaches to understand and possibly control phenomena of a stochastic nature. The Department of Interdisciplinary Statistics, with its three divisions, is set up in order to transfer methodological developments to other disciplines and to receive, in turn, impetus that urges the creation of new statistical methods.

The two centres attached to the Institute have the aim of supplementing its activities. As of April 1997, their names and structures have changed in order to stimulate cross-disciplinary statistical research and to provide researchers both inside and outside the Institute with adequate computational and informational resources. The Centre for Development of Statistical Computing consists of two divisions. Together they undertake research on statistical computing, and also facilitate the use of computers and network connections. The Centre for Information on Statistical Sciences encourages research collaboration, publicises research findings through journals and the internet, and seeks to cultivate statistical thinking in the general public. The Centre has an additional division for foreign visiting professors.

In addition to the departments and centres, the Institute has a section of 12 technical staff that work on special jobs including maintenance of computer systems and bibliographical service. The Institute has an

excellent library of books and journals, not only in pure statistics, but also in fields of specific interest to researchers (e.g., physics, genetics, and social sciences). Lastly there is also a division of 18 officials who take care of general affairs. The Institute devotes itself to educating young statisticians as well. As a constituent of the Graduate University for Advanced Studies (Department of Statistical Science, School of Mathematical and Physical Science), the Institute offers graduate programs leading to a Ph.D. degree.

More information about the Round Table conference can be obtained from Carmen BATANERO, batanero@goliat.ugr.es or from the web page: <http://www.ugr.es/~batanero/iasert.htm>

15. Forthcoming conferences

Statistical Implicative Analysis, Caen, France, June 23-24, 2000

Implicative analysis is a type of data mining. By crossing subjects (or objects) with variables (attributes or properties), it serves to deduce knowledge and rules such as "the attribute a implies the attribute b". It is statistically based on the number of cases confirming the rule. The software CHIC allows us : - to quantify the rule consistency and subject's contributions to the rules, - to represent in a graph, rule chains or a hierarchy, - to add, delete, join or classify variables. This is useful for diagnosis, and for showing or generating theorems in a number of fields such as business, medicine, artificial intelligence, didactics, education, psychology, sociology, or archaeology.

The two days workshop will be organised around plenary conferences to show the principles of the method, papers presenting research results and working groups to handle the software CHIC. Participants can bring their own data. The meeting is supported by *ARDM (Association pour la Recherche en Didactique des Mathématiques)*, *SFC (Société Francophone de Classification)*, *IPN (Institut Polytechnique de Nantes)*, *IUFM (Institut Universitaire de Formation des Maîtres)*, *Académie de Caen* and the *IASE (International Association for Statistical Education)*.

Scientific Program Committee M. Bailleul, C. BATANERO, H. Briand, G. Brousseau, E. Diday, R. GRAS, A. Hardy, Y. Kodratoff, P. Kuntz, E. Lacasta, J. Lejeune, I.C. Lerman, G. Noel, M.G. OTTAVIANI, M. J. Perrin, and J. Phillippe.

Local Organizing Committee M. Bailleul, and R. GRAS. More information is available from Régis GRAS (gras@univ-rennes1.fr) or Marc Bailleul (marc.bailleul@caen.iufm.fr).

15th Australian Statistical Conference, Adelaide, South Australia, July, 3 - 7, 2000

The *Statistical Society of Australia* and the *Organising Committee* invite and encourage you to attend the *Society's 15th Australian Statistical Conference*. The conference will be held at the Adelaide Hilton International Hotel in the very heart of the city of Adelaide. The Programme Committee has provided a number of workshops in the weekends surrounding the conference, and has given us a programme with several major strands running through it. There is a fine selection of invited speakers from Australia and overseas, and there will be sessions covering many aspects of statistics and its applications.

Statistical Education Workshop, July 1-2, 2000

The workshop will focus on the theme of Innovation in Statistical Education. Major input for the workshop will be provided by special guest speaker, Professor David MOORE from Purdue University. The workshop aims to be as interactive as possible, with participants being given a range of opportunities to discuss issues around the main theme. Delegates will also be able to make short presentations on their current work. More information is available from <http://www.sapmea.asn.au/15ASC.htm>

Third European Congress of Mathematics, Barcelona, Spain, July 10-14, 2000

The Third European Congress of Mathematics (3ecm) will be held in Barcelona, Spain, 10-14 July, 2000. Information can be obtained by contacting the congress Secretariat at the Societat Catalana de Matemàtiques, Institut d'Estudis Catalans, Carrer del Carme, 47, E-08001 Barcelona, Spain. E-mail: 3ecm@iec.es or by visiting the websites <http://www.iec.es/3ecm/> or <http://www.sj.upc.es/3ecm/>

EM 2000, Grenoble, France, July 15-17, 2000

On the occasion of the World Mathematical Year 2000, the French Sub-commission for ICMI (Commission française pour l'enseignement des mathématiques) announces the symposium EM 2000 (Espace Mathématique 2000) to be held in Grenoble (France) from July 15 to 17, 2000, on the theme *L'enseignement des mathématiques dans les pays francophones au XXe siècle et ses perspectives pour le début du XXIe siècle*. This meeting has been recognised as an ICMI Regional Conference. Participation is especially solicited from all francophone countries and countries where French is related, at least partially, to mathematics education.

Further information can be obtained on the website <http://www-leibniz.imag.fr/EM2000> or by contacting the Chair of the program committee, Pierre Jullien <pjullien@newsup.univ-mrs.fr>

PME 24, Hiroshima, Japan, July 23-27, 2000

Discussion Group on Stochastical Thinking, Learning, and Teaching

The organisers propose an overarching theme, namely: The relationship between stochastical and mathematical thinking, learning, and teaching. It is their intention to approach this theme from multiple perspectives, including:

1. Philosophical, in terms of the perceived boundaries of the disciplines.
2. Historical, in terms of the developments of the disciplines.
3. Educational, in terms of the positioning and implementation of the teaching and learning of stochastics within school and tertiary curricula, including such fundamental issues as teacher development, assessment, and technology
4. Psychological, in terms of the specific cognitive and sociocultural processes involved in the teaching and learning of stochastics.. Research, in terms of cross-fertilisation of theoretical frameworks and methodologies.

A mechanism already exists for electronic communication between potential participants through the PME Stochastics Teaching and Learning Newsletter, which has been circulating for four years. A number of short contributions will be prepared in advance to provide a focus for discussion. The PME Stochastics Discussion Group will focus on "The Relationship between Stochastical and Mathematical Thinking, Learning, and Teaching". The brief contributions to focus our thinking will be presented by James Nicholson (Northern Ireland) Mario Barra (Italy) and Jenni Way (England/Australia). The co-ordinators for this proposed Discussion Group will be: Dani BEN-ZVI (Israel) dani.ben-zvi@weizmann.ac.il, Brian Greer (Ireland) b.greer@qub.ac.uk, Kath TRURAN (Australia) kath.truran@unisa.edu.au, and JOHN TRURAN (Australia) jtruran@arts.adelaide.edu.au . PME web site: <http://home.hiroshima-u.ac.jp/pme24/index.html>

ICME-9 Tokyo/Makuhari, Japan, July 31 to August 6, 2000

Plenary session: Mike SHAUGHNESSY (USA) is giving a plenary lecture at ICME, as a representative of the IASE. The title of his talk is **From research to teaching: What Research Suggests about Teaching Data and Chance.*

TSG4 The Teaching and Learning of Statistics. Organisers: CO: Susan STARKINGS, (UK) AO: Theodore CHADJIPADELIS (Greece) Michimasa Kobayashi (Japan), Tae Rim Lee (Korea) LAO: Nakano, Toshiyuki (Japan).

Speakers:

1. Elena CARRERA. *Teaching statistics in the first year of university with emphasis on problem solving.*
2. Tae Rim LEE . *The study on the internet course of introductory statistics in cyber university.*
3. Linda GATTUSO. *The understanding of the average.*
4. Hans-Joachim MITTAG. *Multimedia for Teaching introductory statistics.*
5. Li Jun & Lionel PEREIRA-MENDOZA. *Chinese students' probabilistic thinking.*
6. Joe WISENBAKER *Structural equation models relating to attitudes about and achievement in introductory statistics courses: a comparison of results from the US and Israel.*
7. Dani BEN-ZVI. *Towards a characterization of junior high school students' construction of meanings for data representations.*
8. Ruslan MOTORYN. *The teaching and learning of international statistics in transitional country: Case of Ukraine.*
9. Corinne Hahn France. *The use of a multimedia tool in teaching factor analysis to school students. Is there a statistical significant improvement?*
10. Maria da Graca Pereira. *Demonstrative prototype of the statistical methods.*
11. James NICHOLSON. *Teaching and learning statistics : diagnostic and support materials.*
12. Gabriel YANEZ CANAL *If I throw three times, do I have three times probability of win ?*
13. Hiroaki Hirabayashi. *How do we arouse students' interest in statistics by development of teaching materials?*

For further information please contact: Susan STARKINGS: starkisa@vax.sbu.ac.uk or check the IASE, ICME-9 site <http://www.swin.edu.au/maths/iase/icme9.html> or the full ICME9 site <http://www.ma.kagu.sut.ac.jp/~icme-9/>

ASA Joint Statistical Meeting, Indianapolis, USA, August 13 - 17, 2000

JSM (the Joint Statistical Meetings) is the largest gathering of statisticians held in North America. It is held jointly with the American Statistical Association, The International Biometric Society (ENAR and WNAR), the Institute of Mathematical Statistics, and the Statistical Society of Canada. Attended by over 4000 people, activities of the meeting include oral presentations, panel sessions, poster presentations, continuing education courses, exhibits of state-of-the-art statistical products and opportunities, a placement service, society and section business meetings, committee meetings, social activities, and networking opportunities. Indianapolis is the host city for 2000 and offers a wide range of possibilities for sharing time with friends and colleagues. For information, contact <http://www.amstat.org/meetings/jsm/2000/>

A meeting of the International Study Group on the Relations between History and Pedagogy of Mathematics, Taipei, Taiwan, August 9-14, 2000

The Department of Mathematics at National Taiwan Normal University (NTNU) is pleased to announce that, with funding from the National Science Council (NSC) and others it will be hosting the international conference HPM 2000, "History in Mathematics Education: Challenges for a new millennium" (HME), from August 9-14, 2000, in Taipei, Taiwan. HME is one of the satellite meetings of ICME-9, the International Congress on Mathematics Education being held in Japan from 30 July to 6 August 2000. The HME meeting in Taiwan is affiliated to HPM, the International Study Group on the Relations between the History and Pedagogy of Mathematics. The main purpose of the Taipei HME is, therefore, to create a forum entirely for those concerned about the issues of relating history and pedagogy of mathematics.

Email: horng@math.ntnu.edu.tw. Website: <http://hpm.math.ntnu.edu.tw>

Mathematics for Living, Jordan, November 18-22, 2000

The Mathematics Education Into the 21st Century Project, co-ordinated by Dr. Alan Rogerson and Professor Faye Mina, is planning a series of International Conferences to be held throughout the World leading into the next millennium. The first of these was held in Egypt in November, 1999 and will be followed by Jordan in November 2000. The Conference has a local organising committee, including representatives from a Consortium of Jordanian Public Universities, which will be co-ordinated by Dr. Hanan Innabi of the Internationally renowned National Centre for Human Resources Development in Amman, Jordan. It will also be supported by the Third World Forum, which is Chaired by Prof. Ismail-Sabri Abdalla - Coordinator of Project Egypt 2020 and Former Director of The Institute of National Planning and former Minister of Planning (Egypt). The conference theme is "Mathematics for Living" and should attract teachers and researchers in Mathematics Education from around the world. We welcome papers (in English) that deal with ALL aspects of mathematics education and relate to innovative ways to help students and teachers deal with the problem of making mathematics more "alive", more "realistic" and more "accessible". This could take the form of a paper on problem solving, use of technology, new ways of assessment, ways of dealing with cultural differences -overcoming gender and social barriers, improving the curriculum, using the statistics of everyday life, effectively utilising new paradigms in teaching and learning. For further details and a copy of the registration form please email arogerson@vsg.edu.au

TIME 2000 - An International Conference on Technology in Mathematics Education December 11-14th, 2000, Auckland, New Zealand

TIME 2000 will focus upon the uses of technology in, but not limited to, the following areas of mathematics and statistics: Teaching, Learning, Assessment, Distance education, Research, Teacher development, Problem solving, Curriculum, Web-based resources. This conference will serve as a forum to discuss, present, explore and exchange information in mathematics and statistics education using: presented papers, hands-on workshop sessions, panel/group discussions, special interest networking sessions, displays of books, materials and technologies. Sessions will cover a broad range of topics, both theoretical and practical, relevant to educators at all levels. It is anticipated that one day will be particularly relevant to schools. The proceedings of the 2000 conference will contain two sections: (i) a refereed section; (ii) other papers submitted but not refereed. All accepted proposals and descriptions of workshops etc. will be published on the conference web page and in the conference pack given to all participants on registration. Please check our website for more information: <http://www.math.auckland.ac.nz/TIME2000>

International Conference on Recent Developments in Statistics and Probability and Their Applications, India International Centre, New Delhi, India, 30 December–3 January 2001

This International Indian Statistical Association (IISA) Biannual Conference is organised by IISA India Chapter in collaboration with other Indian organisations. **Information:** Kanwar Sen, Department of Statistics, University of Delhi, Delhi 110007, India. E-mail: dustats@del3.vsnl.net.in

URL: <http://www.stat.ohio-state.edu/~hnn/IISA.html>

SRTL-2 The Second International Research Forum on Statistical Reasoning, Thinking, and Literacy, Armidale, Australia, August 15-20, 2001

SRTL-1 on the topic of Statistical Reasoning, Thinking and Literacy was held in Israel last year. Most participants left the forum feeling that it is only the beginning of a very exciting and promising line of research, and that there is much work to be done. It was clear from participants' evaluations that many wish to continue this format again in the future. Therefore, we are planning to have a second SRTL, to be hosted by the Centre for Cognitive Research in Learning and Teaching and the School of Curriculum Studies in the University of New England, Armidale, Australia, August 15-20, 2001. This Forum will offer an opportunity for a small number of statistics education researchers from around the world to meet for a few days to share their work, discuss important issues, and initiate collaborative projects. One outcome of the second forum will be the publication of book summarising the work presented, discussions conducted, and issues emerging from this gathering. Joan GARFIELD (University of Minnesota) and Dani Ben-Zvi (Weizmann Institute of Science) will co-chair this Forum, assisted by Chris Reading (University of New England).

Information: Dr Chris Reading, Department of Curriculum Studies, University of New England, Armidale NSW 2351, Australia, Fax (02) 67735078, E-mail: creading@metz.une.edu.au, Web site:
<http://www.beeri.org.il/SRTL/>

International Statistical Institute, 53rd Biennial Session Seoul, Korea, 22–29 August, 2001

It is a great pleasure for Korean statisticians to host the 53rd Session of the International Statistical Institute (ISI) which will be held in Seoul from 22 to 29 August 2001 under the auspices of the Korean Government and the National Statistical Office (NSO), the Korean Statistical Society and Korean Statistical Association.

The Session will provide a forum for the international exchange of knowledge among participants, and also aims to encourage the international integration of statistics by establishing world-wide relations between the statistical societies and other official and non-official organisations concerned. In addition to being a dynamic forum for scientific and academic exchanges in various fields of statistics, the Session will provide a rare opportunity for all participants to experience the unique Korean culture, history and lifestyle.

The National Organising Committee has the pleasure and honour to invite all members of ISI and its Sections as well as non-members to attend this 53rd Session. In preparation for this conference, arrangements for convenient and comfortable facilities are being made for all participants as well as for a wide variety of social events and cultural tours that will hopefully leave everyone with fond and lasting memories of their visit to Korea.

Again, we are confident that Korea is ready to welcome all visitors from around the world who wish to participate in this first ISI Session of the 21st century. **Information:** ISI Permanent Office, Prinses Beatrixlaan 428, P.O. Box

950, 2270 AZ Voorburg, The Netherlands. Tel.: +31-70-337-5737; Fax: +31-70-386-0025; E-mail: isi@cbs.nl
or visit the Session website at <http://www.nso.go.kr/isi2001>

IASE Invited Paper Meetings, Seoul, Korea, August 2001

The IASE is very pleased to see that the increasing interest in our discipline has lead to an even larger number of statistical education sessions at the 53rd ISI session to be held in Seoul, Korea in August, 2001. There are seven sessions to be organised by the IASE alone, with another four being jointly organised with other sections. Lionel PEREIRA-MENDOZA is co-ordinating our section of the programme. Planning has started and anyone interested in more information should contact Lionel, email: lpereira@nie.edu.sg.

IASE Sessions

1. *Forum: IASE and statistics education in developing countries.* Maria-Gabriella OTTAVIANI <ottaviani@pow2.sta.uniroma1.it>
2. *Undergraduate level statistics programmes.* Shen Shir MING <HRNTSSM@hkucc.hku.hk>
3. *The Future of Statistics Education Research.* Joan GARFIELD <jbg@maroon.tc.umn.edu>
4. *Research on teaching statistics at School and University levels.* Susan STARKINGS <starkisa@vax.sbu.ac.uk>
5. *Undergraduate statistics education in non-statistics degree programmes.* Elisabeth SVENSSON <eliss@math.chalmers.se>
6. *Continuing Statistics Education in the Workplace.* Carol BLUMBERG <wncarolj@vax2.winona.msus.edu>
7. *Postgraduate training of statisticians.* Gilberte SCHUYTEN <Gilberte.schuyten@rug.ac.be>

Proposed Joint IASE Sessions

1. *Women's Contributions to Leadership in Statistical Education,* Joint with CWS. Martha Bilotti-ALIAGA <aliaga@umich.edu>
2. *Technology in Statistics Education,* Joint with IASC Tae Rim LEE <trlee@av9500.knou.ac.kr>
3. *The role of official statistics in the university curriculum,* Joint with IAOS (IAOS to organise)
4. *Education and the Internet: Effective Structures,* Joint with IAOS Brian PHILLIPS <bphillips@swin.edu.au>



The Sixth International Conference on Teaching
Statistics

Durban, South Africa, 7 - 12 July 2002

<http://www.beeri.org.il/icots6/>



ICOTS 6

It is a great pleasure for the IASE Executive Committee to inform the ISI members as well as the members of the sister associations within the ISI family that the Sixth International Conference on Teaching Statistics (ICOTS 6) will be held in Durban, South Africa, 7 - 12 July 2002.

Long before the arrival of the first Europeans in Durban, the Zulu people recognised the value of this jewel on the east coast of South Africa. They named it iThekwini - the place where the sea and earth have made union. This is a part of Africa where the warmth of the sun is reflected in the warmth of the people, where the blue of the sea parallels that of the sky. The conference will take place at the International Convention Centre, Durban, offering versatility and key features of exceptional standards of service and cuisine. This state-of-the-art Centre has set the highest standards for its qualified staff and services to ensure a stress-free and successful event. ICC Durban is the ultimate synergy of Western technology and African hospitality and charm.

The IASE will make a special effort to attract African participants, and in particular will offer some financial assistance to delegates from African developing nations. It is also planned that there will be strong participation from local school teachers. The theme of the Conference is "Developing a statistically literate society." Thus, we plan a special focus SESSIONS - "Statistical Literacy SESSIONS", which would be aimed to attract a wider audience than just the conference attendees. This will include: keynote speakers on statistical literacy, discussions of the role of statistics in various everyday contexts and how these could be reflected in education, discussions of the role of the media and statistical information in this regard in democratic societies, special sessions for administrators on statistical literacy, etc.

International Program Committee (IPC):

IPC Executive:

Maria-Gabriella OTTAVIANI (Italy), *Chair*, <ottavian@pow2.sta.uniroma1.it>

Brian PHILLIPS (Australia), *International Organiser*, <bphillips@swin.edu.au>

Dani BEN-ZVI (Israel), *IPC Secretary*, <dani.ben-zvi@weizmann.ac.il>

Local Organizing Committee (LOC) Executive:

Delia North (South Africa), *Chair of the Local Organizing Committee*, <delian@icon.co.za>

Linda Haines (South Africa), *IPC representative on the LOC*, Past President of South Africa Statistical Association (SASA), <haines@stat.unp.ac.za>

Topic Convenors:

1. *School Level*: Lionel PEREIRA-MENDOZA (Singapore), <lpereira@nie.edu.sg>
2. *Post Secondary*: Gilberte Schuyten (Belgium), <Gilberte.Schuyten@rug.ac.be>, and Allan Rossman (USA), <rossman@dickinson.edu>
3. *Workplace*: Carol Joyce Blumberg (USA), <wncarolj@vax2.winona.msus.edu>, and René H. M. Smulders (The Netherlands), <RSLS@cbs.nl>
4. *Wider Society*: Helen MacGillivray (Australia), <h.macgillivray@fsc.qut.edu.au>
5. *International Perspective*: Vitalis Muba (Tanzania), <eastc@ud.co.tz>
6. *Research*: Carmen BATANERO (Spain), <batanero@goliat.ugr.es>, and Joan GARFIELD (USA), <jbg@maroon.tc.umn.edu>
7. *Technology*: Lawrence WELDON (Canada), <weldon@sfsu.ca>
8. *Other Determinants*: Philip J. BOLAND (Ireland), <Philip.J.Boland@ucd.ie>
9. *Contributed Papers*: Susan STARKINGS (UK), <starkisa@vax.sbu.ac.uk>
10. *Local Teachers*: Vishnu Naidoo (South Africa), <vishnu@yebo.co.za>

ICOTS6 Web-sites:

IPC site: <http://www.beeri.org.il/icots6/>

LOC site: <http://icots.itikzn.co.za/>

The IPC is confident that ICOTS 6 will be a great event for statistical education. For further details, please contact: Maria-Gabriella OTTAVIANI, ottavian@pow2.sta.uniroma1.it, Brian PHILLIPS, bphillips@swin.edu.au, or Dani BEN-ZVI, dani.ben-zvi@weizmann.ac.il